Geneva chemistry & biochemistry days 2013

TH 17 January 2013, 9.00–17.40
FR 18 January 2013, 9.00–12.30

Sciences II – auditoire P.F. Tingry A150
30, quai Ernest-Ansermet – 1205 Genève
No registration required

Prof. Daniel R. Gamelin
University of Washington

Prof. Robin Irvine
University of Cambridge

Prof. Bernhard Lendl
Technische Universität Wien

Prof. Dr Herbert Waldmann
Max-Planck-Institut Dortmund

Junior speakers: Piotr de Silva • Marina Fedoseeva • Nicolas Germain • Jérôme Gouin • David Grassi • Lucie Grebikova • Aurélie Gueho • Alejandro Melero • Pradeep Nareddy • Fedor Romanov-Michaïlidis • Andreas Vargas Jentzsch • Diego Villamaina • Amir Zaïm • Claudio Zambaldo •

FACULTÉ DES SCIENCES
SECTION DE CHIMIE ET BIOCHIMIE

UNIVERSITÉ DE GENÈVE

Foreword:

When an event survives three years of existence, it is mostly prone to become a tradition! The 3rd edition of the "Geneva Chemistry and Biochemistry Days" organised by the Section de chimie et biochimie, University of Geneva, is thus timely placed under the sign of the science ritual.

This event is aimed at giving our students who are close to finishing their PhD studies the opportunity to present their research to a large audience from academia and industry. Our BSc and MSc students are also welcome to smell the very flavour of the research held in our School and learn a bit more about how to present results to a scientific audience.

Four distinguished lecturers will enrich the programme. They have been invited by the Departments of our School (Département de chimie minérale et analytique, Département de chimie organique, Département de chimie physique, Département de biochimie) and will seek to illustrate the breadth and quality of chemical and biochemical research in the world today.

This 1.5-day symposium has become the annual *Geneva rendez-vous* between chemists and biochemists from academia and the industry. The event will help stimulate fruitful discussions between young and advanced researchers, and give our students the opportunity to further prepare their professional careers.

We believe that it will give our guests an opportunity to appreciate the high quality of the different aspects of fundamental research performed in our School.

We hope that you will enjoy the lectures and interactions!

Prof. Alexandre Alexakis
Président de la Section de chimie et biochimie

Steering and organising committee:

Prof. Alexandre Alexakis	alexandre.alexakis@unige.ch Président de la Section de chimie et biochimie
Prof. Eric Bakker	eric.bakker@unige.ch Directeur du Département de chimie minérale et analytique
Prof. Stefan Matile	stefan.matile@unige.ch Directeur du Département de chimie organique
Prof. Thomas Bürgi	thomas.buergi@unige.ch Directeur du Département de chimie physique
Prof. Marcos González-Gaitán	marcos.gonzalez@unige.ch Directeur du Département de biochimie
Dr Didier Perret	didier.perret@unige.ch Chargé de communication de la Section de chimie et biochimie

PROGRAMME – THURSDAY 17 JANUARY 2013:

Session 1 – Morning Chairmen: **Prof. Eric Bakker + Prof. Tomasz Wesolowski**		
09:00--09:15	**Prof. Alexandre Alexakis**	Welcome message Introduction
09:15--10:15	**Prof. Bernhard Lendl** Technische Universität Wien	New Developments in Vibrational Spectroscopy for Analytical Sciences
10:15--10:30	Coffee break	Main hall of Sciences III
10:30--10:50	**Mr Nicolas Germain**	New Chiral NHC Ligands for the Copper-Catalyzed Asymmetric Conjugate Addition of Grignard Reagents
10:50--11:10	**Ms Lucie Grebikova**	Mechanical Properties of Dendronized Polymers at Single Molecule Level
11:10--11:30	**Ms Aurélie Gueho**	Characterisation of *Mycobacterium marinum* Niches
11:30--11:50	**Mr Andreas Vargas-Jentzsch**	Anion-π Interactions and Halogen Bonds in Action

11:50--14:00	Lunch (all invited lecturers + all PhD students)	Restaurant-pizzeria Sole Mio, boulevard Carl-Vogt

Session 2 – Afternoon Chairmen: **Prof. Andreas Hauser + Dr Damien Jeannerat**		
14:00--14:20	**Mr David Grassi**	Copper-Free Asymmetric Allylic Alkylation using Grignard Reagents: Mechanistic Study and Ligand Design
14:20--14:40	**Ms Marina Fedoseeva**	Excited-State Dynamics of Organic Dyes at Liquid/Liquid Interfaces
14:40--15:00	**Mr Amir Zaïm**	Thermodynamics of $Ln(hfac)_3$ Bound to Tridentate N-Heterocyclic Ligands
15:00--15:20	**Mr Alejandro Melero**	The Role of Lipids in COPII Vesicle Formation
15:20--15:40	**Mr Pradeep Nareddy**	Palladium-Catalyzed Asymmetric α-Arylation of Aldehydes
15:40--16:00	Coffee break	Main hall of Sciences III
16:00--16:20	**Mr Diego Villamaina**	Photoinduced Processes in Multichromophoric Systems. Toward Artificial Photosynthesis
16:20--16:40	**Mr Fedor Romanov-Michaïlidis**	Enantioselective Fluorination/Semipinacol Rearrangement for the Synthesis of *spiro*-Fluoroketones Containing an All-Carbon α-Quaternary Center
16:40--17:40	**Prof. Daniel R. Gamelin** University of Washington	Nanocrystals, Dopants, and Spins – Oh Boy!

17:40--19:00	Verre de l'amitié	Main hall of Sciences III
19:00-	Banquet (speakers + chairmen + organisers)	

PROGRAMME – FRIDAY 18 JANUARY 2013:

Session 3 – Morning Chairmen: **Prof. Alexandre Alexakis + Prof. Thierry Soldati + Dr Jiri Mareda**		
09:00- -10:00	**Prof. Dr Herbert Waldmann** Max-Planck-Institut Dortmund	Biology Oriented Synthesis
10:00- -10:20	Coffee break Main hall of Sciences III	
10:20- -10:40	**Mr Jérôme Gouin**	DiMethoxy ChromenoAcridinium : A New Family of [4]Helicene Ions
10:40- -11:00	**Mr Piotr de Silva**	Single Exponential Decay Detector (SEDD): Density-Only Based Descriptor of the Electronic Structure
11:00- -11:20	**Mr Claudio Zambaldo**	Selective Affinity-Based Probe for Oncogenic Kinases Suitable for Live Cell Imaging
11:20- 12:20	**Prof. Robin Irvine** University of Cambridge	Inositol Lipids and Phosphates – Many Signals and Multiple Functions
12:20- 12:30	**Prof. Alexandre Alexakis**	Concluding remarks

Nanocrystals, Dopants, and Spins – Oh Boy!

