CURRICULUM VITAE

Name, First Name: **SANCHEZ, Clément** Married : 3 child

Date and place of birth: 16 Mars 1949 at Paris (France)

Address Chimie de la Matière Condensée de Paris, UMR 7574-UPMC/CNRS/Collège de France
Collège de France, 11 place Marcelin Berthelot Bâtiment D, 75231 PARIS
Tel. : (33) 1.44.27.15.01; (33) 1.44.27.61.62
e-mails: clement.sanchez@college-de-france.fr, clement.sanchez@upmc.fr

https://www.college-de-france.fr/site/clement-sanchez/index.htm

UNIVERSITY DIPLOMAS :

- Engineer of l'Ecole Nationale Supérieure de Chimie de Paris (Major) 1978
- Doctorat ès Sciences (PhD in Physical Sciences) University of PARIS 6-Pierre et Marie Curie 1981

https://www.college-de-france.fr/site/clement-sanchez/index.htm

CAREER IN NATIONAL EDUCATION

- Attaché de Recherche CNRS (1978-1982)
- Chargé de Recherche CNRS (1982-1988)
- Post Doc at UC Berkeley (1983-1984)
- Director of Research II CNRS (1988-1995)
- Professor at l'Ecole Polytechnique (1991-2003)
- Director of Research I CNRS (1995-2006)
- Director of Research Exceptional Class CNRS (2006-2011)
- Director of the laboratory « Chimie de la Matière Condensée» (1999-2013)
- Co-Director of the laboratory « Chimie de la Matière Condensée de Paris » UMR CNRS 7574 (2000-2004)
- Director of the laboratory « Chimie de la Matière Condensée de Paris » UMR CNRS 7574 (2005-2013)
- Professor at the Collège de France, Chaire de « Chimie des Matériaux Hybrides » (2011--2020)
- Emeritus Professor at the Collège de France, Chaire de « Chimie des Matériaux Hybrides » (2021----)
- Professor at USIAS, University of Strasbourg Institut of Advanced Studies
  Chaire de Chimie de la matière ultra-divisée, (2019---)
- University of Bordeaux invited Professor (2021---)

NATIONAL SCIENTIFIC AND ADMINISTRATIVE RESPONSABILITIES

- Member of the 33th section (Materials) of 'Commission de Spécialistes', Univ-Paris-VI, (1996-2008)
- Member of the 19th section (Materials) of 'Comité National du CNRS' (2000-2008)
- Membre of the Rerearch Directory of the section 15 of 'Comité National du CNRS' (2005-2008)
- Member of the 'Directoire de la Recherche', expert for chemistry, University-Paris VI, (2000-2006)
- Member of the Directory of the Solid State Chemistry Division, Société Chimique de France, (2009-2013)
- Openlab Materials PSA-UPMC (2011-2021)

NATIONAL AND INTERNATIONAL SCIENTIFIC RESPONSABILITIES

- Scientific expert for Materials Science of CNRS-Industry CRIN Cell (1991-1994)
- Scientific expert for materials chemistry at the Center of Atomic Energy Le Ripault (since 2001- 2024)
- Scientific expert for DGA in Materials Chemistry (2007- 2009)
- Member of the Scientific Advisory Comitee of "SOLEIL" , the new French synchrotron
- Head of the Nanochemistry Division C'Nano Ile de France (2006-2009)
- Member of the board «Maison de la Chimie » (2008)
- Member of the Scientific council of AC Nanosciences-Nanostructures (2002-2004)
- Member of the Scientific council of 'Action Matériaux-CNRS' (2004)
- Member of the Scientific council of 'ANR « Nanomatériaux » and Member of the directory (2005-2006)
- Scientific coordinator of the OFTA group on *"Hybrid Materials"* (1993-1996)
- **Book** " Matériaux Hybrides" Arago 17, Mai 1996, Ed Masson
- Scientific coordinator of the OFTA group on *"Biomimetism and Materials "* (1998- 2001)
- **Book** "Biomimétisme et Matériaux " Arago 25 , 2001, Ed Tech et Doc.
- Editor in Chief of the international Journal *"New Journal of Chemistry "*(2000-2004)
- Member of the Editorial Board of: *"Chemical Communication" (2000-2004)*
  "Journal of Materials Chemistry"(2005-2012)
- Member of the Advisory Editorial Board of: *"New Journal of Chemistry" (2005- 2009)*
  "Chemistry of Materials " (2004-2012)
  "Chemical Society Reviews " (2011---)

