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## Adaptation of forest trees to climate warming: a case study on Douglas-Fir

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**LE STUDIUM**

Loire Valley  
Institute for Advanced Studies

# SCIENTIFIC REPORT 2014

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# THE PRESIDENT EDITORIAL

The year 2014 was a pivotal year for LE STUDIUM Loire Valley Institute for Advanced Studies, which involved the renewal of a part of the team and its installation at the Hotel Dupanloup in the city of Orléans.

Our main aim remains to contribute to the international reputation of research conducted in the region Centre-Val de Loire and the development of the territory. The more than one hundred foreign researchers hosted this year, for stays lasting a few days (Workshop, Conference), week (Consortium) or from several months to the full year (Fellowship, Chair, Professorship) have made a significant contribution to the research achievements in the region. Hosted in the laboratories of our member organisations, the University of Orléans, the University François-Rabelais of Tours, INSA Centre-Val de Loire, CNRS, BRGM, INRA, CEA and Inserm, the researchers found, thanks to the academic and social environment created by LE STUDIUM, favourable conditions for the success of their project and more broadly to the enhancement of their stay in the region Centre-Val de Loire.

Serving the regional scientific community, LE STUDIUM chose to describe this year more explicitly all activities surrounding the reception of researchers. This choice responds to the desire to better reflect the richness of these receptions, and how the different instruments offered by LE STUDIUM contribute.

In continuity with the commitments made by Professor Paul Vigny, Founding President of STUDIUM, we were firmly committed in 2014 to LE STUDIUM SMART LOIRE VALLEY PROGRAMME. This included the original General Programme and the research projects supported by the region Centre-Val Loire within the framework of «Ambition Research Development 2020 (ARD 2020)», the regional implementation of the «Smart Specialisation Strategy» of the European Union.

Finally, the balance of 2014 is very positive as evidenced in the content of this scientific report and it is thanks to the support of the Regional Council Centre-Val de Loire, the City of Orléans, the department of the Loiret and the European Funds for Regional Development, but also the quality of work done by the entire team, on both the sites of Orléans and Tours, by Professor Nicola Fazzalari the Scientific Director, Sophie Gabillet the General Secretary, Dr Aurelien Montagu the Scientific Relations Manager, and other collaborators Marie-Frédérique Pellerin, Vincent Godard, Amélie Schneuwly, Ludovic Michel and Yves Duranthon.

They are very deeply thanked here for their commitment and the quality of their contribution to our successes.

**Professor Ary Bruand**  
President



**Pr Paul Vigny**  
Founding President of LE STUDIUM

L'année 2014 aura été une année charnière pour LE STUDIUM Loire Valley Institute for Advanced Studies qui s'est matérialisée par le renouvellement d'une partie de l'équipe et son installation à l'Hôtel Dupanloup au centre-ville d'Orléans.

Notre ambition principale demeure de contribuer au rayonnement à l'international des recherches conduites en région Centre-Val de Loire, ainsi qu'au développement du territoire. La centaine de chercheurs étrangers accueillis cette année, pour des séjours d'une durée de quelques jours (Workshop, Conférence), d'une semaine (Consortium), ou encore de plusieurs mois à l'année entière (Fellowship, Chair, Professorship), y ont largement contribué. Accueillis au sein des laboratoires de nos organisations membres, l'université d'Orléans, l'université François-Rabelais de Tours, l'INSA Centre-Val de Loire, le CNRS, le BRGM, l'INRA, le CEA et l'Inserm, ces chercheurs ont trouvé, grâce à l'environnement créé par LE STUDIUM, des conditions favorables à la réussite de leur projet, et plus largement à la valorisation de leur séjour en région Centre-Val de Loire.

Au service de la communauté scientifique régionale, LE STUDIUM a fait le choix de décrire cette année plus explicitement l'ensemble des activités environnant l'accueil des chercheurs. Ce choix répond à la volonté de mieux rendre compte de la richesse de ces accueils et de la façon dont les différents instruments proposés par LE STUDIUM y contribuent.

En continuité avec les engagements pris par le Professeur Paul Vigny, Président fondateur du STUDIUM, nous nous sommes résolument engagés en 2014 dans LE STUDIUM SMART LOIRE VALLEY PROGRAMME qui inclut le Programme Général initial et les projets de recherche soutenus par la région Centre-Val de Loire dans le cadre de « Ambition Recherche - Développement 2020 (ARD 2020) », contribution à la déclinaison régionale de la « Smart Specialisation Strategy » de l'Union Européenne.

Enfin, si le bilan de l'année 2014 est très positif ainsi qu'en atteste le contenu de ce rapport d'activité, c'est grâce au soutien du Conseil Régional Centre-Val de Loire, de la Ville d'Orléans, du département du Loiret et du Fonds Européen de Développement Régional, mais aussi à la qualité du travail accompli par l'ensemble de l'équipe tant sur les sites d'Orléans que de Tours par le Professeur Nicola Fazzalari, Directeur Scientifique, Sophie Gabillet, Secrétaire Générale, le Docteur Aurélien Montagu, chargé de relations scientifiques, et nos collaborateurs Marie-Frédérique Pellerin, Vincent Godard, Amélie Schneuwly, Ludovic Michel et Yves Duranthon.

Qu'ils soient ici très vivement remerciés pour leur engagement et la qualité de leur contribution à nos réussites.

**Professeur Ary Bruand**  
Président

# MESSAGE OF THE SCIENTIFIC DIRECTOR

In 2014 LE STUDIUM embarked on a transformational change to lay the foundation for our future.

- ◆ In January, our staff moved to newly renovated offices and in March, our researchers moved to newly renovated accommodation facilities in Orléans.
- ◆ We welcomed a number of new team members to facilitate the evolution of our activities to align with regional, European and international trends.
- ◆ We announced LE STUDIUM SMART LOIRE VALLEY PROGRAMME, which includes the original General Programme and the Ambition Recherche - Développement 2020 (ARD 2020) Programmes.
- ◆ In September, Ary Bruand was appointed President, following the retirement of LE STUDIUM founding President, Paul Vigny.

This transformation is part of our strategic journey to bring clarity to our role as a prominent regional agency. One that delivers quality services to researchers, our partners and enterprises focused on local and international challenges.

Focusing on our mission, to build human capacity for research, development and innovation, has helped differentiate LE STUDIUM. We deliver value by supporting and connecting the highest quality research in the region to international networks. Our success is the result of the right combination of short-term endeavours, our investment in people, and building long-term strategic partnerships.

The excitement with which I hear regional researchers discuss new professional and personal research possibilities following their involvement with LE STUDIUM is a clear indication we are having a positive regional impact. Noteworthy outcomes include:

- ◆ Regional scientists visiting, for a long stay, the laboratory of the foreign scientists they have previously hosted;
- ◆ LE STUDIUM researchers becoming regular visitors, for collaboration, to the region;
- ◆ LE STUDIUM researchers finding relevant regional employment and building a research team in region Centre-Val de Loire.

The outcomes and benefits of our support for research, development and innovation show that LE STUDIUM is making an important contribution to regional visibility, competitiveness and attractiveness on an international scale. We are making a significant contribution to the creation of a dynamic, outward-looking, international scientific community, by connecting public and private research institutions. Over



this past year, many activities involving LE STUDIUM researchers and laboratory host scientists have attracted hundreds of senior foreign researchers as conference participants. It is excellent to see these visiting senior researchers take information about our regional laboratories, and the heritage of the Loire Valley back to colleagues in their own laboratories.

This year, we are proud to report on the scientific work of LE STUDIUM researchers in the host laboratories for the first time in our Annual Report. We are also glad to have this opportunity to share a number of their most recent achievements.

Partnership with our members deepened this year, with the placement of LE STUDIUM researchers in seven of our member organisations, Université d'Orléans, University François-Rabelais of Tours, INSA CVL, BRGM, CNRS, INRA and Inserm. We welcomed 18 researchers from 12 countries, seven of those being European countries.

We know that one of the key elements of successful innovation is versatile, well-trained, entrepreneurially-minded researchers, who can deliver cutting-edge science and technology to small-to-medium enterprises (SMEs). We also know that SMEs do not necessarily have the facilities or capacity to run their research projects as comprehensively as they would like to. LE STUDIUM fellowships and consortia, (currently nine in total) nurture researcher - enterprise collaborations, with a focus on dialogue that can contribute to SME growth.

At the heart of our achievements and goals are people. Scientists as professionals share a desire to see science make a profoundly positive socio-economic impact. LE STUDIUM strives to build partnerships that ignite the creative spirit of this community.

I would like to thank all our staff, LE STUDIUM researchers and partners for their commitment and efforts this past year.

**Professor Nicola Fazzalari**  
Scientific Director of LE STUDIUM

# IDENTITY & MISSION

**Established in 1996 and inspired by the historical, geographical and human cultures of the Loire Valley, LE STUDIUM is an internationally recognised regional agency, whose goal is to boost international scientific exchange in the community of public and private research laboratories in the region Centre-Val de Loire.**

LE STUDIUM welcomes experienced foreign researchers into public and private regional laboratories and organises scientific events, which promote interdisciplinary exchanges between regional and international scientific communities and enhance the development of human capital for research, development and innovation.

LE STUDIUM was installed in heart of the city of Orléans in January 2014, at the premises of the prestigious Hotel Dupanloup. This location has provided exceptional facilities for researchers and an enhanced international presence in the city of Orléans that strengthens its attractiveness, enabling it to welcome high-level talent in the region Centre-Val de Loire. LE STUDIUM relies on the laboratories in the region Centre-Val de Loire to host foreign researchers that can benefit from and contribute to the laboratories and the region's international recognition in various research themes.

In order to achieve its mission, LE STUDIUM benefits from a strong regional partnership network and works in close collaboration with regional research stakeholders:

- ◆ Higher education and research: University of Orléans, University François-Rabelais of Tours, INSA Centre-Val de Loire, ESAD
- ◆ National research institutes: BRGM, CNRS, CEA, INRA, Inserm, IRSTEA
- ◆ Poles of Competitiveness: Cosmetic Valley, Elastopole, Dream, S2E2
- ◆ Other clusters and organisations: ARITT, Vegepolys, POLEPHARMA, Centréco, Centre-Sciences, CCI, etc.

LE STUDIUM Loire Valley Institute for Advanced Studies provides its researchers in residence an "intellectual and human space", which favours interdisciplinary exchanges and debates, guided by the three necessary conditions required for creative activity, namely Curiosity, Imagination and Intuition.



# SMART LOIRE VALLEY PROGRAMMES

## The Smart Loire Valley General Programme

The call for applications, open from November to February each year, is designed to create synergies between academic disciplines and links with the industrial world in order to increase interdisciplinary research and stimulate socio-economic development. It aims to develop outward looking interdisciplinary teams with a reputation in developing the EU economic landscape. LE STUDIUM Fellows are evaluated by independent external peer reviewers and an independent International Scientific Council to select the best candidates and high added-value research projects.

- ◆ **LE STUDIUM RESEARCH CHAIR** enables a high level foreign researcher to create an interdisciplinary dynamic between at least three laboratories in the region Centre-Val de Loire. The award is for six months.
- ◆ **LE STUDIUM RESEARCH CONSORTIUM** award enables the creation of a virtual team of five researchers (four foreign researchers and one researcher from the region Centre-Val de Loire). This team meets for a full week twice a year over 2 years (4 meetings in total). The consortium should have a well-defined objective, a research work plan to implement and to achieve milestone goals between meetings.
- ◆ **LE STUDIUM RESEARCH FELLOWSHIPS** enable foreign experienced researchers to work in a host laboratory in the region Centre-Val de Loire, for a one-year residence. External applications, are one-year positions designed to offer to senior internationally competitive researchers the opportunity to discover and work in one of the laboratories of the region.
- ◆ **LE STUDIUM RESEARCH PROFESSORSHIP** enables a foreign Professor to participate in postgraduate teaching, research and research team building. The Professorship residence is a period of three months in the region Centre-Val de Loire for 4 consecutive years (12 months in total). For this programme two laboratories in region Centre-Val de Loire or three teams from the same laboratory need to be involved.