Prof. Daniel R. GAMELIN

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This talk will present recent advances in a frontier area of semiconductor research, namely, the challenge of doping semiconductor nanocrystals. The talk will describe various aspects of doped nanocrystal synthesis, characterization, photochemistry, luminescence, and photomagnetism, from a physical inorganic chemist's perspective. Unique physical properties of doped semiconductor nanocrystals that have been discovered recently will be highlighted.

Inositol Lipids and Phosphates – Many Signals and Multiple Functions

Prof. Robin IRVINE

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The inositol molecule is one of evolution's favourite building blocks. We now know that vertebrate cells contain seven polyphosphoinositol lipids, all of which have at least one (most more than one) function, and more than twenty inositol phosphates, of which at least eight have defined functions. In fact, there is probably no corner of cell biology that does not have one of these inositides involved in some way or other as a regulatory or requisite component.

I shall give a brief outline of how cells use this multi-component signalling system, and include my own lab's recent forays into one corner, the enigmatic phosphatidylinositol 5-phosphate 4-kinases.

New Developments in Vibrational Spectroscopy for Analytical Sciences

Prof. Bernhard LENDL

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This presentation will provide an overview on recent new developments in infrared and Raman spectroscopies of interest to modern analytical sciences. Mid-IR lasers, especially miniature quantum cascade lasers have opened a variety of new possibilities for development of compact and robust process analyzers. Characterization of these lasers and their successful use for the analysis of bodily fluids as well as the determination of residual oil traces in produced water on off-shore oil-rigs will be shown.

Pulsed laser systems for Raman spectroscopy have enabled the development of stand-off detection techniques which allow the identification of trace amounts at distances greater than 20 meters.

In combination with other enabling technologies such as microfluidic systems, standing ultrasound waves and separation systems, vibrational spectroscopy can facilitate novel approaches to study biochemical interaction processes, perform in-line bioprocess monitoring and for the sensitive identification of separated biomolecules. These possibilities will be demonstrated on the example of selected applications.

Biology Oriented Synthesis

Prof. Dr Herbert WALDMANN

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Abteilung Chemische Biologie
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Relevance to nature is one of the most important criteria to be met by compound classes for chemical biology and medicinal chemistry research. The underlying frameworks of natural products (NPs) provide evolutionary selected chemical structures encoding the properties required for binding to proteins, and their structural scaffolds represent the biologically relevant and prevalidated fractions of chemical space explored by nature so far.

Biology oriented synthesis (BIOS) builds on these arguments. It employs core structures delineated from NPs as scaffolds of compound collections and creates focussed diversity around a biologically prevalidated starting point in vast structural space. BIOS, therefore, builds on the diversity created by nature in evolution and aims at its local extension in areas of proven biological relevance. Consequently BIOS offers a conceptual alternative to other guiding strategies for library design which for instance are based on mechanistic considerations, sequence or structure homology or on the creation of chemical diversity.

In the lecture the trains of thought leading to the BIOS concept will be detailed, including the development of a Structural Clustering of Natural Products (SCONP) in a tree-like arrangement and its combined use with Protein Structure Similarity Clustering (PSSC) as hypothesis generators for the development of NP–derived and –inspired collections, the chemical feasibility of their synthesis on the solid phase and in solution and the investigation of these compound collections in selected biochemical and biological assays.

References:

1. Breinbauer R., Vetter I.R., Waldmann H. *Angew. Chem. Int. Ed.* **2002**, *41*, 2878–.
2. Koch M.A., Wittenberg L.-O., Basu S., Jeyaraj D.A., Gourzoulidou E., Reinecke K., Odermatt A., Waldmann H. *Proc. Natl. Acad. Sci.* **2004**, *101*, 16721–.
3. Koch M., Schuffenhauer A., Scheck M., Wetzel S., Casaulta M., Odermatt A., Ertl P., Waldmann H. *Proc. Natl. Acad. Sci.* **2005**, *102*, 17272–.
4. Nören-Müller A., Reis Corrêa Jr. I., Prinz H., Rosenbaum C., Saxena K., Schwalbe H.J., Vestweber D., Cagna G., Schunk S., Schwarz O., Schiewe H., Waldmann H. *Proc. Natl. Acad. Sci.* **2006**, *103*, 10606–.
5. Renner S., van Otterlo W.A.L., Dominguez Seoane M., Möcklinghoff S., Hofmann B., Wetzel S., Schuffenhauer A., Ertl P., Oprea T.I., Steinhilber D., Brunsveld L., Rauh D., Waldmann H. *Nat. Chem. Biol.* **2009**, *5*, 585–.
6. Wetzel S., Klein K., Renner S., Rauh D., Oprea T.I., Mutzel P., Waldmann H. *Nat. Chem. Biol.* **2009**, *5*, 581–.

Single Exponential Decay Detector (SEDD): Density-Only Based Descriptor of the Electronic Structure

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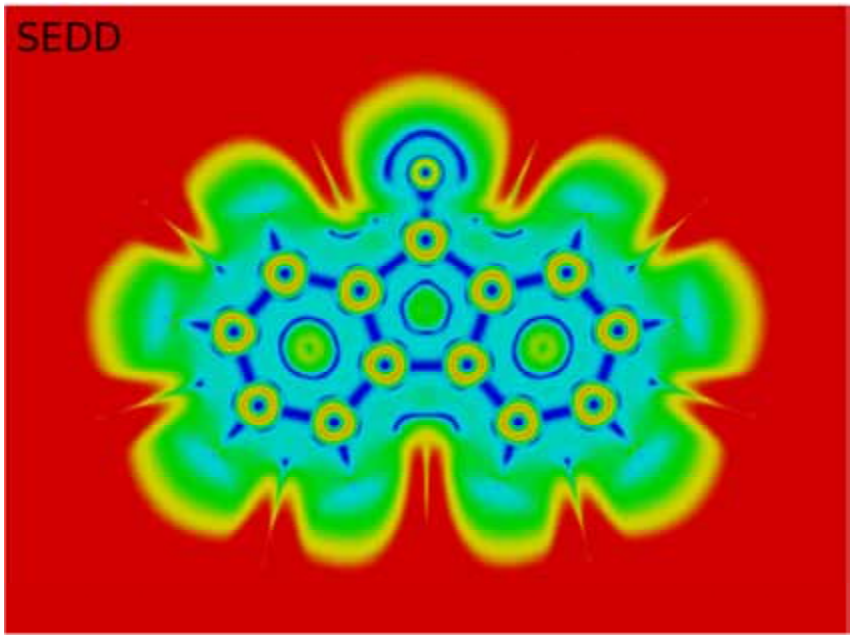
Electron localization is an important concept, which is strongly related to such fundamental elements of a chemist's language like bonds, lone pairs, shells, core and valence electrons. All these terms, despite being very useful in practice, cannot be rigorously defined due to the quantum nature of electrons. Nevertheless, quantum chemistry has developed a multitude of methods helping us to capture the local character of the electronic structure. Typically, these methods are based on the analysis of some kind of an approximate wavefunction. On the other hand, it is well known that the electron density itself contains all the information about any many-electron system.