-French President of the France-Berkeley Fund *(2010---)*
- President of the Comité National de la Chimie CNC (Relations Academie-industrie and with IUPAC: *(2017---)*
- Member of the Société Chimique de France
- Member of the Administration Council of the Société Chimique de France (2012-2018)
- Member of the SAB, L'Oréal (2016-2022)
- Member of the Administration Council of la "Maison de la Chimie" (2018---)

SCIENTIFIC ORGANIZATION or CO-ORGANIZATION OF NATIONAL SYMPOSIA

- "Matériaux Intelligents" (Société Francaise de Physique, Rennes, 1994).
- "Matériaux Hybrides" Société Chimique de France (Bordeaux, 1997).
- "Nanosciences" Société Chimique de France (Rennes, 2000).
- "Les Journées Sol-Gel du CEA" (Tours, 2004, 2006, 2007, 2014).
- "Matériaux Fonctionnels Avancés: Des Nanocéramiques aux Hybrides" (Matériaux 2006, Dijon)
- "N^3 **N**anochimie, **N**anomatériaux, **N**anostructures » (Matériaux 2010, Nantes)
- SCF 2015- Energie (Lille, 2015)

SCIENTIFIC ORGANIZATION or CO-ORGANIZATION OF INTERNATIONAL SYMPOSIA (CHAIRMAN)

- 7^{th} International Workshop on Glasses and Ceramics from Gels (Paris, 1993)
- 1^{st} European Workshop on Hybrid Organic-Inorganic Materials (Bierville, France, 1993):
- "Better Ceramics Through Chemistry VI", Materials Research Society (San-Francisco, 1994)
- "B. C. T. C. VII, Hybrid Materials", Materials Research Society, (San-Francisco 1996).
- "Insights into New Materials" World Congress of the *AICHE*, (1996).
- "Hybrid Materials", Materials Research Society, (San-Francisco, 1998).
- REU International meeting on "Advanced Materials", REU NSF-CNRS (Gainesville 1999).
- "Hybrid Organic-Inorganic Materials", Materials Research Society, (San-Francisco, 2000).
- REU International meeting on "Advanced Materials", REU NSF-CNRS (Paris, 2000).
- "Hybrid Organic-Inorganic Materials", Materials Research Society, (San-Francisco, 2002).
- 3 *EUROMAT* Symposia on "Biomimetic and Bioinspired approaches to Functional Inorganic and Hybrid Materials", (Lausanne, 2003).
- "Hybrid Materials", Materials Research Society, (Boston, 2004).
- "Functional Hybrid Materials: Nanoscale Objects to Nanostructured Inorganic and Hybrid Materials", European-Materials Research Society, (Strasbourg, 2005).
- "Hybrid Materials", Materials Research Society, (San Francisco, 2007).
- 1^{st} International Conference on "Hybrid Materials", (Tours-France, 2009)
- International Conference on "Hybrid Materials II", (Strasbourg-France, 2011)
- " Electronic Organic-Inorganic Hybrid Nanomaterials: Synthesis and Device Physics", Materials Research Society, (San Francisco, 2011).
- International Conference on "Hybrid Materials IV", (Sitges-Spain, 2015)
- International Conference on "Hybrid Materials V", (Lisbonne-Portugal, 2017)
- IUPAC -Centenary World Meeting 2019 (Paris –France) as President
- International Conference on "Hybrid Materials VI", (Sitges-Spain, 2019)
- International Conference on "Hybrid Materials VII", (Genova, Italy 2022)