## The ARD 2020 Regional Programmes

The long-term socio-economic development of the region Centre-Val de Loire, in a period of economic fragility, depends on the strength and growth of quality research, development and innovation.

The ARD 2020 Programmes, the region Centre-Val de Loire initiative to implement the EU Smart Specialisation Strategy, have been designed to generate socio-economic impacts by providing support to create strong regional research and develop centres of international scale, stimulate innovation and job creation and, socio-economic dynamism in the territory.

Thus, the region has supported the strengthening of quality research in a number of domains to foster the development of world-class poles to enhance research and innovation activity in the region: in 2014 ARD 2020 biopharmaceuticals, ARD 2020 LAVOISIER and starting in 2015 ARD 2020 Cosmetosciences and ARD 2020 PIVOTS. LE STUDIUM is an official partner of these ARD 2020 regional programmes.



(c) CEA Le Ripault



# ARD 2020

## Biopharmaceuticals



A drug is any substance or composition presented as having properties for treating, preventing or diagnosing disease in humans or animals. Whereas biopharmaceuticals in the strict sense of the term, are molecules that have the characteristic of being produced from living organisms or their cellular components. These molecules are intermediate between chemical drugs and living biologics.

The proportion of biopharmaceuticals in the drug market should increase from 20% in 2014 to more than 40% by 2020. The region Centre-Val de Loire is at the cutting edge of research in the pharmaceutical sector, so the

Regional Government has provided 7M€ over 3 years for research and to facilitate innovative inter-sectorial industrial development and partnerships for socioeconomic development beyond 2020.

The ARD 2020 Biopharmaceuticals (Biomédicaments) programme aims to further develop and strengthen the region Centre-Val de Loire biopharmaceuticals industry by capitalising on the recognised capabilities of the multidisciplinary research teams from the regional research institutions.

The programme aims to:

- ◆ Develop a flagship research and development pole on biopharmaceuticals in the region Centre-Val de Loire.
- ◆ Configure the biopharmaceuticals field by inter-sectorial development and innovation in the pharmacy/health sectors through start-ups, SMEs including established local and regional based multinational companies.
- ◆ Promote the transfer of technologies/competences to existing businesses.

The Biopharmaceuticals programme focuses on the design and biosynthesis of molecules for preclinical and clinical development by including the search for synergies with conventional chemically synthesised drugs. The programme involves working with a wide spectrum of molecules (vaccines, therapeutic antibodies, nucleic acids...) with the need for a diverse range of competences and the involvement of teams with complementary expertise.

The researchers present in the region Centre-Val de Loire, working in the disciplines of life sciences, are invited to participate and work in synergy, for inter-sectorial development and innovation, in the pharmacy/health sectors to deliver socio-economic outcomes.

### Research institutions and Partners

- ◆ University François-Rabelais of Tours (Programme leader)
- ◆ INRA Centre-Val de Loire
- ◆ CNRS Centre Limousin Poitou-Charentes
- ◆ Inserm
- ◆ University of Orléans
- ◆ CHRU Tours
- ◆ LE STUDIUM
- ◆ POLEPHARMA
- ◆ GROUPE IMT



# ARD 2020

## LAVOISIER

LAVOISIER stands for LABoratory with a VOcation for Innovation of the Safety and Industrialization of Renewable Energy.

The central subject of the LAVOISIER Programme revolves around promoting a process of design, research, development and industrialisation of materials and systems oriented towards new energies, including all considerations of reliability and safety of use for the devices studied during all stages of their deployment. This programme supports the development of the AlHyance platform.

The AlHyance platform is dedicated to joint research efforts (CEA, Universities, CNRS, industrials) in the domain of materials and low carbon energies. The thematic of research are the following: design and materials expertise, safety and effectiveness of the systems, synthesis and characterisation, and methods and implementations. This programme covers activities through research to transfer of technologies and is supported by the Centre-Val de Loire Regional Government with 10.2 M€ over 3 years.

The aims are to gather the conditions to support the energies of tomorrow and develop promising innovations of growth by strengthening academic and industrial collaborations. Accelerate the industrialisation and the dissemination of innovative new products for low-carbon energy, focusing on the storage of electrical energy and hydrogen. Stimulate research on storage of clean and renewable energies (hydrogen, wind and photovoltaic), in order to facilitate their delivery from the place of production to the place of consumption. Promote the transfer of technologies/competences to existing businesses at the regional level and beyond.

The research focuses on the following topics: storage of hydrogen, storage of electrical energy, energy conversion, fuel cells and the production of hydrogen, development of a new and emerging topic on materials related to solar thermodynamic systems and the mechanical storage of energy.

In addition to these research topics, the programme develops a new approach for the design and development of low carbon materials, supported by the analysis of the environmental safety and impact of systems throughout their development stages and life cycles. This is a transverse topic where engineering and research and development are intertwined in the effectiveness of the choice of design guidelines, reducing the development time by optimising the qualification of materials and the quantification of safety margins against dreaded phenomena. This approach gives the project a unique specificity in France in the field of research into new technologies for energy.

### Research institutions and Partners

- ◆ CEA le Ripault (Programme leader)
- ◆ University François-Rabelais of Tours
- ◆ CNRS Centre Limousin Poitou-Charentes
- ◆ INSA Centre-Val de Loire
- ◆ University of Orléans
- ◆ LE STUDIUM



# MATERIALS AND ENERGY SCIENCES

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# LABORATORIES FOR MATERIALS AND ENERGY SCIENCES

## Interfaces, Confinement, Matériaux et Nanostructures (ICMN) - UMR 7374 - CNRS, Université d'Orléans



The Research Center on Divided Materials (CRMD) was originally created as a CNRS unit in 1991. The institute is today a research unit shared by CNRS and University of Orléans including 30 permanent researchers and around 25 PhD students and postdocs. The team members are mainly located on the CNRS campus in Orléans. On 1st January 2015, CRMD changed its name to become Interfaces, Containment, Materials and Nanostructures (ICMN).

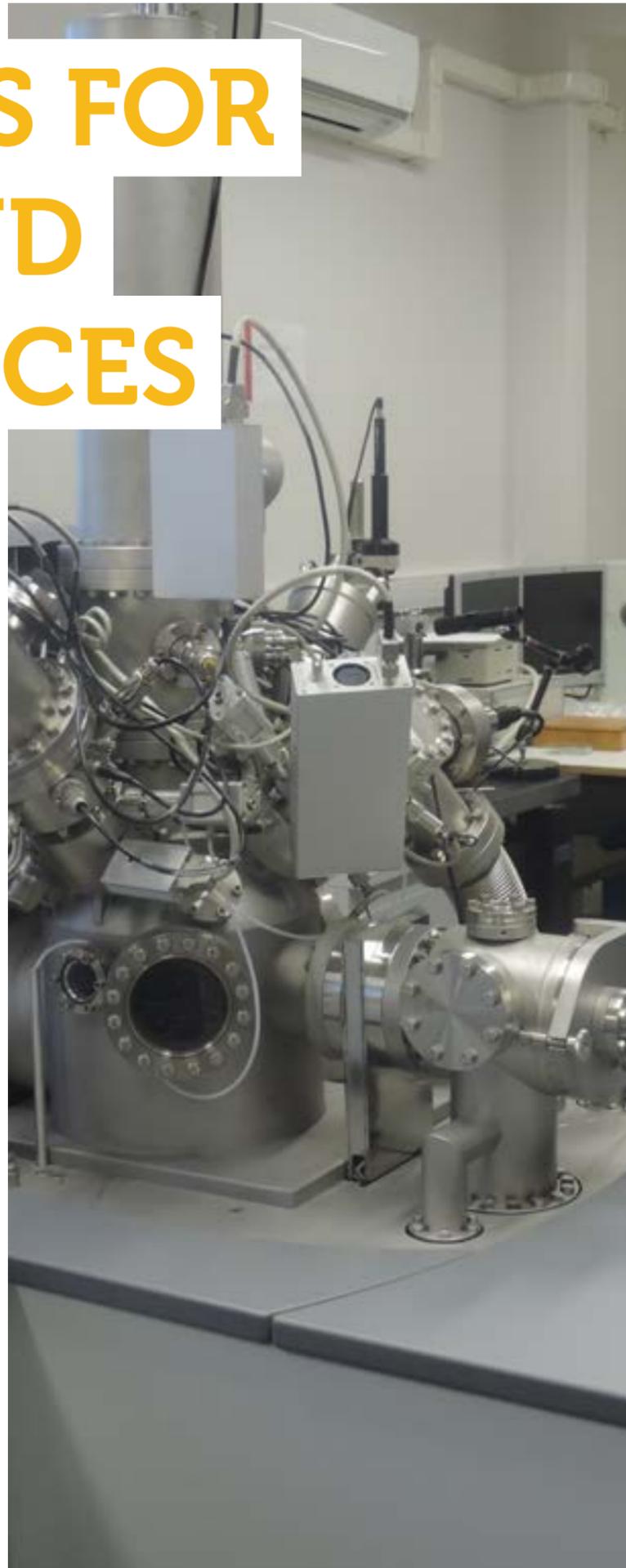
The ICMN laboratory is involved in research and training activities at the heart of a physicochemical multi-scale approach, which addresses the intermediate material scale between nanometer and millimeter scales. The tools such as experimental methods and laboratory characterization, which include synchrotron methods and mathematical modelling, are widely used. They are applied to studies of a range of fundamental issues and their potential applications including energy storage and conversion, photovoltaic devices, water pollution control and environmental protection, sustainability of heritage, catalysis, aerospace, cosmetics, health, nanofluidic networks and nanomagnetic devices.



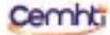
## Unité de Recherche Déchets et Matières Premières - BRGM

The BRGM, operating as a public industrial and commercial institution, was created in 1959. It is France's leading public institution in Earth Sciences for the sustainable management of natural resources (including mineral resources). Building on geology as its core competence, BRGM develops expert knowledge in resource management, risk management and innovative eco-technologies. BRGM research brings practical responses to the major challenges facing society and arising in particular from climate change, increasing mineral resource scarcity, new energy needs, natural risks and soil and water pollution.

The Waste and Raw Materials Unit has strong experience in the development of innovative mineral processing operations and has a recognized expertise in mineral processing and bio-hydrometallurgy up to the engineering of an industrial scale plant for bioleaching of sulphidic minerals. The team is strongly involved in the current research and development efforts conducted at the European Union level on Raw Materials (European Innovation Partnership).



## Conditions Extrêmes et Matériaux: Haute Température et Irradiation (CEMHTI) - UPR 3079 - CNRS

 Originally formed in 1969 and then renamed the Centre de Recherche sur les Matériaux à Hautes Températures (1998). In 2008, it merged with the Centre d'Etudes et de Recherches par Irradiation laboratory. Its goals are to analyze and understand the physical and chemical properties of materials under extreme conditions based on a detailed description of the atomic-scale structures and defects in the solid state or the melt. CEMHTI has an international level of expertise in chemistry and physics at high temperature and/or under irradiation. Its objectives are the analysis and the understanding of the physicochemical properties of solid and molten materials and their behaviour in extreme conditions of temperature (up to more than 2500°C) and irradiation, from a better description of the local atomic structure and defects in the solid and liquid states. The laboratory has expertise in the fields of high temperatures, fusion and solidification, phase transitions, local order and disorder, meta-stability, in optical, radiative, thermic and electrical properties, which are studied in crystalline and amorphous oxides, ceramics, cements and molten salts. The laboratory uses and develops cutting-edge experimentation in high-temperature spectroscopies, non-contact instrumentation, thermic analyses, and irradiation (positron and Vander Graff) for both materials damaging and characterization.