In this contribution, I will introduce the Single Exponential Decay Detector (SEDD)[1], a new tool unravelling the bonding patterns in molecular systems. Being a semi-local density functional, SEDD is applicable at any level of theory as well as it can be extracted directly from experimental densities. As the motivation for the introduction of SEDD is rooted in the Frozen Density Embedding Theory[2,3], applications to the development of an approximate Non-additive Kinetic Energy Functional will be briefly outlined.



References:
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2. Wesolowski T.A., Warshel A., *J. Phys. Chem.* **1993**, *97*, 8050–8053.
3. Wesolowski T.A., *Phys. Rev. A* **2008,** *77*, 012504.

Excited-State Dynamics of Organic Dyes at Liquid/Liquid Interfaces

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Liquid/liquid interfaces play an important role in numerous areas of science. However, direct spectroscopic access to this thin (~1 nm) region is not possible with conventional optical methods.

The presentation will focus on the time-resolved second harmonic generation technique – a powerful surface-specific tool, which can deliver rich information on the dynamics of photoinduced processes at liquid interfaces.

Several examples will show how this technique can be applied to yielding the knowledge not only of such interfacial properties as local friction, hydrogen bonding and aggregation, but also of a molecular probe itself revealing its deactivation mechanisms.

References:

1. Fedoseeva M., Richert S., Vauthey E., *Langmuir* **2012**, *28*, 11291-11301.
2. Richert S., Fedoseeva M., Vauthey E., *J. Phys. Chem. Lett.* **2012**, *3*, 1635-1642.

New Chiral NHC Ligands for the Copper-Catalyzed Asymmetric Conjugate Addition of Grignard Reagents

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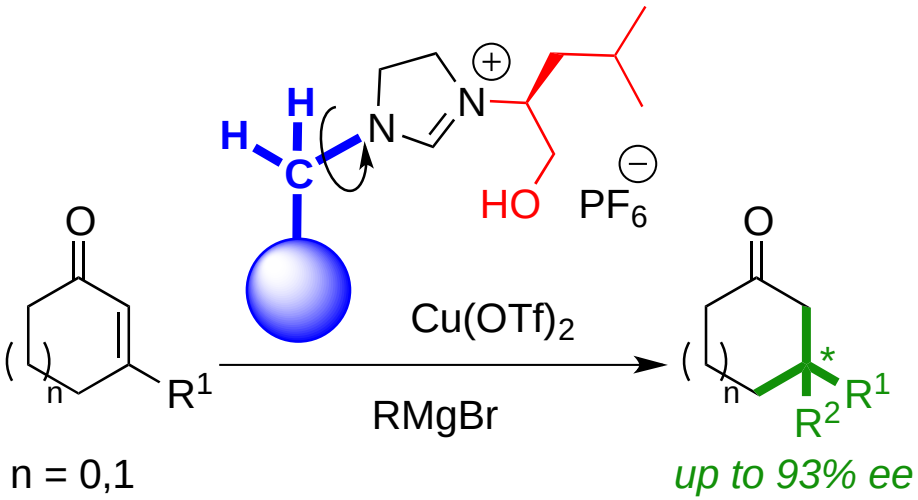
Since asymmetric conjugate additions (A.C.A.) represent a powerful methodology allowing direct access to enantioenriched ketones, we kept our attention on some specific remaining challenges[1]. At this time, only few nucleophiles were introduced selectively on trisubstitued enones, promoted by various types of NHC's chiral ligands in combination with copper salt[2]. The present work discloses recent advances in the A.C.A. of the highly desirable Grignard reagents to β-substituted cyclic enones[3].

Several ligands have been synthetized in high yields and involved in catalysis for the addition of ethylmagnesium bromide leading to chiral 3,3-cyclohexanone (up to 93% *ee*). The best ligand was then engaged in optimized conjugate additions of various Grignard reagents allowing for the formation of quaternary centers with high level of regio- and enantioselectivity with only 0.75mol % of catalyst loading. Noteworthy is the addition of alkylmagnesium bromide for the construction of 3,3-cyclopentanone (up to 86% *ee*), highlighted by useful chiral synthon synthesis. Such level of selectivity for A.C.A. of alkylmagnesium bromide to 5-membered rings remains unprecedented.



References:

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3. Germain N., Magrez M., Kehrli S., Mauduit M., Alexakis A., *Eur. J. Org. Chem.* **2012**, *27*, 5301-.

DiMethoxy ChromenoAcridinium : A New Family of [4]Helicene Ions

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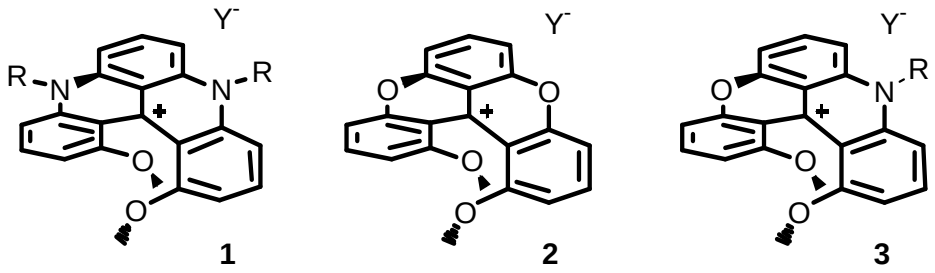
Helicenes are ortho-condensed polyaromatic compounds which are chiral due to the helical conformation of their backbone[1]. Whereas historically, and still today, neutral helicenes are predominantly synthetized, cationic helicenes are more and more reported[2]. Previously, we have shown that cationic diaza[4]helicenes **1** can be readily prepared and resolved, these moieties displaying rather high barriers of racemization ($\Delta G^{\neq}$ = 173 kJ.mol^{-1} at 200 °C) [3,4].

The dioxo equivalent **2** was also prepared, and it presents interestingly a much lower barrier to racemization ($\Delta G^{\neq}$ = 115 kJ.mol^{-1} at 20°C)[5]. Intrigued by this important difference, it was deemed interesting to prepare the mixed azaoxo derivative **3**.



Y- = BF_4^-, PF_6^-

Herein, we report the synthesis and properties of a new class of [4]helicene carbenium ions, that of dimethoxychromenoacridinium **3**. Other reactivity aspects discovered while studying these compounds will be presented and discussed.