EDITION of BOOKS and JOURNAL SPECIAL ISSUES

- Proceedings of the 1^{st} European Workshop on Hybrid Organic-Inorganic Materials 1993.
- "Better Ceramics Through Chemistry VI", Materials Research Society Symposium Proceedings, vol 346,1994.
- Numéro special du New Journal of Chemistry, Hybrid Organic-Inorganic Materials, Oct 1994 (Guest Editor)
- "Better Ceramics Through Chemistry VII" Hybrid O-I Materials, Materials Research Society Proceedings, vol 435,1996
- Numéro spécial du Journal of Sol-gel Science and Technology, Organic-Inorganic Hybrid Materials. 1995.
- Hybrid O-I Materials, Materials Research Society Symposium Proceedings, vol 539, 1998.
- "Hybrid Organic-Inorganic Materials", Materials Research Society Symposium Proceedings, vol 528, 2000.
- "Hybrid Organic-Inorganic Materials", Materials Research Society Symposium Proceedings, vol 726 **,** 2002.
- "Functional Hybrid Organic-Inorganic Materials", Wiley VCH , vol XVII, 2003, ISBN 3-527-304843 2002.
- "Hybrid Organic-Inorganic Materials", Materials Research Society Symposium Proceedings, vol 847 **,** 2004.
- Themed Issue on "Functional Hybrid Materials", J. Mater. Chem., 215, vol 35-36, 2005.
- Special Issue of the Symposium "Functional Hybrid Materials: Nanoscale Objects to Nanostructured Inorganic and Hybrid Materials", in Progress in Solid State Chemistry (33), 2005.
- "Organic-Inorganic Hybrid Materials", Materials Research Society Symposium Proceedings, Vl.1007, 2007.
- Special Issue on " *Recent progress made in Hybrid Materials Science* ", Chem. Soc. Rev., 2011.
- "Electronic Organic and Inorganic Hybrid Nanomaterials", MRS Symposium Proceedings, vol. 1359, 2011.
- "Hierarchically Structured Porous Materials", Wiley-VCH, Weinheim, ISBN-13: 978-3-527-32788-1, 2011
- "Sapiens : métamorphose ou extinction ? "Editors Yves Lefloch-Soye, Alain Berthoz, Clément Sanchez, Humensciences, 23/02/2022 :

MEMBER OF SCIENTIFIC COMITEE in INTERNATIONAL MEETINGS

6th International Workshop on Glasses and Ceramics from Gels (Séville, Espagne, october 1991)
Perspectives in Inorganic Chemistry, (Brixen Italy, 1995)
Perspectives in Inorganic Chemistry, (Brixen Italy, 1996)
Perspectives in Inorganic Chemistry, (Brixen Italy, 1997)
SPIE International Symposium "Optical Devices for Fiber Communication", Boston, september 1999
13th International Zeolite Conference (Montpellier, France, July 8–13, 2001)
Silica –2001, Mulhouse Sept 2001 France
XIV International Symposium of OrganoSilicon Chemistry, Würsburg, july 2005
International Mesostructured Materials Symposium, Cap Town, May 2004
Symposium "Nanoporous Materials IV" june 2005 Niagara Falls, Canada.
International Mesostructured Materials Symposium, Shangai, sept 2006.
International Materials Symposium CIMTEC, Sicile, July 2006.
Essonn' European School on Nanosciences and Nanotechnologies, Grenoble Sept 2005-2006-2007-2008
Nanoporous V conference, Vancouver 2008.
EUCHem 2008 Conference, Turin, Italy.
International Advisory Board of the International Sol-Gel conference, Hangzhou, China, 2011