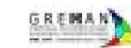
## PRISME - EA4229 - INSA Centre-Val de Loire, Université d'Orléans



PRISME is a joint laboratory created in 2008 in region Centre-Val de Loire. The laboratory embraces more than 170 professors, researchers, engineers and PhD students located in Bourges, Chateauroux, Issoudun, Chartres and Orleans. PRISME is multidisciplinary in the domains of science for engineering, in a large spectrum of fields, such as materials, energetics, mechanics, combustion engine, energy and thermodynamics, aerodynamics, signal processing and automation and robotics. The laboratory activities are gathered inside two main poles: 1) fluids, mechanics, materials and energetics and 2) image processing, robotics, automatics and signals. The Pyrolysis and Propulsion group research focus is on the phenomenological understanding of the reactive interactions between fluids and solids; particularly by considering chemistry and multiphysics effects. The investigations are conducted both numerically and experimentally to enhance knowledge through computation and validate/observe through experiments.



## Groupe de Recherche en Matériaux, Microélectronique, Acoustique et Nanotechnologies (GREMAN) - UMR 7347 - Université François Rabelais de Tours, INSA Centre-Val de Loire, CNRS, CEA



GREMAN is the materials research laboratory for microelectronics, acoustics, and nanotechnology. Created in 2012 as a collaborative laboratory between the University François-Rabelais de Tours, the National Center for Scientific Research (CNRS), the Office of Atomic and Alternative Energies (CEA), the National Institute of Applied Sciences (INSA), and the company ST Microelectronics. It has three mission axes, the first axis synthesizes and studies materials with remarkable properties and develops novel methods of characterization. This axis has a particular focus on the application of materials for energy efficiency and environmental inertness. The second axis has a strong focus on the magnetic and optical properties of ferroic (ferromagnets, ferroelectrics, and ferroelastics) and electronic materials. This team utilizes experimentation, numerical modeling and simulation. The third axis has broad interest in material chemistry and energy conversion. There is currently a strong push for this group to develop materials and systems to allow energy harvesting from mechanical movements in the environment to power micro and nano systems. These axes function as an integrated unit through ongoing collaboration between the researchers and principal investigators.





# Dr Arayik Hambardzumyan

LE STUDIUM RESEARCH FELLOW  
Yerevan State University, Armenia  
In residence at ICMN, Orléans – September 2014 to December 2015

*Arayik HAMBARDZUMYAN is an Assistant Professor in Yerevan State University. He has the following diplomas and experience: - Asperantura (PhD degree) from the Yerevan State University, Armenia, awarded 1994. PhD in Reactions in biphasic water/organic solvent systems in the presence of surfactant: Inverse phase transfer catalysis or interfacial catalysis, from Montpellier II University, France, awarded 1999. He has held post-doctoral positions at the Catholic University of Louvain, Belgium and then at INRA, Reims, France. He has expertise in colloidal systems, emulsions, solid surfaces, and lignocellulosic materials.*

## The impact of adsorption layer structure and chemical composition on the stability of encapsulated product in emulsions

This project aims to investigate emulsion performance and the application of green chemistry in the formulation of emulsions, which are important issues in the field of cosmetics. This project focuses on essential questions in the field of cosmetics; the stability of emulsified systems against coalescence, the evaporation of perfume oil from colloidal multiphase mixtures and the antioxidant properties of adsorption layers.



Equipment used at ICMN

Many cosmetic formulations are basically oil in water or water in oil emulsions. In the frame of this project we aim to study the evaporation rates of oil phases and the protection of products encapsulated in emulsions. The protection of products is controlled by the structure and the chemical composition of the adsorption layers formed at liquid-liquid interfaces. An innovative aspect of this research is

the application of naturally occurring macromolecules (natural renewable carbon resources) in cosmetic formulations; for instance adsorption layers formed by lignin and cellulose nanocrystals will be tested for their antioxidant properties.

In order to characterize the efficiency of these interfacial layers, surface pressure-evaporation rate relations, measured at different temperatures, will be carried out by Langmuir monolayer technique. In addition we will study the evaporation process through the monitoring of lipid mesophase droplet evolution by small angle scattering techniques.

This project, studying the surface properties of macromolecules, seeks to develop the scientific basis for the application in cosmetic products of naturally occurring plant macromolecules.



### HOST SCIENTIST

Samuel GUILLOT is an Assistant Professor at University of Orléans - ICMN laboratory since 2006. He has the following experience and diplomas:

- Master of Advanced Studies in Theoretical physics of liquids, University Paris VI, France, awarded 1997. PhD in Aggregation structures and interfacial properties of methylcellulose, at CEA Saclay, France, awarded 2001.

He has held post-doctoral positions at the University Paris XI, Orsay, France, at the Technical University of Munich, Garching, Germany, at Paul Pascal Research Center, Bordeaux, France and at Karl-Franzens University, Graz, Austria.

He has expertise in internally structured emulsions, lipid mesophases, polymer physics, surfactant/polyelectrolyte complexation, adsorption layers, hydrogels, delivery systems and biopolymers (cellulose derivatives). adsorption layers, hydrogels, delivery systems and biopolymers (cellulose derivatives).

### COMMUNICATION RELATED TO THE PROJECT

#### Oral communication

- ◆ Hambardzumyan, A. Specifics properties of surfaces, ICMN, University of Orléans, France, October 23, 2014





# Dr Edouard Asselin

LE STUDIUM RESEARCH FELLOW

University of British Columbia, Vancouver, Canada

In residence at Unité de Recherche Déchets et Matières Premières, Orléans – September 2013 to September 2014

Edouard Asselin is a tenured Associate Professor and Canada Research Chair from the Department of Materials Engineering, at the University of British Columbia in Vancouver, Canada. He's a metallurgist and he primarily works in the field of aqueous extractive metallurgy: that is, he specializes in extracting metals from rocks into water-based solvents and then recovering said metals in pure, solid, saleable form. He manages a variety of industry and government funded research projects related to aqueous processing of metals.

## Advanced bio-hydrometallurgy for recovery of metals from complex deposits – modelling of the leaching step

Metals such as copper and nickel are used ubiquitously in everything from plumbing to electronics: they are necessary for modern human civilization. However, the minerals and metals industry is changing worldwide and has reached a turning point.

Large, easily exploitable and relatively clean deposits are increasingly rare and the industry is now faced with the challenge of extracting metals from smaller, more complex, deposits with higher levels of toxic impurities such as arsenic, antimony and mercury. Similarly, waste dumps from historical mining operations as well as forms of post-consumer waste (such as electronic scrap) are increasingly economically viable sources of needed metals.

All of these "secondary" sources of metals pose significant processing challenges requiring novel approaches. Aqueous metals processing (hydrometallurgical) technologies are ideally suited to the exploitation of smaller, impurity-laden ores and wastes.



Example of Copper mine

### HOST SCIENTIST



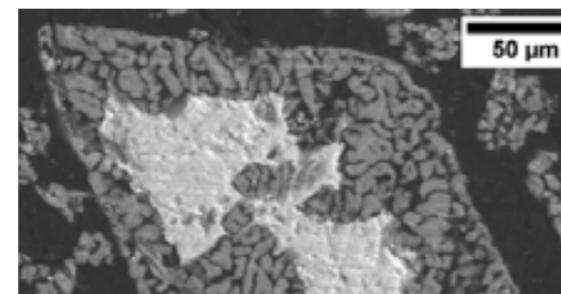
Patrick d'Hugues is a biotechnology engineer. He obtained his doctorate at the BRGM in 1996 and did his postdoctoral work at the University of Warwick UK on mineral bio-leaching.

In 2000, Dr d'Hugues contributed to the startup of the Kasese (Uganda) industrial process for the bio-hydrometallurgical recovery of Co from sulphidic wastes.

He then coordinated the large European research and development effort Bioshale (<http://bioshale.brgm.fr/>) and participated in the management of Biomine (<http://promine.gtk.fi/>). Today Dr d'Hugues is responsible for the "Wastes and Primary Resources" R&D unit at the BRGM.

New hydrometallurgical technologies will offer an opportunity to continue economic resource extraction with a smaller environmental footprint and increased competitiveness. At the heart of these technologies lies the leaching step – the solubilisation of metals into the aqueous media, which is usually dilute acid.

To date, extensive kinetic testing (measurements on the speed of reaction) on a variety of sulphide minerals has been completed at BRGM facilities and kinetic models are now being built to enable a better mechanistic description of the leaching step.



structure of the sulfide mineral chalcopyrite



LE STUDIUM THURSDAY - 3 April 2014



Left: copper metal.

Right: Bioleaching reactor for recovery of cobalt from cobalt pyrites



LE STUDIUM CONFERENCE, 14-15 October 2014

## COMMUNICATION RELATED TO THE PROJECT

### Oral communication

- ◆ Asselin, E. Securing metal for the future, LE STUDIUM THURSDAYS, Orléans, France, April 3, 2014



LE STUDIUM CONFERENCES

## COPPER, A STRATEGIC METAL? THE PRESENT AND FUTURE OF RESOURCES, PROCESSING AND RECYCLING

14-15 October 2014  
Orléans, France

The goal of this conference was to discuss the challenges that are posed, for the metals industry, by decreasing ore grades and increasing ore complexity.

Copper is necessary for modern civilization as it plays an important role in modern technology; its production has increased at an average rate of approximately 3% since the 1960s. It can be anticipated that the copper production in the next 25 years will be greater than the total amount of copper produced since the beginning of humanity.

This continued and growing demand is now confronted with changes in the nature of the global copper resource: average ore grade is decreasing whereas ores are increasingly complex, often containing toxic impurities.

Similarly the recycling of copper-containing end of life products is increasingly complex. These changes will impose technological advances on the mining and processing industries in order to adapt to new market forces.

LE STUDIUM Conference examined the effect of present and anticipated global copper resources (geological and urban) on the economic and technological viability of existing and proposed metallurgical processes for extraction and recycling.





# Dr Igor Leontiev

LE STUDIUM RESEARCH FELLOW  
Southern Federal University in Rostov-on-Don, Russia  
In residence at CEMHTI, Orléans – June 2013 to June 2014

Igor Leontiev is Associate Professor of the Department of Nanotechnology of the Southern Federal University in Rostov-on-Don, Russia. He obtained his PhD thesis in Physics in 2002. He was then appointed Assistant Professor at the Azov-Black Sea State Agro-Engineering Academy in Zernograd and joined the University of Rostov-on-Don in 2006. His main scientific interests relate to the project, are the study of catalysts including nucleation and growth processes with in-situ experiments, structural investigations (mainly with XRD diffraction techniques), and the determination of catalytic activities.

## In situ combined investigations of nano-particles nucleation and growth processes of platinum carbon supported electro-catalysts for low-temperature fuel cells.

Composite materials containing pure or alloyed Pt nanoparticles deposited on carbon support are very promising catalysts for low temperature fuel cells.

It is well known that the catalytic activity of Pt catalysts significantly depends on the microstructural characteristics such as the average particle size, the particle size distribution or the nanoparticles shape, and hence from the synthesis route. One of the major approaches to improving the activity of Pt-based catalysts is the optimization of the synthesis procedure.