References:

1. Shen Y., Chen C., *Chem. Rev.* **2012**, *112*, 1463- and ref. therein.
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5. Guin J., Besnard C., Lacour J., *Org. Lett.* **2010**, *12*, 1748-.

Copper-Free Asymmetric Allylic Alkylation using Grignard Reagents: Mechanistic Study and Ligand Design

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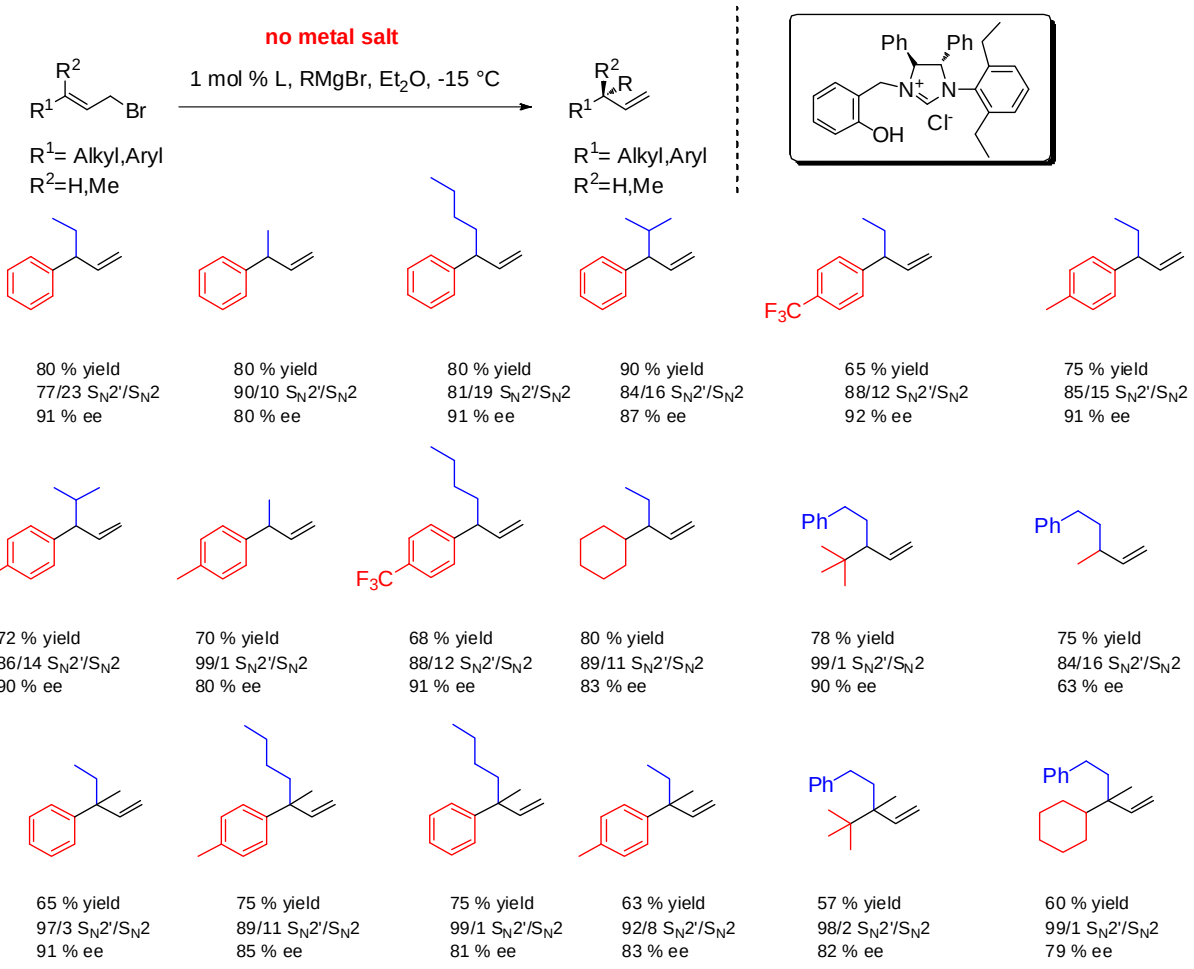
Traditional way of thinking in organic chemistry for asymmetric synthesis is to combine the appropriate metal with the right ligand family in order to achieve high selectivity and enantioselectivity. In this lecture another concept is explored. By using a bidendate NHC ligand[1-4] without any metal salt and Grignard reagent we could reach high enantioselectivity and interesting selectivity especially for the construction of quaternary centers in the Asymmetric Allylic Alkylation. Kinetic and mechanism aspect will be also discussed.



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2. Grassi D., Alexakis A., *Org. Lett*, **2012**, *14*, 1568-1571.
3. Jackowski O., Alexakis A., *Angew. Chem. Int. Ed*, **2010**, *49*,3346-3350.
4. Grassi D., Dolka C., Jackowski O., *Chem. Eur. J*, **2012**, *manuscript accepted.*

Mechanical Properties of Dendronized Polymers at Single Molecule Level

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Dendronized polymers have attracted considerable scientific interest in recent years. They consist of a central linear polymeric core with appendent dendrons and attain a rod-like, cylindrical shape[1].

Polymethacrylate-based dendronized polymers of different generations (PGn) adsorbed on a chemically modified mica substrate were imaged with atomic force microscopy (AFM) in solution. Mechanical properties of individual dendronized polymers were investigated using single-molecule force spectroscopy (SMFS) by manipulating single polymer chains in solution. The force measurement was performed directly after imaging on the precise position on the molecule.

The measured force-distance curves using AFM-based SMFS revealed a detailed insight into material properties at the molecular level. The generation dependence investigation puts in evidence the unique behavior of PG5 where the particular polymer conformation (pearl-necklace structure) induces different adsorption properties in comparison with the lower generations. While PG1-PG4 show single force events (peeling and pulling), PG5 presents multiple pulling events and two peeling forces.