SCIENTIFIC DISTINCTIONS AND AWARDS

- Recipient (1978) of the Major Medal of the ENSCP
- Recipient (1983) of a NATO Fellowship
- Laureate (1988) of the IBM Price for « Materials Science »
- Laureate (1994) of the Price from the French Chemical Society (Solid State Chemistry Division)
- Recipient (1995) of the CNRS Silver Medal
- Laureate (2000) of the Yvan Pueches Price of the French Academy of sciences
- Laureate(2000) of the ADFAC –University of Paris VI Price for research valorisation
- Recipient (2007) of the Lavoisier Medal CEA Le Ripault
- Catalan-Sabatier Award of the Real Sociedad Espagnola de Quimica (2007)
- Laureate (2008) of the Gay-Lussac-Humboldt Award of the Alexander von Humboldt Foundation.
- Lecturer (2008) of the Otto-Warburg-Vorlesung, University of Bayreuth
- Guest Professor of the University of Jilin-China (2009-)
- Guest Professor of the University of Wuhan-China (2009-)
- Recipient (2009) of the P. Süe Award of the French Chemical Society
- Recipient (2010) of the Institut Français du Petrole Award of the French Academy of Sciences
- Nominated Foreing Academician of the Real Academia Nacional de Farmacia, Spain 2011.
- Nominated Academician of the European Academia of Sciences, 2010.
- Nominated Academician of the French Academie of Sciences, 2011.
- Nominated Academician of Academia Europaea, 2012.
- Nominated Fellow of the Material Research Society, 2012.
- Lecturer of the Nippon Sheet Glass-UCLA lecture, University of Los Angeles : 2014.
- Recipient of François Sommer Award « Man and Nature » 2014.
- Nominated Foreing Academician of the Royal Academia of Belgium, 2014.
- Recipient of Eni Award « Protection of the Environment » 2014.
- Nominated Fellow of the Royal Society of Chemistry, 2014.
- Recipient of the Career Award of the International Sol-Gel Society 2015.
- Guest Professor of the ETH Zurich (2016)
- Advanced Materials PSA Award 2016
- Chevalier dans l'ordre national de la légion d'honneur (2017)
- Highest Award (Grande Médaille) of the French Society for Materials & Metallurgy (SF2M) (2017)
- Nominated Academician of the World Academy of Ceramics (2017)
- Nominated Academicien of the French Academy of Technologies (2018)
- International Chair Francqui Award (U. Louvain-U. Namur- U. Leuven) (2018)
- Prof C.N.R Rao Oration Lecture Award of University of Delhi (2018)
- CNR Rao Award Lecture of the Chemical Research Society of India (Raipur-2018)
- Nominated Fellow of the ISGS (International Sol-Gel Society), 2018.
- Nominated Honorary Fellow of the Chemical Resarch Society of India (CRSI) 2018
- Nominated guest Professor at USIAS , the Insitut of Advanced Studies of Strasbourg (2019…)
- Chemistry Blaise Pascal Medal of the European Academy of Sciences (2021)
- Guest Professor in (IDex) Initiative d'Excellence University of Bordeaux (2021---)
- Honorary Member of CICECO, Aveiro 2021
- Doctor Honoris Causa of University of Aveiro 2022
- Leloir Prize **2022** for Exact Sciences (International Award from the Scientific Minestary of Argentina) (received 16 Mars 2023)
- Doctor Honoris Causa of University National of San Martin, Buenos Aires Mars **2023**
- Special Issue of Chemistry of Materials and ACS journal: October **2023**
  https://pubs.acs.org/page/cmatex/vi/clement-sanchez-2023?ref=vi_journalhome
- Grand Prix International de la Maison de la Chimie **2024**

TECHNOLOGICAL TRANSFERT, INDUSTRIAL VALORISATION

- Basic research performed since 40 years on the field of hybrid materials yield to numerous applications (for example see the list of patents and the two general review articles J. Mater Chem. 2005 ; Chem. Soc. Rev., 2011.)
- Leader of many public and industrial contracts and grants *(Rhodia, Saint-Gobain, IFPEN, Corning, Protex, Bouyges, Lafarge, l'Oréal, CEA, EADS, Sumitomo, Air liquide, Materis, Kerneos, Total, PSA, Solvay, SARP, Faurecia, Symbio …)*,
- High valorisation of the research on Hybrid Materials (co-inventor of 75 patents).
- ADFAC-UPMC Award for Research valorisation for Hybrid Materials (2000)
- 1 commercial product with large distribution in cosmetics
- 1 licence on MOF
- Several Patented works that are at TRL 5-6

RESEARCH INTERESTS and FIELDS of EXPERTISE

*** Designed construction of a large variety of hybrid organic-inorganic nanostructured materials**
*** Development of Sol-gel science & technology non only based on silica chemistry but also based on transition metal oxides, rare earth oxides, aluminium oxides, tin oxides chemistries.**
*** Bio-inspired approaches to hierarchically structured inorganic and hybrid organic-inorganic materials**
*** Soft chemistry based routes to nanostructured materials. Sustainable chemistry (chimie douce)**
*** Synthesis of exotic nanoparticles (metal phosphides, borides, carbides, multicationic oxides…)**
*** Templated synthesis of inorganic gels and mesoporous coatings and particles (self-assembly)**
*** Optical, electronic, ionic, catalytic and mechanical properties of nanomaterials**
*** Applications of hybrids in the domains of energy, environment, biomaterials and health.**

SCIENTIFIC INDICATORS and SUMMARY of PRODUCTIONS

Publications in high impact journals: **566+** Book Chapters: **18**
Publications in reviewed proceedings: **67** Patents: **75 +**
Book and Guest Editions: **18**
Invited Conferences **497** such as :
Invited Conferences, Keynotes Lectures and Plenary lectures in International conferences: ***241***
Invited Conferences National Symposia: ***62***
Invited Conferences in National Universities or Industrial Research Centers: ***95***
Invited Conferences in International Universities or Industrial Research Centers: ***99***