During the project, 3 main studies were performed:

1) A set of carbon supported Pt nanoparticles with diameters ranging from 2 to 28 nm has been prepared, which were studied using X-ray diffraction (XRD). The evolution of the lattice parameter with the particle size was interpreted using the Continuous-Medium model that gives a good agreement with the experimental results.

In-situ XRD investigations of these samples at high pressure and high temperature were performed at the European Synchrotron radiation Facility (ESRF) in Grenoble. The data analysis is in progress and the results should give new information about the effect of the nanoparticle size on its Young modulus and about the grain-size dependence of the thermal properties.

2) Various carbon-supported electrocatalysts (Pt, Pt<sub>3</sub>Co, and Pt<sub>3</sub>Ni) were prepared using electrochemical dispersion and studied by thermal gravimetric analysis in conjunction with electrochemical measurements.

## HOST SCIENTIST



Louis HENNET graduated from the University Pierre & Marie Curie in Paris and entered the CNRS in 1992, after a PhD thesis in material science.

In 1997, he joined CEMHTI to develop research focusing on x-ray and neutron scattering techniques. From 2004 to 2014, he has been the group leader of the Synchrotron Radiation and Neutron Research Group. He is also associate researcher at the French Synchrotron (SOLEIL) and the neutron source (Laboratoire Leon Brillouin).

His main research activity is concerned with studying the structure, dynamics and transport properties of high temperature melts (glasses, ceramics and metallic alloys). He received the CNRS Cristal award in 2004.

The electrocatalytic tests using membrane electrode assemblies showed that the catalytic activity increases following the sequence: Pt<sub>3</sub>Ni/C < Pt<sub>3</sub>Co/C < Pt/C. From the thermogravimetric data it was found that the onset temperature and activation energy of the carbon support thermal oxidation reduced in the order Pt/C < Pt<sub>3</sub>Co/C < Pt<sub>3</sub>Ni/C (corresponding to the increase of the catalytic activity).

3) NiO/C nanocomposites were prepared using a one-step electrochemical route based on electrochemical dispersion of nickel by an alternating current. The samples were studied using XRD and Raman spectroscopy that confirmed the formation of β-NiO. Electron microscopy observations showed a morphology consisting of a tightly packed array of nanoparticles. By using cyclic voltammetry and galvanostatic charge-discharge methods, we found high electrochemical

potentialities showing that our simple synthesis route enables to obtain composites with promising properties for supercapacitor applications.

## COMMUNICATIONS RELATED TO THE PROJECT

### Oral communication

- ♦ Leontiev, I., Catalytic activity of carbon-supported Pt nanoelectro-catalysts. Why a the size of Pt nanoparticles is not always beneficial?, LE STUDIUM CONFERENCE: Heterogeneous catalysis: recent advances in preparation and characterization, Orléans, France, March April 31-1, 2014.

### Scientific publication

- ♦ Leontiev, N.; Kuriganova, A. B.; Leontiev, N. G.; Henet, L.; Rakhmatullin, A.; Smirnova, N. V.; Dmitriev, V. Size dependence of the lattice parameter of carbon supported platinum nanoparticles: X-ray diffraction analysis and theoretical considerations, *RSC Advances*, **2014**, *4*, 35959



LE STUDIUM CONFERENCE, 31 March-1 April 2014



LE STUDIUM LECTURE, 31 March 2014



### LE STUDIUM CONFERENCES

## HETEROGENEOUS CATALYSIS: RECENT ADVANCES IN PREPARATION AND CHARACTERIZATION

31 March – 1 April 2014,  
Orléans, France

Heterogeneous catalysis is involved in numerous industrial processes with significant impact on our society and economy. The aim of the conference was to present current research on catalysts, focusing on their preparation and characterization, in particular at large-scale facilities. This conference brought together scientists working on various domains related to catalysis. It included talks presenting original approaches for the synthesis of nanoparticles and catalytic processes.

Then we had a good summary of the various techniques used to investigate the properties of the catalysts and the catalysis reactions in real time, in particular using x-ray techniques at synchrotron sources. Finally, some presentations focused on applications, all of which gave rise to stimulating discussions between the attendees.

### LE STUDIUM LECTURES

## DU LABORATOIRE À L'ESPACE, UNE AVENTURE PASSIONNANTE : CINÉTIQUE, CATALYSE ET PROPULSION

31 Mars 2014  
Orléans, France

Professor Charles Kappenstein  
Professor Emeritus of the University of Poitiers

Three important questions about catalysis followed by a short historical survey

The use of catalysis for propulsion began just before WWII in Germany with the decomposition of 80-85 wt% hydrogen peroxide through injection of permanganate. The first applications were: assisted takeoff units for He-176 plane; V1 catapult; V2 turbo-pump gas generator. H<sub>2</sub>O<sub>2</sub> was also used for torpedo and submarine propulsion. After WWII, the UK Black Knight rocket program associated kerosene with H<sub>2</sub>O<sub>2</sub> as a propulsion system using silver screens as catalyst.

Catalytic decomposition of hydrazine for space propulsion and hydrazine substitutes

During the late fifties, the start of the space program led to the replacement of unstable H<sub>2</sub>O<sub>2</sub> by more stable hydrazine N<sub>2</sub>H<sub>4</sub> as a monopropellant propulsion system, using newly developed Ir/Al<sub>2</sub>O<sub>3</sub> catalysts. The main application was orbit and attitude control of launched satellites. This control is obtained through the use of small on-board engines (or thrusters) giving low but precise impulses.



# Dr Christopher Oshman

LE STUDIUM RESEARCH FELLOW  
University of Colorado, Boulder, Colorado, USA  
In residence at GREMAN, Blois – October 2013 to October 2014

Christopher Oshman completed his Ph.D in Mechanical Engineering at the University of Colorado, Boulder, Colorado in the Development, Fabrication, and Experimental Study of Flat Polymer Micro Heat Pipes. A graduate researcher at the University of Colorado, working on Micro-Electro-Mechanical Systems fabrication and two-phase technologies, he developed low-cost thermal energy transfer devices.

## Investigation of the feasibility of strain sensing and energy harvesting with piezo-semiconducting nanostructures

This project has several ambitions. First, there have been recent developments in the realm of energy harvesting using nanomaterials. Specifically, piezoelectric materials when strained by an external force, because of their unique crystal structure, generate a voltage potential. The use of nanomaterials was found to be beneficial to increase sensitivity to motions with small amplitudes and with a broad array of frequencies. This enables power generation for small systems in the micro and nano scale. The historically dominant piezomaterial for such applications has been lead zirconium titanate, or PZT, due to its high piezoelectric coefficient. This material is however dangerous to the environment and biological systems due to its lead content and it has the additional drawback of requiring a process called poling to align the molecules to activate the piezoelectric property.

To overcome such drawbacks, this project focused on the use of zinc oxide, ZnO, as the active piezoelectric material. For many decades, ZnO was used primarily for the production of vulcanized rubber and as an additive in the food industry. There has been recent excitement in the last decade about the piezoelectric properties of ZnO and possible applications of the material exploiting this property. So, one ambition of this project was to develop power generation systems using this newfound property and a source of power for micro/nano systems. There was also the objective of using the material as a sensing element. If the material is designed and arranged in such a way as to produce a voltage potential when there is a physical deformation in a macro-scale member of a large mechanical system, like a bridge, building, aircraft, or animal, then the device can serve as a strain sensor for critical applications such as structural health monitoring.

To execute such energy harvesting and strain sensing applications, a nanostructured system of ZnO was developed. The small size scale of the system offered several advantages. First, the material was physically flexible because of the small

## HOST SCIENTIST



Guylaine Poulin-Vittrant (CNRS Researcher) received her PhD in Electrical Engineering in 2004 from Orsay University, Paris XI, on human mechanical energy harvesting using bulk PZT ceramics. In 2005 she became full time CNRS researcher at Grenoble Electrical Engineering Laboratory and has been at GREMAN since 2008. Her research interests are experimental investigation and theoretical models development for piezoelectric materials and devices. She has participated and participates in European ("MIND" EU Network of Excellence, Piezo Institute), national ("OVMI" and "EVA" ANR projects) and regional ("CEZnO" Centre region funding) projects.

size scale. This allowed the design and development of flexible sensors and energy harvesting devices. Secondly, the nano-scale ZnO material was very sensitive to small movements. Third, a very simple and effective procedure was developed to grow high quality ZnO nano-structures in the form of vertical nano-rods and nano-wires.

They were grown in a hydrothermal environment at temperatures as low as 100°C, permitting the use of flexible and even stretchable polymer substrates.

Growing these structures on any metallic substrate was applied using a weak galvanic reaction between the substrate material in contact with a dissimilar metallic anode. This is an advancement allowing facile and low cost fabrication of devices, which brings the technology closer to the realm of commercial production. During the course of this project, we have developed a flexible power generator, which creates a voltage potential with the application of a bending moment.

## COMMUNICATIONS RELATED TO THE PROJECT

### Posters

- ◆ Oshman, C.; Opoku, C.; Dahiya, A.S.; Camara, N.; Alquier, D.; Lethiecq, M.; Poulin-Vittrant, G. Challenges Associated with the Performance Assessment of Nanogenerators, LE STUDIUM Conference on Piezoelectric Micro and Nano Structures and their Applications, Blois (France), September 25-26, 2014
- ◆ Opoku, C.; Oshman, C.; Dahiya, A. S.; Poulin-Vittrant, G.; Tran Huu Hue, L.-P.; Alquier, D.; Camara, N. Towards the development of hydrothermally grown ZnO nanowire based piezoelectric nanogenerators, LE STUDIUM Conference on Piezoelectric Micro and Nano Structures and their Applications, Blois (France), September 25-26, 2014
- ◆ Dahiya, S.; Opoku, C.; Oshman, C.; Poulin-Vittrant, G.; Tran Huu Hue, L.-P.; Alquier, D.; Camara, N. Evaluation of metal-ZnO nanostructure contact properties for high performance laterally integrated nanogenerators, LE STUDIUM Conference on Piezoelectric Micro and Nano Structures and their Applications, Blois (France), September 25-26, 2014

### Oral communications

- ◆ Alquier, D.; Dahiya, A. S.; Opoku, C.; Oshman, C.; Poulin-Vittrant, G.; Cayrel, F.; Tran Huu Hue, L.-P.; Camara, N. 1D and 2D ZnO Nanostructures: From Materials to Devices, EXMATEC 2014, Delphi (Greece), June 18-20, 2014
- ◆ Opoku, C.; Oshman, C.; Dahiya, A. S.; Poulin-Vittrant, G.; Tran Huu Hue, L.-P.; Alquier, D.; Camara, N. Fabrication of ZnO nanowire based piezoelectric generators and related structures, LE STUDIUM Conference on Piezoelectric Micro and Nano Structures and their Applications, Blois (France), September 25-26, 2014



LE STUDIUM THURSDAY, 6 February 2014



LE STUDIUM CONFERENCE, 25-26 September 2014



## LE STUDIUM CONFERENCES PIEZOELECTRIC MICRO AND NANO STRUCTURES AND THEIR APPLICATIONS

Blois 25-26 September 2014  
INSA Blois, France

The objectives were to bring leading experts in the broad field of piezoelectric materials and devices to focus on current and emerging research trends on micro and nano mechanical and electrical systems. Specifically, we wanted to provide a platform to discuss the piezoelectric aspect of 1-D, 2-D, and 3-D structures and the future paths and challenges that are faced in this field. The invited speakers to the conference were from similar but different enough fields to have been mostly unaware of each other's work. This conference permitted these researchers to learn about their interests, achievements, and capabilities. The networking sessions offered the participants time to casually discuss possible collaborations and the sharing of exceptional skills and abilities. The outcome of the conference is that the participants went home with a broader view of the context of their research fields and a renewed determination to join forces and explore novel research avenues.