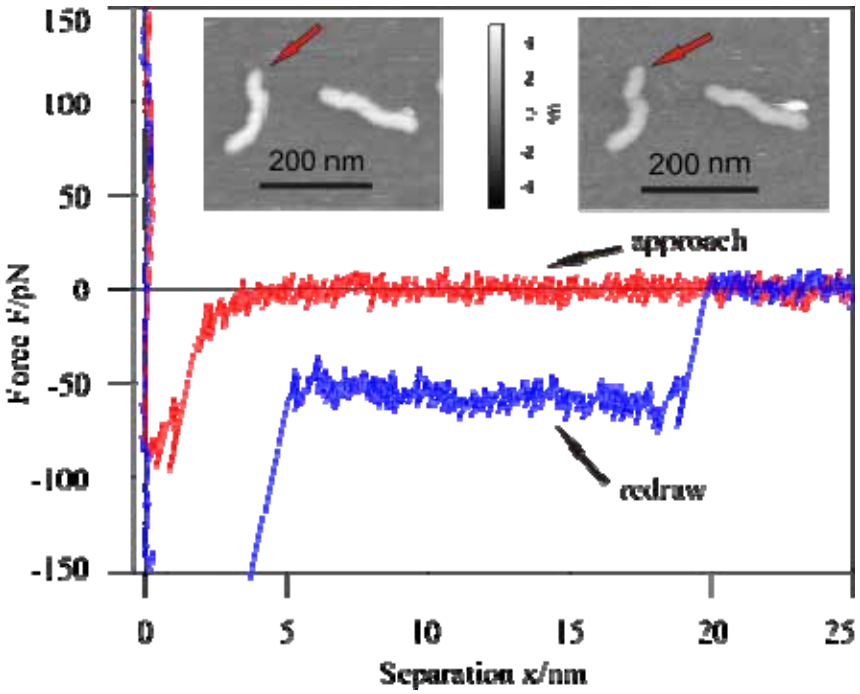

Figure: AFM height images and force curves of PG4 adsorbed on mica in solution at pH 4.

Reference:

1. Schlüter A.D. et al., *Angew. Chem. Int. Ed.* **2000**, *39(5)*, 864-883.

Characterisation of *Mycobacterium marinum* Niches

Aurélie GUEHO

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Tuberculosis remains a world-wide health issue. *Mycobacterium tuberculosis*, the agent responsible for this disease, is able to manipulate the phagocytes of the innate immune system. *M. marinum* is responsible for fish tuberculosis and utilises similar virulence mechanisms. After uptake by phagocytosis, both stop the maturation of the phagosome where they reside and establish a niche where they proliferate. Our aim is to characterise the virulence mechanisms and manipulations of the phagocytic pathway.

M. marinum, a close cousin of *M. tuberculosis* is able to infect the professional phagocyte *Dictyostelium discoideum* and arrest phagosome maturation as it does in macrophages. We established a novel procedure to purify compartments containing the pathogenic *M. marinum*, the non-pathogenic *M. smegmatis*, the avirulent *M. marinum*-L1D or the attenuated *M. marinum*-RD1 strains. Using the TMT sixpack isobaric labelling and mass spectrometry, we compare the proteomic composition of those isolated compartments to determine the impact of pathogen manipulation to divert the bactericidal phagosome into a friendly replication niche. We can already observe proteomic differences at very early times of infection (1 hpi) with decreased amounts of vATPase, contractile vacuole markers and late phagosomal markers in the *M. marinum*-containing compartment and increased amounts of some early phagosomal markers. As the WASH complex is important for the retrieval of the vATPase, we characterise the dynamic delivery and retrieval of the proton pump to and from the mycobacterial phagosome using WASH-GFP and ΔWASH strains. Similar proteomic analyses will be performed on compartments isolated at 6 hpi.

This quantitative mass spectrometric approach will allow us to identify host factors that modulate resistance or susceptibility to *M. marinum* during the early stages of infection, as well as mycobacterial proteins expressed intraphagosomally and potentially involved in the manipulation of phagosome maturation.

The Role of Lipids in COPII Vesicle Formation

Alejandro MELERO-CARRILLO

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Inside a cell, transport of proteins and lipids between organelles is mediated by spherical membrane structures called vesicles. These vesicles are formed due to extreme membrane deformations orchestrated by protein coats. Coated Protein complex II (COPII) is involved in vesicle transport from Endoplasmic Reticulum (ER) to Golgi apparatus, and it is considered the way for cargoes such as proteins to leave the ER. Many critical steps of vesicle formation remain unclear, like control of the size of vesicle size and scission from the donor membrane. Lipids are proposed to play a role in this processes not yet characterized.

We focus in the role of lipids during the deformation of ER membrane to generate a COPII vesicle. We have observed that certain proteins involved in lipid metabolism can rescue mutants unable to form COPII vesicles. Particularly, we have found that *sec12-4*, a mutation that affects COPII proteins recruitment, can be rescued by changes in the general levels of lysophospholipids. Accumulation of these lipids in membranes is proposed to affect the physical properties of lipid bilayers, such as curvature and lipid packaging. This finding highlights the importance that lipids must play in the formation and scission of COPII vesicles. We use mass spectrometry analysis and biophysical approaches, as our interest is to know which lipids are involved in the formation of a vesicle and what is the role played by them in the membrane.

Therefore, we show results from lipid composition analysis, together with *in vitro* and *in vivo* assays where we explore variations in lipid levels and its effect in the formation of COPII vesicles.

Reference:
Antonny B., *Curr. Opin. Cell Biol.* **2006**, *18*, 386-394.

Palladium-Catalyzed Asymmetric α-Arylation of Aldehydes

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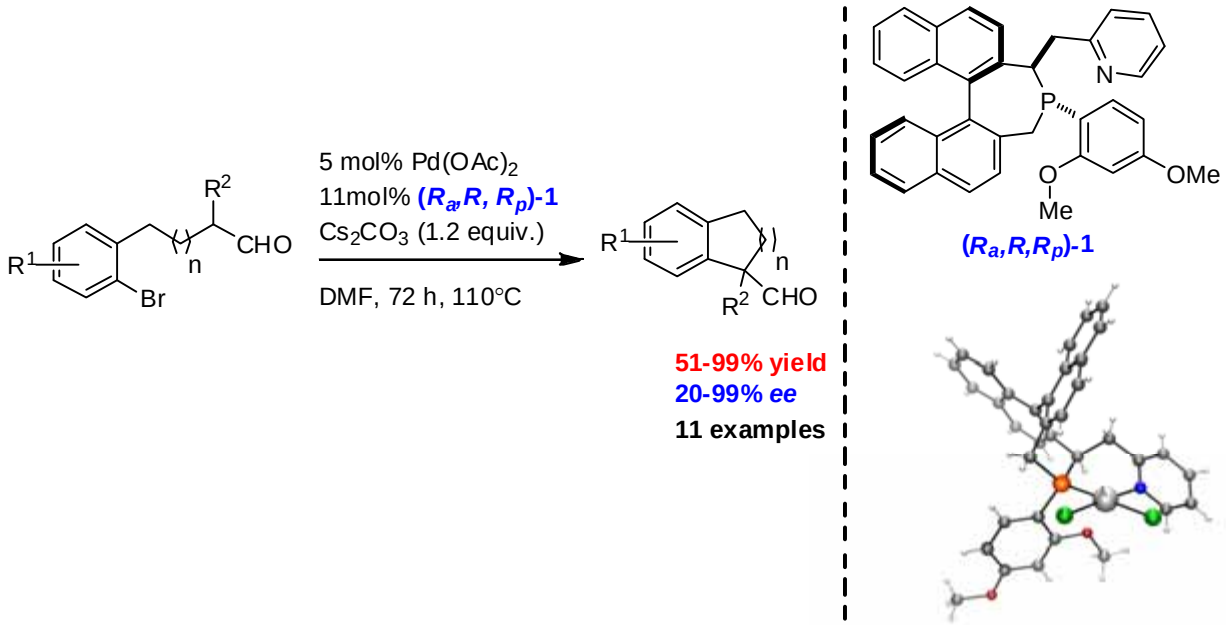
Our group has an interest in developing catalytic methods to access chiral aldehydes in view of further use in synthesis. In this context, we have recently developed an asymmetric isomerization of primary allylic alcohols[1] and an asymmetric hydroboration of terminal alkenes[2]. Although high levels of enantioselectivity were obtained for both reactions, none of these methods provides access to α-chiral aldehydes with quaternary stereocenters. The underdeveloped Pd-catalyzed α-arylation of aldehydes pioneered by Miura[3] is an attractive strategy to access such motifs[4].