- **h factor = 122 Number of Citations > 75000**
- **(Google scholar) : https://scholar.google.fr/citations?user=vM9snnEAAAAJ&hl=fr**
- **Belong to the list of the most cited scientists in Materials Science: http://isihighlycited.com/** (last 20 years)
- **Cited in the world's most influential scientific minds 2014**

Strategy of my research and main objectives

- ***My work spans the areas of soft chemistry routes including sol-gel science to nano-structured materials, templated synthesis, "legolike chemistry", designed construction of hierarchically structured inorganic and hybrid materials****. My fundamental scientific motivations have always been associated with the design, synthesis and processing of original inorganic and hybrid organic-inorganic materials. Our strategies enabled us to follow the chemical evolution of molecular precursors and intermediates, to specify their reactivities, to establish the structure of the resulting metal oxides or non oxides, the obtained hybrid polymers and to control their micro- and nano-structures as well as their texture. Early on we became convinced of the high importance of coupling processing and chemistry.*
  *The quality of this coupling impacts the resulting morphological texture, structure and therefore the resulting material properties. We initiated entirely new approaches that marry template synthesis, soft chemistry, with a large variety of processes, including dip-coating, foaming, aerosol, ink-jet printing, electrospinning and reactive extrusion. These strategies allow us to put in practice many of our fundamental concepts, as demonstrated by the set of patents filed some of them with different industrial companies. They also open ecocompatible news avenues to obtain functional materials and catalysts. The development of such materials yields innovative responses to societal concerns, mainly related to renewable energy and sustainable chemistry****.***

see figure summary: from "Chimie Douce" to Hybrid Materials

Main Objectives:

- To produce both fundamental and applied research at the frontier between nanosciences, biology, medicine, energy, and environment by pushing to their limits: chemistry developed with inorganic or hybrid matter, innovative processing techniques…
- - To study and understand the often complex formation processes of hybrid materials from the molecule to the final material via the combination of ex situ and in situ studies *(*modern spectroscopies and microscopies, XAS, SAXS, and other physical characterisation methods).
- To conceive and to elaborate original inorganic and hybrid organic-inorganic nanostructured materials allowing the development of innovative responses to social concerns. Study the mechanism of formation of nanomaterials from molecular inorganic and hybrid precursors to the final materials (dense and porous materials, in the form of films, fibers, powders, monoliths). We are not only developing soft and green chemical routes in green solvents, ionic liquids, molten salts but also new processing approaches at intermediate temperatures between "Chimie douce" and conventional solid state chemistry that allow to synthesize nanostructured materials with new or broader chemical compositions.
- To understand the chemistry and processes of formation of inorganic and hybrid nanostructured materials to allow their tailored fabrication (composition, size, morphology, texture) along with a final control over their chemistry and associated behavior.
- To develop bio-inspired engineering permitting the access of new multifunctional architectures (hierarchical structures) with perfect control over the structure, texture, and the functionalization of the material at different length scales. This biomimetic and / or bio-inspired approaches that we are following, promise undoubtedly a more sustainable development of materials useful to our society

Themes of Research

- **Chimie douce based routes to multifunctional hybrid materials (sol-gel science)**
- **Bio-inspired strategies, Green processing, to obtain hierarchically structured inorganic and hybrid materials**
- Texturation and meso-organization of metallic oxides at organized organic interfaces.
- Synthesis and characterization of hybrid functional nano-objects obtained by polymerization of heterofunctional molecular precursors and the study of their possible assembly.
- Engineering of hybrid hierarchical structures with multiple functionalities.
- Engineering new mineral structures or new inorganic nanoparticles (metal phosphides, carbides and borides, multicationic metal oxides, metal oxy-sulfides etc…) ,
- Studying the processes of self-assembly and characterization of the organic mineral interface by spectroscopic techniques, diffraction and scattering (*in-situ* and *ex-situ* methods).
- Synthesis of inorganic and hybrid textured materials under external stress.
- Green stragies to Functional Inorganic and hydrid catalysts
- Studying the properties (optical, electronic, mechanical, catalytic…) of novel nanomaterials.
- Targeted application domains include: the study of some properties (optical, electronic, mechanical, catalytic…) of the novel nanostructured materials and their use as chemical and biological sensors, photoelectodes, photocatalysts, smart coatings, protective coatings or as new materials for catalysis, membranes, fuel cells, microbatteries, bio-nanocomposites for tissue engineering or cosmetics, and new hybrid vectors for theranostics.

