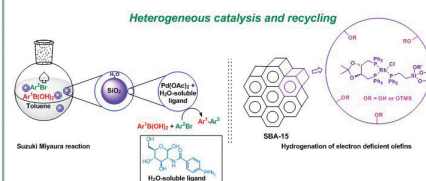
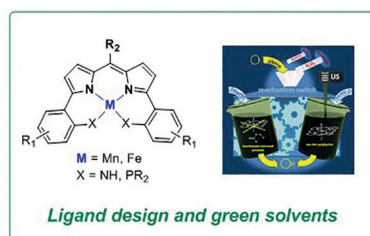
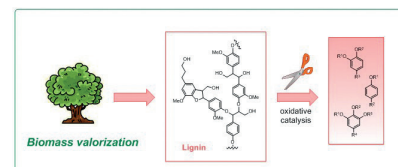
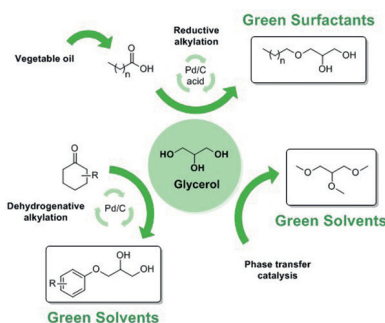


BRUNO ANDRIOLETTI **MARC LEMAIRE**

Professor

Professor,
Member of IUF



The CASYEN research group is part of the ICBMS, a synthetic chemistry and biochemistry research and teaching unit, working under the authorities of University Lyon 1, CNRS, INSA Lyon and CPE-Lyon (www.icbms.fr). It belongs to the Department of Chemistry and Biochemistry of the Faculty of Sciences and Technology, located on the LyonTech - La Doua Campus of the University of Lyon, in Villeurbanne.

The CASYEN research group is constituted by two independent teams sharing the same interest for "green chemistry" and the same approach combining fundamental and applied researches: The Lemaire and Andrioletti groups are both dedicated to the development of new tools and methodologies for carrying out environmentally friendly chemical transformations. A majority of the research projects investigated in the groups are developed in collaboration with industrial partners. Hence, in 2012, cooperation with Sofiproteol, Novance, Minakem, Rhodia-Solvay, Tereos-Syral, ECOAT, Desangos, S' Gobain, IFPEN have supported researches in the Lemaire Group (including 6 Cifre grants). Similarly, several research axes of the Andrioletti group are being developed in collaboration with Essex-IVA, Juxta, Novasep and S' Gobain.

TOPICS

Catalyst design – Catalyst recycling–Oxidation – Reduction – Valorization of biomass– Green surfactants – Green polymers – Mechanistic studies – Green solvents – Design and sustainable access to bioactive molecules and specialty chemicals.

CATALYST DESIGN

The Lemaire group is specialized in designing catalysts of high efficiency and selectivities (including enantioselectivity), easier to separate and recycle. Over the past few years supported homogenous catalyst and liquid/ liquid biphasic catalysis in either water, ionic liquid, and supercritical CO₂ were described in publications and/or patented. Approaches to selective catalytic reactions that take advantage of novel ligands and environmentally friendly stoichiometric reactants (oxidants, ...), while avoiding expensive transition metal catalysts, is one of the centerpieces of the Andrioletti group. The ligand design is anticipated to afford maximum tenability and robustness, as well as affording opportunities for designing and comprehending enhanced selectivity features.

MECHANISTIC INVESTIGATIONS

Optimization of a given reaction often requires a reliable understanding of its mechanism.

As part of industrial development and scaling up programs, the Lemaire group already studied and published detailed mechanistic inside for the trimerisation of isocyanate, catalytic reduction of phosphine oxide, and reductive alkylation of glycerol.

The Andrioletti group is equipped with in situ IR spectroscopy that allows the identification of the intermediates formed during a given reaction. In addition, the expertise of the group in organic synthesis allows the synthesis of model molecules which spectral signatures are compared with the spectroscopic data of the (macro)molecules.