Herein, we will present the synthesis of a novel class of chiral (P,N) ligands which display unprecedented selectivity levels for the Pd-catalyzed intramolecular α-arylation of α-branched aldehydes[5].

References:

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2. Mazet C., Gérard D., *Chem. Commun.* **2011**, *47*, 298-300.
3. Terao Y., Fukuoka Y., Satoh T., Miura M., Nomura M., *Tetrahedron Lett.* **2002**, *43*, 101-104.
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Enantioselective Fluorination/Semipinacol Rearrangement for the Synthesis of *spiro*-Fluoroketones Containing an All-Carbon α-Quaternary Center

Fedor ROMANOV-MICHAÏLIDIS

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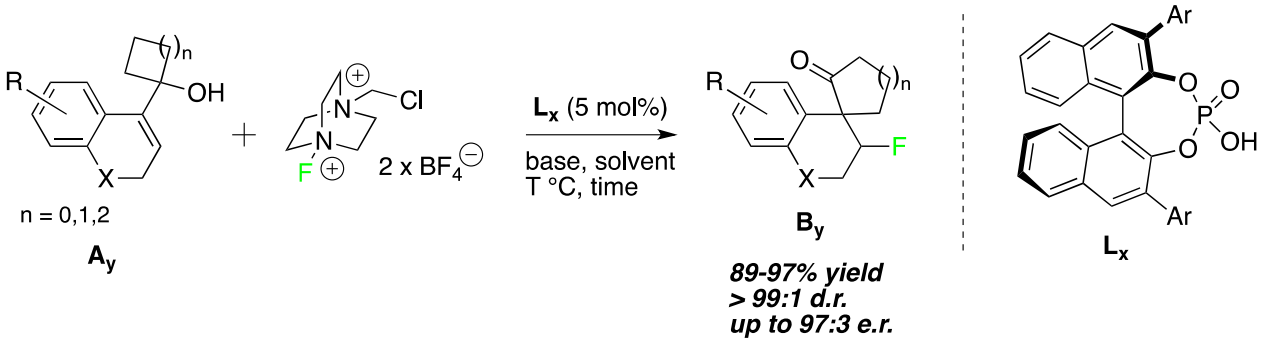
Halocyclization of olefins is an important class of organic transformations. Among these reactions, halolactonization has been studied extensively and applied in the synthesis of many bioactive molecules[1]. However, the development of catalytic and enantioselective versions remains a challenge. Only recently, the group of Yeung *et al.* reported on a truly general enantioselective organocatalytic procedure[2].

Even less studied is the related halogenation/semipinacol rearrangement cascade. In this last reaction, an allylic alcohol undergoes a Wagner-Meerwein alkyl migration, initiated by the formation of an halonium ion intermediate.

In the recent years, chiral phosphoric acids based on the BINOL scaffold were widely employed as organocatalysts for many types of interesting transformations, as for example, in the kinetic resolution of secondary alcohols[3], or in enantioselective fluorination reactions[4]. One of the projects in the Alexakis group consists in exploring a set of chiral phosphoric acids (**L_x**) as catalysts to access enantiopure fluorine-containing *spiro*-ketones (**B_y**) through the semipinacol rearrangement of strained allylic alcohols (**A_y**).



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Anion-π Interactions and Halogen Bonds in Action

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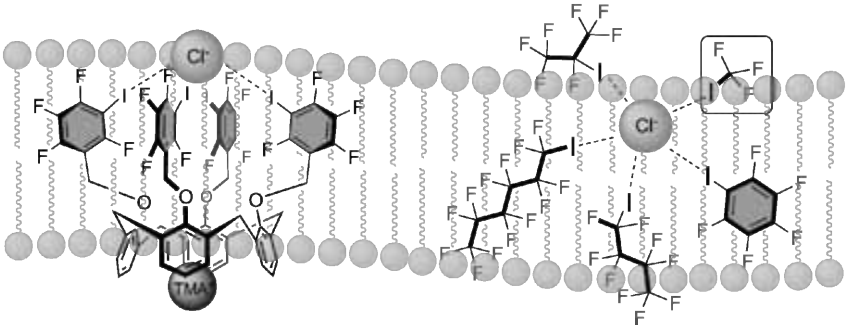
The creation of supramolecular functional systems is of paramount importance. In this context, the available interactions to create function should be widened as much as possible. Ion transport systems are practically well suited to probe for the functional relevance of otherwise elusive interactions, because only weak contacts are needed for activity, whereas stronger contacts cause inactivation; a similar Goldilock-type situation exists in catalysis.

Whereas most of the synthetic transport systems relay on intrinsically hydrophilic non-bonding interactions, especially hydrogen bonds, the possibility to use hydrophobic analogs appeared very promising. Therefore, the application of less recognized non-covalent interactions to anion transport systems seemed most fitting.

Early work includes transport with anion-π interactions[1], here the focus is on anion transport systems that operate with halogen-bond donors. Their strength, directionality and hydrophobic nature seemed ideal for this purpose.



Exploiting known scaffolds (*i.e.* calixarenes), we have shown that anion transport in bilayer model systems can be achieved with halogen bonds. However, these initial examples required assistance from ion pairing and were too complex[2]. Therefore, we simplified the concept and minimized the system to the extreme. This approach provided access to extremely small molecules, down to highly volatile transporters containing one single carbon only, that are capable to self-assemble in lipid bilayer membranes and form supramolecular anion transport systems.

These systems were studied for anion transport in fluorogenic vesicles as well as in planar bilayer conductance experiments, in the solid state with x-ray crystal structures and modeled in silico. The outcome is a clean, leakage free, highly selective, non-ohmnic and minimalist transport system.