## LE STUDIUM LECTURES INTELLIGENT OBJECTS AND ELECTRONIC CIRCUITS OF THE LAST GENERATION

25 September 2014  
INSA CVL Blois, France

**Professor Laurent Montes**  
Institute of Microelectronics Electromagnetism and Photonics (IMEP-LAHC), Grenoble, France.

His research involves low-dimensional wearable electronic components, Micro-Electro-Mechanical Systems/Nano Electro Mechanical Systems, sensors, and energy recovery devices. In his public talk, Professor Montes presented the state of the art in next generation electrical components including size evolution, performance development, and basic physics pertaining to such devices. He went further and showed prospects for the future following current research avenues related to topics discussed in the LE STUDIUM Conference.



# Pr Scott Kroeker

LE STUDIUM RESEARCH FELLOW  
 Department of Chemistry, Winnipeg, Manitoba, Canada  
 In residence at CEMHTI, Orléans – August 2014 to August 2015

Scott Kroeker is a Professor from the University of Manitoba, Canada. His Ph.D. is in physical and theoretical chemistry, and was a Natural Sciences and Engineering Research Council of Canada postdoctoral fellow at Stanford University. Since joining the University of Manitoba in 2001, he has established a research program focusing on the use of solid-state NMR to discern structure-property relationships in disordered inorganic materials. He was a visiting professor in Mineral Physics at the University of Cambridge (2007/08). He is a founding member of the Manitoba Institute of Materials.

## High-temperature nuclear magnetic resonance spectroscopy of devitrification processes in nuclear waste glasses

The motivation for this work stems from the significance of nuclear power as an important component of our global energy portfolio.

A key obstacle to widespread acceptance of nuclear power is the disposal of radioactive waste after fission. Despite effective engineering solutions and materials carefully designed to isolate the waste from interaction with the biosphere, the extremely long time-scale of radioactive decay demands the highest degree of reliability.

Although some radioisotopes decay to safe levels after a few hundred years, many remain radioactive for hundreds of thousands of years, dwarfing the life-spans of cities and civilizations. In view of this long-range perspective, utmost attention must be devoted to ensuring that the materials used to lock up radioactive species remain intact for an extended period of time.

It is for this reason that highly durable glasses are used to encapsulate the radioactive waste products that result from reclaiming the unused fuel from spent-fuel rods. Encased in stainless steel canisters, these glasses are able to withstand all manner of environmental incursions, retaining the dangerous ions within the robust network of the solid.

However, recent innovations in nuclear fuels have introduced several elements into the front end of the fuel cycle which improve energy efficiency, but tend to resist complete incorporation into the glassy phase at the back end of the cycle resulting in the separation of less-durable phases from the bulk glass. While the current practice is to reduce fuel-loading levels sufficiently to prevent such phase separation, the human and environmental health imperative demands a comprehensive understanding of such processes.

## HOST SCIENTIST

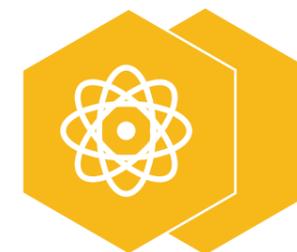


Pierre Florian received an engineer degree from l'école supérieure de l'énergie et des matériaux University of Orléans and a Ph.D. in physical chemistry at University of Orléans (1993). After two years as a postdoctoral researcher at Ohio State University (U.S.A.), he joined the CNRS in 1996. He currently manages the NMR platform (6 instruments in the network of Infrastructures de Recherche Résonance Magnétique Nucléaire, Très Hauts Champs (TGIR RMN THC - FR3050)) at the CEMHTI.

His research focuses on developing in-situ high-temperature and high-resolution NMR experiments with applications to materials science. He currently has more than 80 publications in peer-reviewed journals, has given several invited talks at international conferences, has been part of European programs (Research Infrastructure, Large Scale Facilities and Marie Curie Training Sites) and has taught at several summer schools.

The research to be conducted involves the use of spectroscopy to determine the chemical phases of molybdenum in borosilicate model nuclear waste glasses at temperatures ranging from ambient, where the materials exist as solids, to 1000°C, where they exist as liquids.

By defining the structures and amounts of each distinct phase as a function of temperature, the mechanism of phase separation during the formation of nuclear waste glasses can be discerned, thereby providing a scientific basis for developing chemical solutions to improve the incorporation of molybdenum in nuclear glasses and ensure their long-term durability.



# Recycling of used refractory ceramics and circular economy

AFFILIATED EVENT  
 22 October 2014

Thematic day with Groupe Français de la Céramique - Société Française Métallurgie Matériaux (GFC-SF2M) in partnership with the pole of competitiveness Technologies de l'Environnement Appliquées aux Matières et aux Matériaux (TEAM<sup>2</sup>)

Raw materials have a direct and immediate impact on the overall cost structure of refractory products. Their production is expensive and requires a lot of energy. Consequently, the use of recycled raw materials is an alternative challenge to reducing the cost of refractories, to substitute expensive raw materials, to secure access to the market, to reduce the energy requirement for production of refractories and to limit environmental impact (reduction of CO<sub>2</sub> greenhouse gas consistent with the European Kyoto Protocole).



Examples of used refractory ceramics

The objective of this event was to evaluate the possibilities for the recycling of used refractories.

The event outcomes and perspectives are:

- ◆ 58 participants;
- ◆ a very significant representation of industrial and technical centers - 64%;

## BIOGRAPHY OF THE EVENT COORDINATOR



Jacques Poirier is Professor at University of Orléans/CNRS, France. He worked in the steel making industry (Arcelor Group) for 17 years.

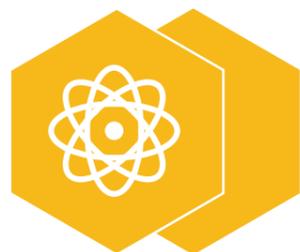
From 1989 - 1990, he worked at the Metallurgy and Material Engineering Department of the École Polytechnique de Montréal as a visiting professor of the Industrial Refractories Chair (CIREP).

Since 2001, Jacques Poirier has been a full Professor at the Material Engineering Department of Polytech, University of Orléans and is Head of the Refractory Materials, Design and Corrosion Research Group, at CEMHTI Laboratory

Professor Poirier is also an adjunct professor at the Ecole Nationale Supérieure de Céramique de Limoges and the Ecole Supérieure de Forges et Fonderie de Sévres.

- ◆ representatives from 5 countries - Belgium, Netherlands, Germany, Austria and France;
- ◆ 10 scientific and technical papers were presented;
- ◆ scientific exchange between working groups.

Recycling of secondary raw material is desirable and technically has many advantages; minimization of environmental impact, reduction of disposal costs and possibilities to reuse raw materials. In this context, the best scientific and commercial practices should be applied to optimise the organisation of recycling chains.



# e-Solid-State Nuclear Magnetic Resonance (e-SSNMR)

LE STUDIUM RESEARCH CONSORTIUM



The initiator of the project was Dr Dominique Massiot, at that time director of the CEMHTI Orléans and leader of a group specialized on the NMR characterization of the local structure and dynamics of solid and molten materials. He is developer of the Dmfit programme that is the most commonly used tool to extract NMR parameters from NMR spectra in the materials science community. Promoted head of the Chemistry Institute of the CNRS in 2013, he passed the project coordination on to Dr Sylvian CADARS and Dr Pierre FLORIAN, respectively researcher and research engineer at CEMHTI, with expertise in experimental NMR and the combined use of quantum chemistry for the characterization of inorganic and hybrid organic-inorganic materials. Pierre Florian is the leader of a group focusing on the methodology, instrumentation, and applications of high-resolution NMR of solid materials and high temperature melts. He is the author of 81 publications and 6 invited conferences. Dr Cadars is involved since 2011 in an ANR project focusing on visual analytics for materials science and molecular biology, with direct connections to the e-SSNMR project. He is the author of 25 publications.

Solid-state nuclear magnetic resonance (NMR) is an important experimental technique for the characterization of the molecular-level structure and dynamics of advanced materials. A number of software packages have been independently developed to help understand and predict experimental NMR results. Solving complex materials science problems, however, nowadays requires facilitated access to all these tools, to combine experimental NMR data with modelling and fully exploit the strong potentialities of the technique, which is currently too often overlooked in the Materials Sciences & Engineering communities.

Our project aims to catalyse the crucial and necessary evolution of the use of modern solid-state NMR spectroscopy by developing the interoperability of existing concepts and software tools that range from data acquisition, processing, fitting, and modelling to the comparison with parameters assessed from crystallography, molecular dynamics, and/or quantum chemistry computations. The consortium gathers expert developers of well-established programs in all of these until now relatively independent areas, to direct future developments towards a greater inter-connectivity and facilitated access to both expert and non-expert users.

A synergetic usage of these existing programs and of new tools currently under development in the different consortium members' groups is expected to attract an extended community of materials scientists, spectroscopists, theoretical physicists, and chemists, offering them the opportunity to integrate the deep molecular-level information provided by NMR into the fundamental understanding and the control of materials properties.

After three meetings all of the consortium members are now fully aware and regularly informed of the progress of the developments made by the others in their respective fields.

This has already changed the way we all think about future developments, to integrate analytical tools into a broader ensemble at a higher level of priority. This has impacts in particular on the program language chosen and on the data (and exchange) file formats, which have been extensively debated during the meetings.

Several directions have been identified to converge toward stronger interconnectivities between the different tools and the integration of some of these tools into a prototype of web platform (developed by Jonathan R. Yates and Julien Wist) that may be the starting point for the development of a database of experimental and calculated solid-state NMR data on materials.

A reflection has been initiated on the design of a general decision tree that is intended to facilitate the systematization of the collection of solid-state NMR experiments, to then facilitate deposits onto databases and make progress towards the higher-level automation of data acquisition, processing, and interpretation that are necessary to attract a broader range of materials scientists. A true synergy has been created, with constructive interactions that have been initiated and are now on-going between several of our partners, which will positively impact our scientific field in the next few years.



NMR spectrometer installed at CEMHTI Laboratory

## CONSORTIUM PARTNERS



**PR PHILIPP J. GRANDINETTI**  
Department of Chemistry, Ohio State University, USA

is a worldwide-recognized expert in the experimental and theoretical aspects of Solid-State NMR, with primary interests in the field of glasses and disordered materials, and has expertise in the combined use of NMR and quantum chemical modelling. His is the developer of the NMR software package (Apple platforms) for the processing multi-dimensional NMR data.



**PR THOMAS VOSEGAARD**  
Center for Insoluble Protein Structures, Interdisciplinary Nanoscience Center and Aarhus School of Engineering, University of Aarhus, Denmark

is one of the developers of SIMPSON, a powerful and widespread software performing in-silico solid-state NMR experiments. He has experience with high performance and distributed supercomputing, and has devoted much attention in the past few years to the integration of dynamics into in-silico NMR experiments.



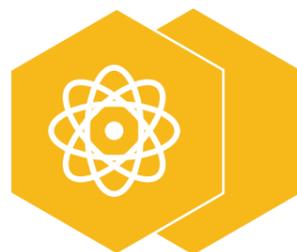
**PR JONATHAN R. YATES**  
Department of Materials, University of Oxford, UK

is among the world leading scientists in the field of quantum mechanical computations of NMR parameters, which he implemented into the CASTEP software. He has largely demonstrated the power of these computations to elucidate the structures of many (mainly organic) materials. He is also the leader of the British Collaborative Computational Project « NMR Crystallography » that has been funded in October 2011 by the Engineering and Physical Sciences Research Council (EPSRC).



