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The Chemistry Institute

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EDITOR'S NOTE

Prof. Marc FONTECAVE

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- 1 **Chemistry at the Collège de France has received particular attention over the last few years. After the departures of Profs Jean-Marie Lehn and Jacques Livage, new ambition for developing this discipline has led to the creation of several Chairs: Prof. Marc Fontecave's Chair of Chemistry of Biological Processes in 2008, Prof. Clément Sanchez' Chair of Chemistry of Hybrid Materials in 2011, and the Chair of Chemistry of Materials and Energy, which Prof. Jean-Marie Tarascon has held since 2014. For the first time in the history of the institution, the Collège de France therefore hosts three chemistry Chairs.**

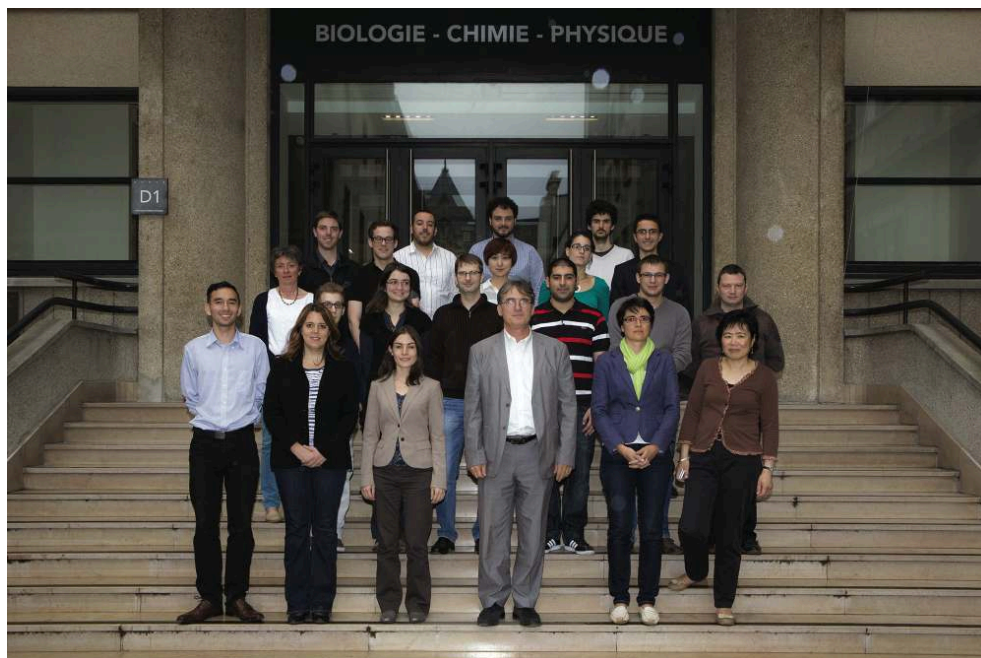


Prof. Jacques Livage, Prof. Clément Sanchez and the team of the Chair of Chemistry of Hybrid Materials

- 2 With the end of the extensive reconstruction work at the Collège de France, the three Chairs now share the same premises: the Institute of Chemistry. This institute brings together the three laboratories affiliated to it: the Chemistry of Biological Processes laboratory headed by Marc Fontecave, the Laboratory of Condensed Matter Chemistry of Paris headed by Clément Sanchez from 1999 to 2013, and the Chemistry of Materials and Energy laboratory headed by Jean-Marie Tarascon. This set up was clearly designed to create a chemistry research centre of excellence, based on the three Chairs' complementarity.
- 3 Marc Fontecave's laboratory, whose work is located at the interface of chemistry and biology, studies the mechanisms and structures of the complex enzymatic systems that are found in living organisms and participate in metabolic or biosynthesis reactions, the biosynthesis of essential organic and inorganic cofactors, and the selective modification of nucleic acids. As of recently, it has a protein crystallography platform, installed at the Collège de France. These systems are studied primarily for their potential applications as therapeutic targets or biocatalysts in energy conversion systems. On that basis, the laboratory develops original bio-inspired chemistry approaches, seeking to imitate enzymes' active sites to invent new synthetic catalysts, which can be potentially useful in artificial photosynthesis processes leading to hydrogen production or CO₂ valorization.
- 4 Prof. Clément Sanchez is a specialist in materials chemistry. His research group develops methods for synthesizing original materials and nanomaterials, using molecular precursors – including ones of biological origin – to control the crystalline structure, homogeneity, size, porosity, and morphology of these materials. Soft chemistry methods in particular are applied, involving temperature, pressure and solvent conditions that allow for the incorporation of biological molecules. This research requires one to have competences in the characterization of materials: solid-state NMR, X-ray diffraction and scattering, diverse microscopies and interface analysis. The projects aim to foster technological development and applications in the

fields of energy (materials for catalysis and photocatalysis) and health (imaging, therapeutic targeting, biomaterials, etc.).

- Materials chemistry plays a major role in the developments of the chemical industry. Today, new materials must be more sophisticated, miniaturized, robust, recyclable, environmentally friendly, energy efficient, and cheaper. Jean-Marie Tarascon represents this field at the Institute, particularly through his innovative research on energy storing. His laboratory develops new, cheap, and efficient materials in which nano-structuring plays a major role, for the production of original electrodes to be used in electric vehicle batteries. It also studies organic materials from biomass (sugars, organic acids) so as to invent new “green” batteries made with renewable electrodes.



Prof. Marc Fontecave and his team

- The Chemistry Institute, thus comprised of three Chairs and of three laboratories that are interestingly complementary, with some fifty researchers and sixty PhD students and post-docs, is involved in significant large-scale research on the synthesis of molecules and various materials, from their detailed characterization using modern tools to their technological transfer systems. Alongside the pursuit of a wide variety of projects, the Chemistry Institute has the clear strategic aim of positioning itself in the field of new energy technologies. The strengths of the three laboratories can work in synergy, particularly to create hybrid, solid, molecular and bio-inspired (nano)materials with catalytic, photocatalytic and electrocatalytic properties that will allow the elaboration of new membranes and catalysts for fuel cells, photo-electrolysers, and batteries. While collaboration already exists between the Institute's different laboratories, uniting these scientific forces geographically can only increase their strength. The proximity of physicists like Antoine Georges and his team, specialized in the theoretical study of the electronic properties of materials – for example transition metal oxides –, opens up exciting prospects, at the Collège de France, for the development of projects at the chemistry-physics and theory-experiment interfaces.

- 7 Finally, this institute, located in the centre of Paris, aspires to be a driving force in the field of chemistry, through both its interactions with the Pierre and Marie Curie University's outstanding chemistry research and through its participation in the Paris Science et Lettres research university. Within this environment, it can hope to develop chemistry both in the field of fundamental research and in that of engineering. The twofold orientation can have an original impact on the training of junior chemists (Master's, PhD and engineering students) and on relations with industry. It thus enables the institute to follow a policy of innovation and active technology transfer.
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AUTHOR

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