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Photoinduced Processes in Multichromophoric Systems. Toward Artificial Photosynthesis

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In the photosynthetic apparatus of plants and bacteria, solar energy is harvested by antenna complexes and funneled toward the reaction center, where it is used to achieve long-lived charge separation, allowing its conversion into chemical energy with high efficiency. Nature has inspired the design of artificial analogs mimicking one or more photosynthetic functions, *i.e.* excitation energy transfer and photoinduced charge separation. These processes are ultrafast, occurring on picosecond and femtosecond time scales. Therefore spectroscopic methods with comparable time resolution are required to study them.

We are investigating the ultrafast photophysics of various artificial systems[1]. Simple donor-acceptor assemblies together with more complex molecular architectures probed in liquid solution and on a solid surface will be presented and discussed.

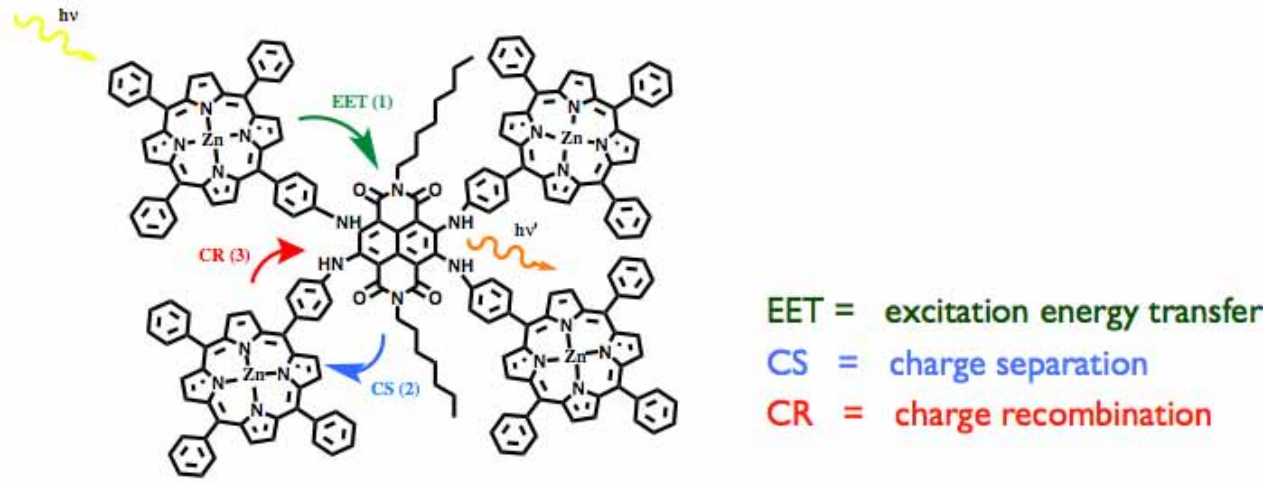

Figure: Series of ultrafast events occurring in a multichromophoric system upon photoexcitation.

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Thermodynamics of $Ln(hfac)_3$ Bound to Tridentate N-Heterocyclic Ligands

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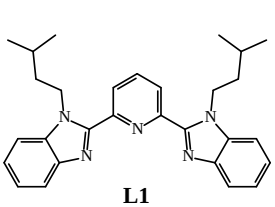
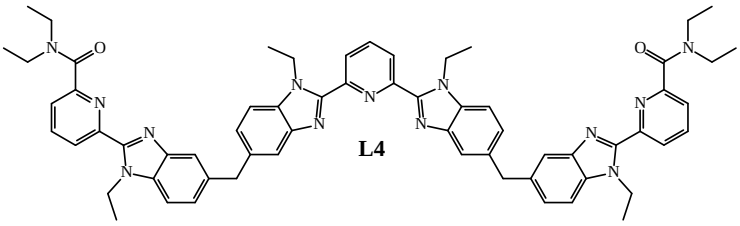
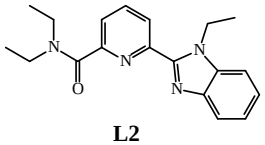
Lanthanide(III) β-diketonates are among the most thoroughly investigated classes of coordination compounds for both their easy synthesis and the variety of their applications as NMR shift reagents, as catalysts and as luminescent sensing/probing devices[1]. Herein, a series of new oligomeric lanthanide complexes has been synthesized by reacting bent aromatic tridentate binding units with fluorinated lanthanide β-diketonates [$Ln(hfac)_3$(diglyme)] (hfac = hexafluoroacetylacetonate)[2]. Surprisingly, the nature of the set of donor atoms (NNN in **L1** and **L4**, NNO in **L2 – L4**) deeply affects the organization of the hfac counter-anion around the central trivalent lanthanide. Moreover, the thermodynamic metal loading procedure switches from anti-cooperative binding processes with $Ln(NO_3)_3$ toward cooperative events with $Ln(hfac)_3$. The consequences on the speciation in solution are discussed together with the unprecedented possibility of isolating polynuclear microspecies with an exact alternation of filled and empty sites in linear Wolf type II luminescent metallosupramolecular polymers[3].



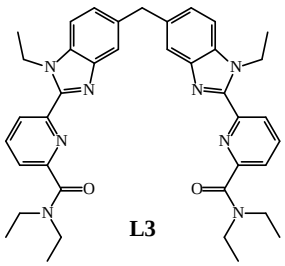
L1



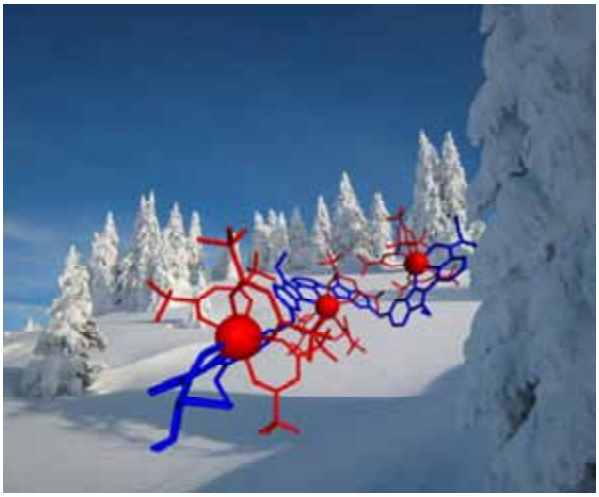
L4



L2



L3



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Selective Affinity-Based Probe for Oncogenic Kinases Suitable for Live Cell Imaging