- **Figure summary: From "Chimie Douce" to Hybrid Materials**
  - ***(VIDE INFRA)***

Green Strategies to Bio-inspired Tailor-made Hybrid Materials

From the fundamental studies of mechanism of formation…

Bottom-up strategies from Molecular Precursors

"Chimie Douce" coupled with green processing

Legolike chemistry from well-defined "Nano-Objects"

$M(OR)_n$ $(OR)_3Si\sim Si(OR)_3$ $R'\text{-}M(OR)_x$

Organo-functional or Bridged Alkoxides

MX_n *(metallic salts)*

Multifunctional Ligands

Controlled Hydrolysis

Sol-Gel Routes
Hydrolytic
Non-hydrolytic

Hydrothermal Conditions
ΔT, ΔP

Organic Templating Agents

Bio-inspired Self-Assembly

Nanoparticles, Hybrid Clusters

Nano-clays HDL …

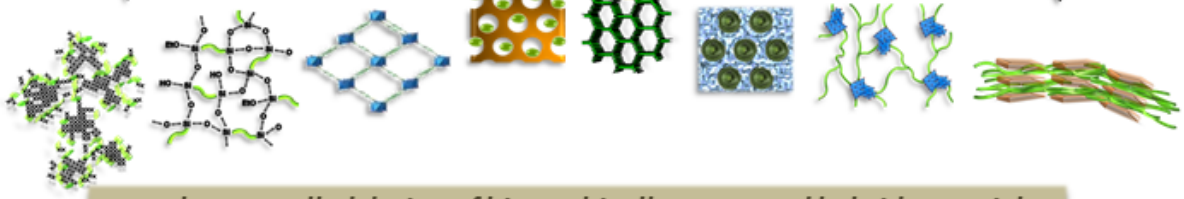
Monomers

Polymers

Dispersion-Assembly Nanobuilding Blocks (NBBs)

Organic Connectors

Intercalation Chemistry

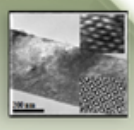


… to the controlled design of hierarchically structured hybrid materials…

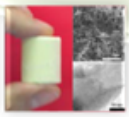
Materials with Hierarchical Structures: Combining synthesis routes with various templating agents and processes

Dense Hybrid Monoliths

Mesostructured Thin Films



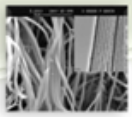
Multi-scales Hybrid Foams



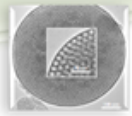
Ink-jet Printed Mesostructured Dot Arrays

Controlled Phase Separation Bimodal Porosity

Multi-scales Hybrid Fibers



Spray-dried Mesoporous Particles



… targeting societal, environmental and industrial demands.

Smart recycling of materials

- *Incinerated wastes-based adsorbers and catalysts*
- *Self-healing materials*

Membranes – Sensors
Protective coatings

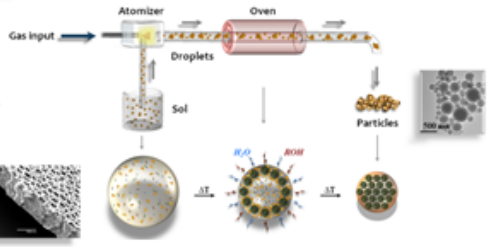
Environment Renewable Energy

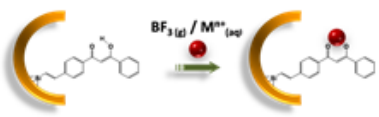
Fuel cells
Photovoltaic devices

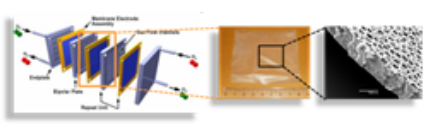
Biomaterials Non-toxic pigments

Diagnosis – Imaging – Controlled release – Tissue repair

New catalysts







Collège de France – https://www.college-de-france.fr/site/clement-sanchez/Biographie.htm