**PR JULIEN WIST**  
Universidad Del Valle, Ciudad Universitaria, Cali, Colombia

is the developer of web-based evolutive platforms that integrate all aspects of a researcher's requests for NMR analysis of small molecules in solution, from spectra analysis to database management and quantum chemical calculations. These approaches represent the basic framework of what the consortium project intends to implement for solid-state NMR of materials.



# Cooling of Hypersonic Advanced Reacting Applications: Coupled Transient Evaluation of Reactions (CHARACTER)

LE STUDIUM RESEARCH CONSORTIUM



Professor Nicolas GASCOÏN obtained his PhD in Process Engineering from the University of Orléans, France in 2006. He worked as Associate Professor for six years for the University of Orléans before becoming Full Professor in 2013 at INSA-CVL in Bourges. During this period, he worked on the hypersonic propulsion thematic (chemical effect on materials resistance and behaviour). He currently works at the PRISME laboratory. He is scientific head and coordinator of several national and industrial projects (European Space Agency, DAHER-SOCATA, EADS,...). He is the focal point of several EU projects (ISCREEN, GULSP, CUPCUSC-MEM...). He has authored over 30 peer-review articles, attended over 40 international conferences and has two internationally licensed patents. He is an expert reviewer for H2020, JRC, VLIR-UOS, ANRT/ANR, NCSE... He is a reviewer for over 30 international journals. He has several international collaborations. He spent one year training in the HEC Business School of Paris and he is the cofounder of the SME GVTechnologies. He has an experience based understanding of Innovation and Technology Transfer.

The project is proposed as a coordination action with ambition to establish a unique European consortium to address the main challenges in the composite materials for aerospace activities. Over 40 European partners (Industries, SMEs, Academics, Stakeholders) were invited during two one-week consortia meetings and the main outcome of technical discussions was that mechanical study of materials is not anymore a challenge while energetic studies to enable to find materials able to withstanding temperature over 1500 K were required.

Thus, a third one-week consortium meeting was scheduled to prepare a phase one consortium proposal for a H2020 call for projects. Following a successful outcome, the last consortium meeting was dedicated the preparation of a full application to ensure smooth continuity between the CHARACTER LE STUDIUM Consortium and the MAC<sup>2</sup>H European Union Consortium.

The main achievements are first that this LE STUDIUM action significantly increased the international visibility of the PRISME laboratory, the laboratory EU network connections and it gave the CHARACTER coordinator the unique opportunity to build

his EU project coordination skills. Second, the MAC<sup>2</sup>H proposal would not have been possible without LE STUDIUM support to enable the management of the massive work time that building a competitive EU project requires. Achieving this time demanding task was possible because it was done in a clear framework to achieve the objective. A number of valuable connections were possible with MAC<sup>2</sup>H partners, with LE STUDIUM members and with other invited researchers.

In addition, new collaboration with Professor Sergey Traytak (LE STUDIUM RESEARCH FELLOW 2012-2013), from the Russian Academy of Sciences, can be cited as an example of significant benefit that resulted from working in the community of international scholars of LE STUDIUM Loire Valley Institute for Advanced Studies.



3<sup>rd</sup> meeting of the CHARACTER project

## CONSORTIUM PARTNERS



**PR JOHAN STEELANT**  
European Space Agency and Catholic University of Leuven, Belgium

Professor Steelant has high-level expertise in experimental design of conditions experienced for hypersonic vehicles.



**DR MARKUS KUHN**  
German Aerospace Center, Stuttgart, Germany.

Dr Kuhn has expertise concerning the active cooling of supersonic combustors and hot reentry surfaces.



**PR KEVIN VAN GEEM**  
Ghent University, Zwijnaarde, Belgium.

Professor Van Geem field of research is in thermochemical reaction engineering. A former Fulbright Research Scholar at MIT, he has experience in the collaborative analysis of pyrolysis results.



**PR GUY MARIN**  
Ghent University, Gent, Belgium

Professor Marin is a leader in chemical reaction engineering, experienced in computational fluid dynamics of industrial reactors. The kinetic modeling of reactions in mixtures containing several hundred molecular species is the specific expertise of his laboratory.



## LIFE AND HEALTH SCIENCES

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- ◆ **FELLOWS**
  - DR PETER ARENSBURGER
  - DR MOHAMMED AYOUB
  - DR ROBIN BEECH
  - DR CHARLES SENNOGA
  - PR KATHLEEN CAMPBELL
  - DR JORGE GUTIERREZ
- ◆ **CONSORTIA & WORKSHOPS**
  - COSMETICS IN ORLÉANS (COSMO)
  - STUDIUM CONSORTIUM FOR RESEARCH AND TRAINING IN REPRODUCTIVE SCIENCES (SCORT)

# LABORATORIES FOR LIFE & HEALTH SCIENCES

## Nutrition, Croissance et Cancer (N2C) – UMR 1069 - Inserm, Université François- Rabelais de Tours

 The mixed research unit of Inserm and the University François-Rabelais of Tours has international recognition in research at the interface between cancer and nutrition. The team was the first to link diet-related changes in the lipidome of breast-associated adipose tissue to breast cancer development and metastasis. The role of lipids on cancer is examined at the structural, metabolic and physiological levels. We are specialized in lipid biochemistry and metabolism as well as in breast and prostate cancer, cancers frequently associated with bone metastases.

The research is multidisciplinary and focuses on the transversal interaction between medicine, pharmacology and sciences. We explore different modes of molecular and cellular actions and, the impact of specific lipids on mitochondrial function, cancer cell lines and, the relationships between tumour and its host. This knowledge may benefit patients who have chemical-resistant and/or



## Imagerie et Cerveau (IC) - UMR U930 - Inserm, Université François-Rabelais de Tours

Inserm U930 is composed of 5 research teams. The Ultrasound team at the University François-Rabelais of Tours dates back to the early 70s with Doppler work of Professor Léandre Pourcelot. The Imaging and Ultrasound group explores the physical and technical aspects of ultrasound for diagnosis and therapy.

Inserm U930's research interests are concerned with normal and pathological brain development, from the perinatal period to adulthood.

The unit's main objectives are to develop, validate and use in clinical research, functional and structural brain imaging methods (MRI, PET, SPECT, EEG and ultrasound) in order to better characterise brain development and functioning, as well as understand and treat brain pathology.



(c) Ness Kerton - madNESS Photography 2013

## Centre de Biophysique Moléculaire (CBM) - UPR 4301 - CNRS



The CBM (Center for Molecular Biophysics), a CNRS laboratory UPR 4301, affiliated with the University of Orléans, is funded and managed by CNRS. The Center was founded in 1967 to foster interdisciplinary collaboration between physicists, chemists and biologists. The laboratory is organised into three departments and 15 research teams focusing their research on understanding the role and mechanisms of action of biological macromolecules and, the formation of prebiotic organic molecules and extraterrestrial organic molecules. The laboratory researches the molecular causes of biological dysfunctions, which trigger the development of diseases. The center is also recognized for its research in biomedical imaging. Exobiology Research team was founded by André Brack, a world-renowned prebiotic chemist. The group studied the formation of prebiotic organic molecules and the effect of space radiation on organic molecules brought to Earth, during its earliest history, by carbonaceous meteorites and micrometeorites. From 2002 the group's activities diversified to include the geology of the early Earth and the study of fossils more than 3 billion years old, as well as continuing investigation of the fate of extraterrestrial organic molecules in space. The group is renowned for its contributions to astrobiology missions to Mars. It is this activity that led to the definition of the European (and now Russian) ExoMars 2018 mission. The group is very active in ground-based activities related to Mars missions.



## Physiologie de la reproduction et des Comportements (PRC) - UMR 7247 - INRA, Université François Rabelais de Tours, CNRS

The Reproductive Physiology and Behaviours Laboratory is affiliated to INRA, CNRS, University François-Rabelais of Tours and IFCE. The Biology and Bioinformatics of Signalling Systems (BIOS) group uses systems biology approaches, including mathematical modelling and bioinformatics, to decipher G protein-coupled receptors (GPCR)-induced signalling and develops new pharmacological strategies targeting these receptors. A particular emphasis has long been put on the follicle stimulating hormone receptor, a GPCR centrally involved in the control of reproduction. Capitalizing on the dynamics initiated in Region Centre-Val de Loire in the framework of the MabiImprove LabEx and the ARD 2020 "Biopharmaceuticals", the BIOS group is currently developing GPCR-specific antibody fragments displaying pharmacological efficacy in vivo.



## Infectiologie Animale et Santé Publique (IASP) - UR 1282 - INRA Centre-Val de Loire

The Multi-resistance and Pathogenicity of Nematodes team (MPN) belonging to Infectiology and Public Health Unit (IASP, UR 1282) is composed of three senior scientists, one junior scientist, two engineers, four technicians and one PhD student. The main aim of the MPN team is the sustainable control of gastro-intestinal parasitic nematodes (GIN) in livestock. During the past ten years, they have therefore investigated several different aspects of anthelmintic resistance, from field studies to molecular characterization of parasite anthelmintic targets. From 2006 to 2010 57 articles have been published in international peer review journals.

The team identified the first molecular markers for levamisole resistance, and was the first to perform the functional expression of strongylid AChR in *Xenopus* oocytes. The range of expertise includes: molecular ecology, mathematical modelling, biochemistry and cellular and molecular biology. They have a large network of collaborators all over the world and have participated in numerous international projects dealing with anthelmintic resistance.





## Dr Peter Arensbürger

LE STUDIUM RESEARCH FELLOW  
California State Polytechnic University, Pomona, USA  
In residence at PRC, Tours – December 2013 to September 2014

Peter Arensbürger is Assistant Professor at the California State Polytechnic University in Pomona California, USA. His laboratory is mainly focused on bioinformatic analysis of whole genome sequences. His professional achievements include authorship of 24 manuscripts including 5 manuscripts in Science and 1 in Nature. He has recently been the recipient of the Provost Teacher-Scholar award at the California State Polytechnic University, Pomona.

### Review of transposable element taxonomy, identification of flaws in the current taxonomy and framework for the establishment of a revised taxonomic system

The ambitions of this project are vast. A formal taxonomic system for transposable element classification originated nearly 25 years ago with the work of D. J. Finnegan. While this system has been updated and perfected over the years, the basic outlines of the Finnegan taxonomy are still in use today by nearly all researchers working on eukaryotic transposable elements. However, a number of flaws in this taxonomic scheme have been identified over the years, particularly as new data have demonstrated that some of its fundamental assumptions are inconsistent with transposable element evolutionary history.

Therefore, one of the ambitions of this project is to identify and summarize the flaws of the existing transposable element taxonomy, and to propose a framework for the establishment of a new system, more closely reflecting evolutionary history, by groups of qualified researchers.

A manuscript describing the state of transposable element taxonomy today and a proposal for the establishment of a consortium to address the problems of current transposable element taxonomy has been prepared. Furthermore, we have opened communication regarding the problem of transposable element taxonomy with several influential scientists in this field.

### HOST SCIENTIST



Yves Bigot is CNRS Research Director and the former Head of UMR CNRS 6239 (2000-2009). Since January 1st, 2012, he is the Head of the research team PGEP in the UMR INRA-CNRS7247. His main international projects include: FP6: LSHB-CT-2005-018716, NSF: INT-9726818, AFM Franco-Swiss N°14020, 14509. He has published 97 papers in peer reviewed International journals, 11 book chapters, 49 oral communications (Congresses and workshops; 23 invitations), and holds 7 patents.

### COMMUNICATIONS RELATED TO THE PROJECT

#### Oral communication

- ◆ Bigot, Y.; Arensbürger, P. Transposable elements in avian genomes, 3rd Workshop on the Application of Next Generation Sequencing to Repetitive DNA Analysis in Plants, Ceske Budejovice (Czech Republic), May 27-29, 2014.