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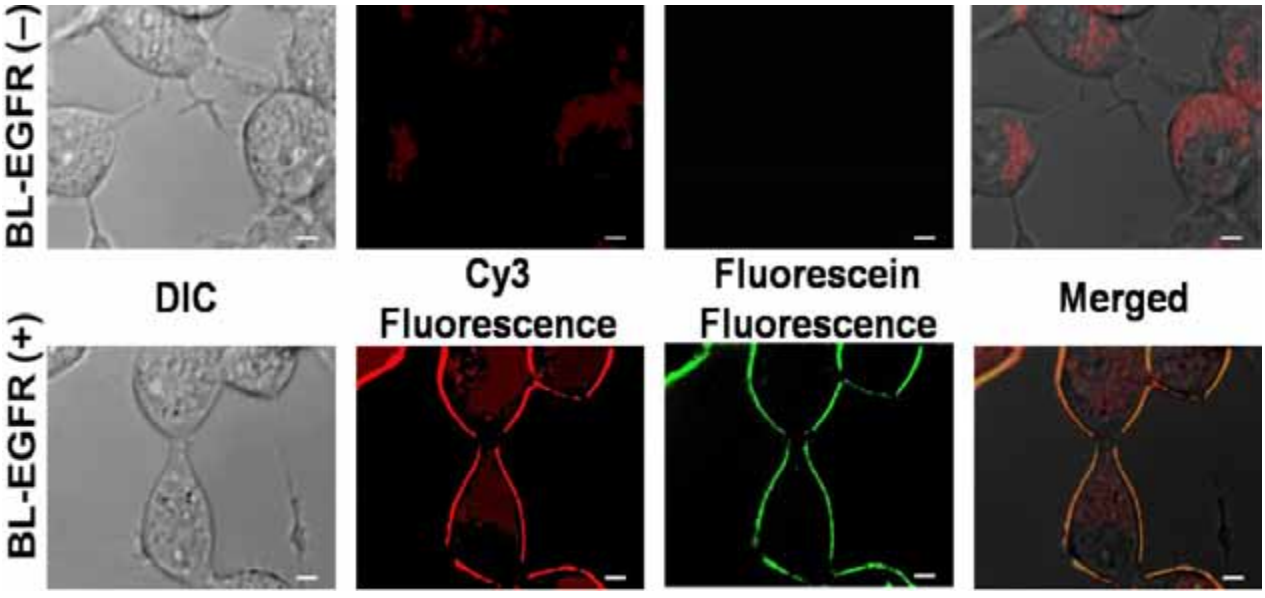
The resorcylic[1] acid lactones containing an enone moiety such as hypothemycin and related analogs (radicicol A, LL-Z1640) represent a unique scaffold that reacts irreversibly with a subset of kinases bearing a suitably positioned cysteine[2].

We reasoned that the resorcinol acid that acts as a weak hinge binder could be used as a platform to target other kinases by moving the position of the electrophilic trap.

Based on the therapeutic relevance of several kinases bearing an exposed cysteine at the edge of the hinge region (EGFR, ERBB2, JAK3, BTK), we began with a focused library aiming the electrophile in that direction.

We prepared an analog of the most potent compound emerged from both enzymatic and cellular assays, and we derivatized it with fluorophore or affinity tag.

As shown in Figure, the transfected cells show a strong Cy3 signal for a membrane-associated protein. Taken together, the data demonstrates that the probe is specific for EGFR, is cell permeable and suitable for live-cell imaging.



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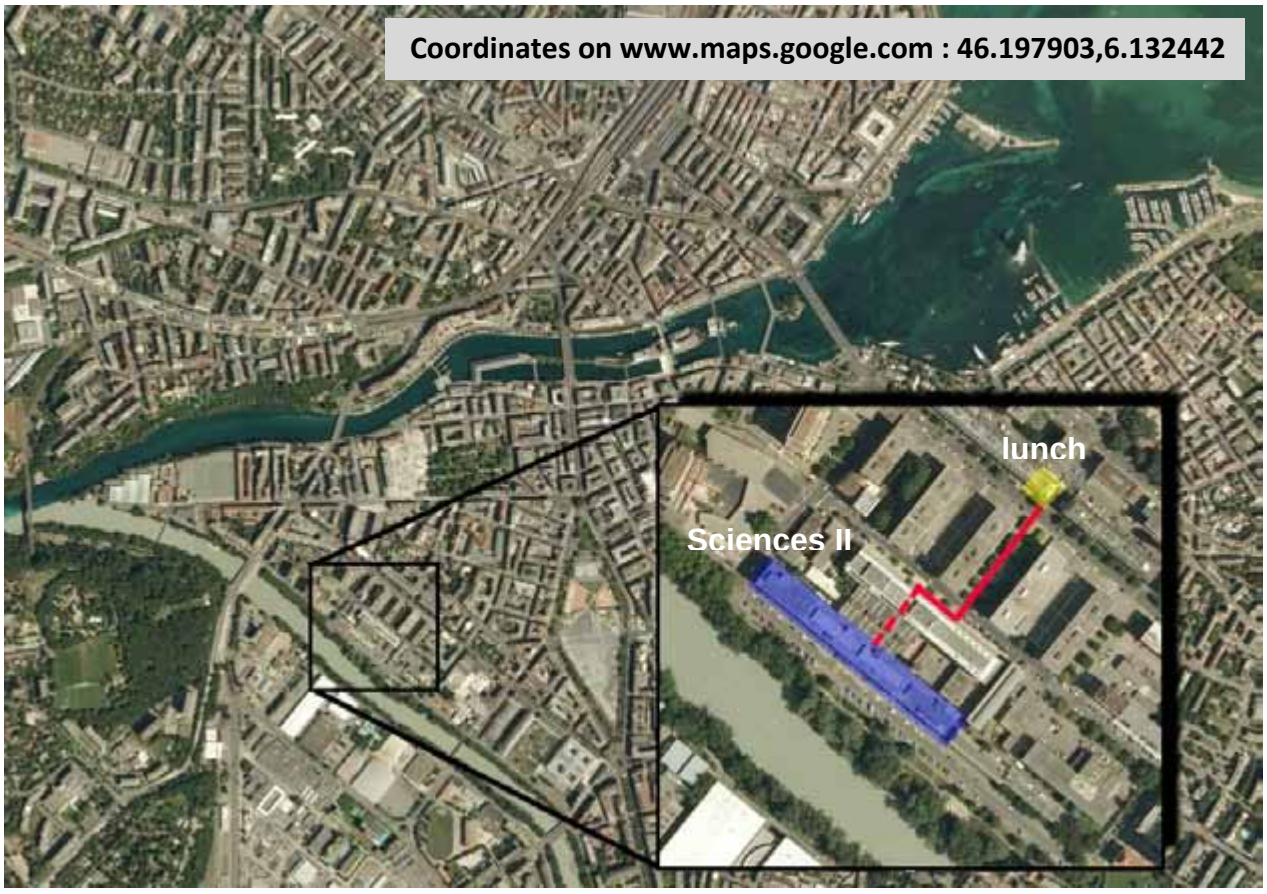

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