| Figures

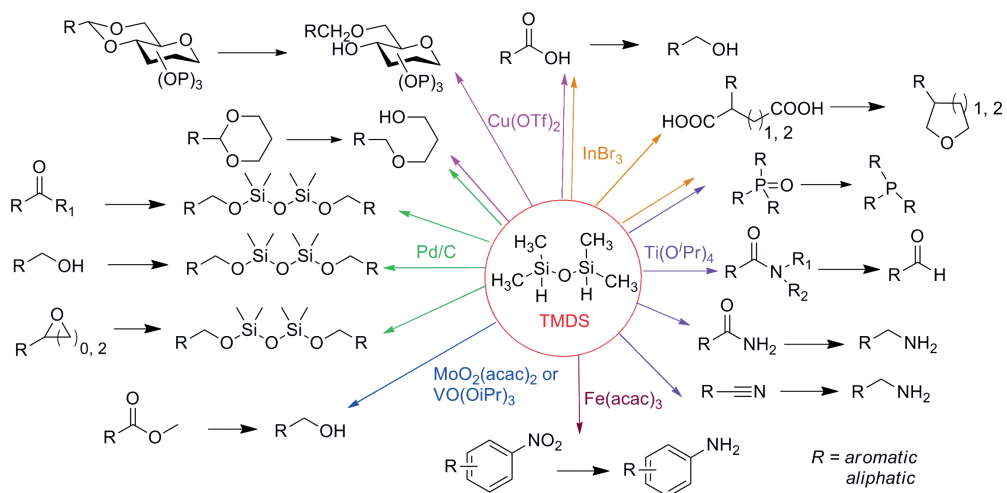
Left: A Schlenk tube
Centre: Catalytic reactions run in a carousel
Right, top: Examples of valorization of biosourced starting material – Lemaire group (left) ; Environmentally friendly approaches in the Andrioletti group (right)
Right, bottom: Environmentally friendly approaches in the Andrioletti group (right)

EQUIPMENT

- > High pressure reactors.
- > Double-wall Flasks.
- > Schlenk lines.
- > Super critical CO2 equipment
- > Analysis (available in the Institute): NMR (300, 400, 500 MHz), MS (ThermoLCQ, MicroTOFQII, MAT95XL...)
- > Analysis (available in the TEAM): GC-MS, FID-GC, HPLC, IR, UV-Visible...

EXPERTISES

- > Catalysis (homogeneous, heterogeneous).
- > Organic synthesis.
- > Polycondensation.
- > Mechanistic investigations.
- > REACH-compliant approaches
- > Renewable material.



Examples of new cleaner and safer reducing agent : Alternatives for LiAlH₄ and NaBH₄ (Lemaire group)

REACH COMPLIANT TECHNOLOGIES

The new REACH regulation promotes alternative methods to ensure a high level of protection for the human and the environment. The Andrioletti group is interested in the replacement of toxic solvents and reagents in industrial processes by more environmentally sound alternatives that will respect the terms of the REACH regulation.

Research challenges in solvent substitution include:

- Understand the exact role of a solvent in a transformation,
- Understand the required parameters of the solvent for the success of the reaction
- Replace the toxic solvent by a more environmentally sound one (possibly bio-sourced).
- Adapt the reaction conditions with the new solvent to obtain the desired outcome of the reaction.

Research challenges in reagent substitution include:

- Determine the properties that govern the desired effect,
- Propose and synthesize an environmentally friendly alternative (possibly bio-sourced),
- Adapt the formulation to match the expected application properties.

RENEWABLE STARTING MATERIALS

One of the most important economical and ecological challenge of modern chemistry is to avoid the use of fossil starting materials. Since 10 years, the Lemaire group is involved in researches using glycerol, fatty acids and sugars (Cooperation with Dr Y. Queneau ICBMS) as starting materials for speciality and fine chemicals synthesis. As for the Andrioletti group, it is involved in the valorization of lignin, sugars and levulinic acid.

BIOACTIVE MOLECULES

Efficiency and selectivity of the new catalysts and reagents developed in the Lemaire group are also tested in multistep synthesis of bioactive molecules in order to evaluate their performances compare to more classical methods. Last few years, new anticoagulant and antimalaria molecules (cooperation with Prof. Popowycz ICBMS), new inhibitors of Alkaline Phosphatase (cooperation with Prof. Buchet ICBMS), were discovered and studied.

STAFF

CASYEN-Andrioletti group (1 post-doc, 5 PhD Students, 2 undergraduates).

Bruno Andrioletti, Professor
Eric Framery, Associate Professor
Catherine Goux-Henry, Associate Professor
Ludvine Jean-Gérard, Research Associate

CASYEN-Lemaire group (1 post-doc, 1 technician, 10 PhD, 4 undergraduates)

Eric Da Silva, Chargé de Mission
Marie-Christine Duclos, Technician
Nicolas Duguet, Associate Professor
Marc Lemaire, Professor
Estelle Métay, Research Associate

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