#### Poster

- ◆ Quizard, S.; Piégu, B.; Arensbürger, P.; Bigot, Y. The chicken repeated sequences, 27th Colloquium Biotechnocentre, Seillac (France), Octobre 9-10, 2014.



## Dr Mohammed Ayoub

LE STUDIUM RESEARCH FELLOW  
King Saud University, Saudi Arabia  
In residence at PRC, Tours – July 2014 to June 2017

Mohammed Ayoub did his PhD in the Cochin Institute (Paris) on the Oligomerization of the melatonin receptors. He has held postdoctoral positions at the Institute of Functional Genomics in Montpellier and the Institute of Medical Research in Western Australia, working on the molecular pharmacology of GPCRs. He then held an academic/research position at King Saud University in Saudi Arabia (2012-2014). Recently, he has been awarded the prestigious AgreenSkills fellowship (in the frame of Pierre & Marie Curie Actions). His scientific career has as a major research axis the study of the biology and pharmacology of the receptors present at the surface of cells. He has focused his research interest and career plans on the development of new technologies and assays to study the different aspects of GPCRs.

### Development and characterization of new generation of GPCR therapeutics

This project deals with a new generation of biologicals based on small antibodies generated from camelids, called nanobodies. The aim is to develop selective nanobodies targeting GPCRs, one of the major families of protein receptors present at the surface of the human and animal cells. In the framework of the ARD 2020 Biopharmaceuticals, a pharmacological study and a functional characterization of GPCR-selective nanobodies is being undertaken with the aim to discover nanobodies that could be used as therapeutics in both human and animals. GPCR to be targeted will be obtained in collaboration with Synthelabo, a small company specialized in the production of membrane proteins which is launching a laboratory within the PRC Unit to work on the project.

Nanobodies will be selected using phage-display libraries generated in the BIOS group. Dr Ayoub is in charge of developing a battery of molecular, biochemical, and pharmacological assays that will be instrumental for both the screening and the detailed characterization of the nanobodies. The selection of the nanobodies will be performed depending on the nature of the effect observed on the receptors. Thus, the GPCR activating (agonist) and inactivating (antagonist) nanobodies will be selected and tested both in vitro (in cell cultured in the laboratory) and in vivo (in animals) to assess their potential for clinical and agronomic applications. Bioinformatics will be a key element of the project since the BIOS group has developed a docking algorithm, which allows predicting with great accuracy the epitope recognized by a nanobody, knowing only its nucleotidic sequence. Ongoing developments aim at taking advantage of the algorithm for in silico maturation of nanobodies (i.e.: improving their selectivity and/or affinity).

To date, almost all the cellular and molecular tools required for the development and characterisations of antibodies have been assembled. This includes the cell lines, the different

### HOST SCIENTIST



Eric Reiter is research director at INRA Nouzilly. He has a long-standing experience of GPCR biology and pharmacology. He received his PhD in Molecular Biology from University of Liège, Belgium in 1996. The same year, he took a position of researcher at INRA, Nouzilly, France. He visited Robert J. Lefkowitz's laboratory at Duke University for two years between 2003 and 2005. He was group leader in the PRC Unit from 2006 to 2011. In 2009, he co-founded ReproPharm, of start-up from INRA. He has published 67 peer-reviewed papers that have been cited more than 3150 times. He has mentored numerous students and coordinated research projects funded by Région Centre, ANR and INRA. He has acted as an expert for national and international agencies (AERES, ERC, ESF, BBSRC,...). He organized 1 international congress and 2 workshops and maintains sustained editorial responsibilities for a number of journals. He is a WorkPackage leader in MabImprove LabEx and coordinates the GPCRAB project in the framework of ARD 2020 Biopharmaceuticals.

cDNAs (genes coding for the proteins of interest), the assays and systems to generate and to select the nanobodies, the pharmacological and functional assays, as well as the instruments to be used. Phage libraries have been prepared from the blood naïve animals (i.e.: animals that have not been immunized with the targeted GPCR) and will soon be compared with phage libraries prepared from immunized animals.



## Dr Robin Beech

LE STUDIUM RESEARCH FELLOW  
McGill University, Canada

In residence at IASP, Tours – September 2013 to September 2014

Robin Beech graduated BSc in Genetics and Biochemistry, in Nottingham University, Scotland in 1983. He was awarded his PhD in Molecular Population Genetics, in Edinburgh University, Scotland in 1987. He then worked as a post-doctoral fellow at the University of Alberta and McGill through the years 1987-1992 and 1992-1993. Since 1993, Robin Beech is an Associate Professor, at the Institute of Parasitology, McGill University.

### Nicotinic receptors in parasitic nematodes: A pharmacological target for next generation anthelmintics

Our goal was to combine bioinformatics, evolution, protein modelling and computer docking cloning, in vitro expression and characterization (Neveu) to build a new approach for identifying new, parasite specific drug targets from the acetylcholine receptors that respond to nicotine.

Computer models of three nicotine receptors and two morantel receptors were built and manual adjustment allowed predictions of nicotine and nornicotine binding that were proportional to the experimental EC50 values that estimate the strength of drug binding in the lab. This was a major advance in a case where the crystal structure of a receptor protein is not yet available. To achieve this, the ACR-16 receptor was cloned and expressed in *Xenopus* oocytes for three different related species of nematode parasite.

We were also able to provide a structural explanation for why the morantel receptor can respond to morantel while other nicotinic acetylcholine receptors cannot. The ACR-16 receptor from an additional four species has now been expressed and we continue to generate binding data for these receptors as well as new compounds for all the receptors we have in hand. Once the data is complete, this will be used to further refine the computer models ready for a computer screen for compounds likely to be specifically active against the parasite receptors in a library of nicotine derivative drugs synthesized at INRA.

A new innovation we were able to develop during the year was to use genome sequence data from more than 50 different species of nematode to identify evolutionary signals to provide guidance on the expression of functional acetylcholine receptors in target species. We had previously cloned the ACR-21 receptor subunit but were unable to produce any functional receptor. We were able to identify the LGC-4 subunit as a likely candidate to form a combined receptor with ACR-21. Initial experiments confirmed that indeed a new receptor is produced that has a unique profile of response to a panel of different anthelmintic drugs.

### HOST SCIENTIST



Following a PhD thesis Cédric Neveu focused on plant resistance and the mechanisms by which the parasitic nematode *Meloidogyne incognita* overcome these defences and a post doc on the pathogenic bacteria *Helicobacter pylori*. Cédric Neveu was recruited to the French National Institute for Agricultural Research (INRA) in 2005. Currently, he has in charge a research team working on gastro-intestinal parasitic nematodes of small ruminants. The main thematic concerns the identification of molecular mechanisms involved in anthelmintic resistance and the development of alternative control strategies.

Previously, we had jointly identified a set of gene duplications that suggest an expanded set of potential drug target receptors in the parasites of farm animals, including sheep and goats. Extending our sequence-based analysis we were able to show that the evolutionary rate was significantly different among these copies. This novel approach matched data on receptor characteristics we generated in the laboratory. Together, this work shows a level of detail of nicotinic receptor function that was not possible before. We are now in a position to identify the sequence specific signals of receptor assembly. This is particularly important since we have recently shown that apparently similar receptors from closely related species show specific differences in receptor assembly that affect their response to different anthelmintic drugs.

This same approach has identified gene duplications in the filarial nematode parasites that cause disease in humans and companion animals and we are beginning to investigate these for their potential as new drug targets.

### COMMUNICATIONS RELATED TO THE PROJECT

#### Oral communications

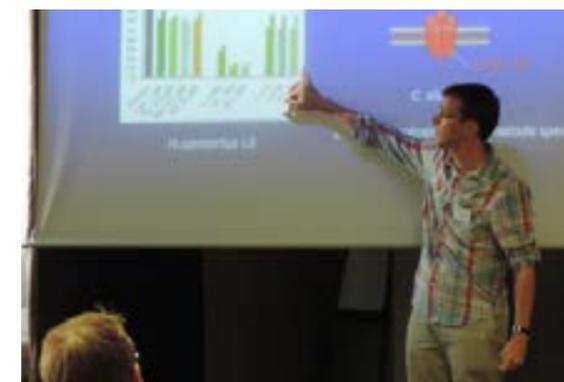
- ◆ Beech, R. N. The Changing Face of Ligand-Gated Ion-Channels, Berlin (Germany) January 16, 2014.
- ◆ Beech, R. N. Ion-Channel Drug Targets, Bayer Animal Health, Leverkusen (Germany), January 13, 2014.
- ◆ Beech, R. N. Nicotine and parasite targets, Scientific Council of LE STUDIUM, Orléans (France), June 18, 2014.
- ◆ Beech, R. N.; Duguet, T.; Charvet, C.; Neveu, C. Evolution and Functional Diversity in the Nematode Levamisole Receptor, Molecular and Cellular Biology of Helminth Parasites VIII, Hydra (Greece), September 1-6, 2014.

#### Posters

- ◆ Duguet, T.; Charvet, C.; Wever, C.; Dent, J.; Neveu, C.; Beech, R. N. Functional divergence of unc-29 copies in *Haemonchus contortus*, Nicotinic Acetylcholine Receptors, Cambridge (United Kingdom), July 23-26, 2014.
- ◆ Duguet, T.; Charvet, C.; Forrester, S.; Wever, C.; Dent, J.; Neveu, C.; Beech, R. N. Functional diversification of levamisole receptors in the Trichostrongylid nematode *Haemonchus contortus*, Anthelmintics: From Discovery to Resistance, San Francisco (USA), February 4-7, 2014.
- ◆ Duguet, T.; Charvet, C.; Forrester, S.; Wever, C.; Dent, J.; Neveu, C.; Beech, R. N. Functional diversification of levamisole receptors in the Trichostrongylid nematode *Haemonchus contortus*, Anthelmintics: From Discovery to Resistance, San Francisco (USA), February 4-7, 2014.
- ◆ Courtot, E.; Charvet, C.; Beech, R. N.; Cortet, J.; Peineau, N.; Wolstenholme, A.; Woods, D.; Neveu, C. Characterization of a parasite specific acetylcholine receptor as potential target for development of novel anthelmintics, NemaTours: Bringing worms together, Tours (France), July 17-18, 2014.



LE STUDIUM CONFERENCE, 17-18 July 2014



LE STUDIUM LECTURE, 17 July 2014



#### LE STUDIUM CONFERENCES

### NEMATOURS: BRINGING WORMS TOGETHER

17 – 18 July 2014  
Tours, France

We chose eight researchers with international reputations, representing a wide variety of different parasitic and free living nematode models and many different research approaches specifically to foster new interactions to make it easier to adopt new technologies to enhance progress throughout the field of nematode research. In practical terms, we provided an unusual format that proved very successful. Each presenter was given 1 hour for their presentation with 30 minutes of questions and discussion. At typical conferences in this area, presentations are for no more than 15 minutes with 5 minutes of questions. The extended time provided a relaxed atmosphere that stimulated wide-ranging discussion and interactions that were allowed to develop in many different directions, rather than being abruptly cut off as would normally be the case.

The impact of this type of meeting will not be felt immediately since our intention was to generate the basis for long-term interactions. Despite this, we can already see new ideas and projects developing. John Gilleard is a specialist in genome analysis and together with Cedric Neveu is developing a genome mapping approach for mapping genes responsible for levamisole resistance.

#### LE STUDIUM LECTURES

### LES NÉMATODES: DES VERS AMIS OU ENNEMIS ?

17 July 2014  
Tours, France

#### Professor Pierre Abad

UMR INRA / CNRS / Université de Nice Sophia Antipolis, Interactions Plantes-Microorganismes et Santé Végétale

Professor Pierre Abad is an international expert on the parasitic worms that cause serious problems for agriculture and plant production. His presentation covered the parasitic diseases common for farm and household plants as well as problems specific for the production of wine.

#### Dr Cédric Neveu

INRA - UMR 1282 Infectiologie et Santé Publique, Nouzilly

Dr Cédric Neveu is a specialist on the parasitic diseases of farm animals. His presentation provided information on the animal side of common parasitic diseases.



# Dr Charles Sennoga

LE STUDIUM RESEARCH FELLOW  
Imperial College of London, United Kingdom  
In residence at IC, Tours – September 2013 to December 2015

Dr Charles Sennoga graduated from the University of London and obtained a PhD in Chemistry at Imperial College where he developed X-ray instrumentation for the time-resolved study of lyotropic systems. His current research interests focus on the engineering, characterisation and optimisation of macromolecular tools for targeted imaging, drug and gene delivery. Understanding the biological principles and therapeutic intervention through non-invasive in vivo investigations of cellular and molecular events that are involved in normal and pathologic processes. Dr Sennoga has successfully combined the use of targeted microbubbles and ultrasound to influence the development of the next generation combined drug delivery and ultrasound imaging that is highly specific, sensitive, safe, and low-cost, with improved large-molecule drug and gene delivery.

## Targeted drug delivery to the brain

The present research sought to develop non-viral drug targeting technology based on microbubbles (usually 3/1000 of a millimetre in diameter) and focused ultrasound, such that large drug molecules (>50 kDa) that are usually excluded from crossing the blood-brain-barrier (BBB) can be safely, site-selectively and efficiently delivered without the use of viral vectors. The BBB drug targeting technology developed in this work involves the creation of what can be described as «artificial viruses» comprising non-immunogenic lipids and targeting protein ligands, with the therapeutic drug packaged in the interior of the drug delivery vehicle, called a pegylated immunoliposome (PIL). These drug-carrying PILs are usually 1/10000 of a millimetre in diameter and, are relatively invisible to the body's immune (reticuloendothelial) system, which normally removes liposomes and other undesirable agents from the blood. The surface of our PILs are decorated with monoclonal antibodies (mAb) that recognise certain molecules (e.g., transferrin and insulin) expressed on the BBB of subjects with brain disorders with high specificity. These mAb facilitate adhesion of PILs onto the BBB via specific receptors. Hundreds of such PILs are tethered to gas-filled microbubbles, which due to their compressibility act as contrast agents, when injected intravenously, by allowing their location and that of the tethered drug carrying PILs to be identified within the vasculature using ultrasound imaging. Perhaps significantly, our approach allows us to elevate the ultrasound pressures used, which in turn, potentiates drug release from the PILs and its transmigration via sonoporation processes, across the BBB that separates blood from the surrounding brain tissues where the drug molecules can therapeutically act on the targeted malfunction.

The development of targeting microbubbles capable of adhering selectively and specifically to transferrin expressed on the BBB was completed, using thiol-maleimide chemistry, which has advantages in terms of immunogenicity over biotin-streptavidin used in most reported studies. Analysis of the resultant microbubbles in terms of their ability to selectively

## HOST SCIENTIST



Dr Ayache Bouakaz is Research Director of Imaging and Brain INSERM U930 at the University of François-Rabelais in Tours, France. His research focuses on imaging and therapeutic applications of ultrasound, microbubble contrast agents and transducer design. He graduated from the University of Sétif, Algeria, and obtained a PhD at the Institut National des Sciences Appliquées de Lyon, France. In 1998, he joined the Bioengineering Department at The Pennsylvania State University USA and later moved to the Erasmus University Medical Center, Rotterdam in the Netherlands. He is Associate editor for IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, a member of the editorial board of the Journal of Ultrasound in Medicine and Biology, and a Member of the technical program committee of the IEEE Ultrasonics International Symposium.

adhere to recombinant transferrin was successfully performed. However, the prohibitive cost in terms of the amount of antibodies required forced us to revise the approach and use biotin-streptavidin at least during optimisation with the view of reverting to thiol-maleimide conjugation in the final stages of the study.

PILs comprising non-immunogenic lipids and targeting mAbs have been developed and subsequently loaded with Lucifer Yellow (LY) or FITC-dextran (FD). Targeting microbubbles decorated with PILs loaded with LY have been optimised and are currently under in vitro evaluation for their ability to deliver LY (0.45 kDa) or FD (9.4 kDa) across human Cerebral Microvascular Endothelial cell line (hCMEC/D3) after ultrasound activation.

Finally, the evaluation of our targeted microbubbles decorated with PILs in a mouse model of malignant gliomas, Alzheimer's and Parkinson's disease will start shortly to fully evaluate this highly promising drug delivery protocol in collaboration with other Inserm Unité 930 teams.

In summary, the primary goal of this Fellowship was the transfer of targeted microbubble engineering technology to Inserm Unité 930 in Tours, which has been successfully accomplished. The success of this exercise opens numerous opportunities for us to expand our research base not only in the highly vibrant research area of targeted drug delivery to the brain but also its application in oncology, cardio- and neurovascular.

## COMMUNICATIONS RELATED TO THE PROJECT

### Oral communication

- ◆ Sennoga, C. A. Ultrasound molecular imaging of inflammation in the heart: a journey from targeting bubble engineering to ultrasound imaging and quantification of molecular expression, LE STUDIUM CONFERENCE: Targeted ultrasound contrast imaging and drug delivery, Tours (France), May 20, 2014.

### Scientific publication

- ◆ Novell, A.; Sennoga, C. A.; Escoffre, J. M.; Chaline, J.; Bouakaz, A. Evaluation of chirp reversal power modulation sequence for contrast agent imaging, *Phys. Med. Biol.*, **2014**, *59*, 5101-5117.



LE STUDIUM CONFERENCE, 19-20 May 2014



Ultrasound exam controlled by joystick



## LE STUDIUM CONFERENCES

### LE TOURS DE MICROBULLE: TARGETED ULTRASOUND CONTRAST IMAGING AND DRUG DELIVERY

19 – 20 May 2014  
Tours, France

This highly successful conference sought to shed light on current and emerging research trends for ultrasound contrast imaging and therapy by providing a platform for discussion with a peloton of internationally acknowledged leaders.

The conference generated significant debate on an important emerging treatment modality generally referred to as sonoporation. The momentum generated by the conference has allowed us to mobilise an interdisciplinary team of academic, clinical and industrial researchers with a singular mission of translating sonoporation to the clinic. This will offer a next generation cancer therapeutic method that is non-invasive, specific and affordable.

## LE STUDIUM LECTURES

### 50 ANS D'ULTRASONS

19 May 2014  
Tours, France

**Professor Léandre Pourcelot**  
Emeritus Professor, University François-Rabelais of Tours

Professor Pourcelot is an acknowledged leader in the field of ultrasound imaging, and a pioneer in clinical Doppler vascular research. In 1974 Professor Léandre described the "Resistance Index" now commonly called the "Pourcelot index" used in the assessment of Doppler velocity waveforms. In 1977, he described pioneering work on color-coded Doppler images. Over the past 5 decades he has worked at inventing and perfecting innovative Doppler devices. At CHRU Hospital Bretonneau in Tours France, Professor Pourcelot led a team of researchers and clinicians who devised important and creative experiments to develop the application of Doppler ultrasound in adult vascular diseases as well as in the assessment of foetal conditions.

In his public lecture, Professor Léandre Pourcelot described the pioneering work undertaken in Region Centre-Val de Loire (particularly in Inserm Unit 930) its impact and importance in medical ultrasound imaging both on the national and international stage.



## Pr Kathleen Campbell

LE STUDIUM RESEARCH FELLOW  
University of Auckland, New Zealand  
In residence at CBM, Orléans – February 2014 to December 2014

Kathleen Campbell is an Associate Professor in the Earth Sciences programme, School of Environment, University of Auckland, New Zealand. She was designated an "A" grade researcher (top 13% of New Zealand's academic researchers) in a 6-yearly national assessment. Her prestigious grant awards include those from the Royal Society New Zealand Marsden & Charles Fleming Senior Scientist funds; NZ Ministry for Business Innovation & Employment; The National Geographic Society; Petroleum Fund of the American Chemical Society; and Germany's national BMBF for marine geology research. She was voted the 2009 Hochstetter Lecturer (Geoscience Society of New Zealand) and 2011 Burbidge Lecturer (Astronomical Society of New Zealand). She has published 73 book chapters and international science journal articles. Kathleen Campbell has supervised 60 graduate students, delivered 60 invited lectures, and held 20 media interviews.

### The importance of hydrothermal systems for early life

The project seeks to answer the following questions. What was the nature of microbial activity in the vicinity of the oldest known hydrothermal systems? Is it possible to document the distribution of different fossilized microbial life forms around such systems? Was there a relationship between hydrothermal systems and photosynthetic and chemotrophic communities?

We are using a dual approach to answer these questions through studies of geologically young, silicifying hydrothermal systems (New Zealand, Argentinean Patagonia) and comparisons with ~3.53Ga-old systems from Barberton, South Africa. Our results also will be of interest in the search for traces of past and/or present life on Mars where recent finds of silica by the Mars Exploration Rovers (MERs) and by orbital measurements have been attributed to hydrothermal influences.



Philae, robotic lander that accompanied Rosetta spacecraft trying to explain origin of life

### HOST SCIENTIST



Frances Westall is a geologist with a 30-year experience working in the field of geomicrobiology and is interested principally in the oldest fossil traces of microbial life in terrestrial rocks and the search for traces of life (microbial) on the planet Mars. She has worked in a number of European countries and also the USA (NASA) and South Africa her place of birth). Since 2003 she is head of the Exobiology Research Group at the CNRS-Centre de Biophysique Moléculaire. She now leads the group's activities in the field of prebiotic chemistry as well as in geology and geomicrobiology. Frances Westall has an international reputation for her work on the fossilization of microorganisms, the oldest traces of life on Earth, and life on Mars. She is frequently a member of international study groups and committees dealing with these subjects (e.g. ESA, NSF, ESF, EU) and is currently president of the European Astrobiology Network Association.

### COMMUNICATION RELATED TO THE PROJECT

#### Oral communication

- ◆ Campbell, K. A.; Guido, D. M.; Westall, F., Foucher, F. Biosignatures across space and time conference, Nordic Network of Astrobiology & Centre for Astrobiology, Bergen (Norway), May 18, 2014.



## Dr Jorge Gutierrez

LE STUDIUM RESEARCH FELLOW  
Columbia University, New York, USA  
In residence at NCC, Tours – November 2014 to June 2017

Jorge L. Gutierrez-Pajares worked at Columbia University (New York, USA) conducting cancer research in a multidisciplinary environment. His collaborative work with the Institute for Cancer Genetics, the Stem Cell Initiative, the Molecular Genetic Pathology, and the Center for Computational Biology and Bioinformatics has allowed him to gain experience in the fields of cell signaling, epigenetics, high-throughput sequencing, and system biology focused on understanding the behavior of complex biological networks. His research takes advantage of epigenetic and genomic analysis of cancer tissues and established gastric cancer cell lines. He was awarded a Columbia University - University of Glasgow fellowship to the Institute of Cancer Sciences (Glasgow, UK). In 2009, he was awarded a fellowship from American Association for Cancer Research - Avon to be presented at 100th Annual Meeting of the AACR in Denver, USA.

### Cholesterol and Cancer

The team's scientific project is multidisciplinary (biology, biochemistry, physiology, metabolism, nutrition and cancerology) and focuses on the transversality of their resources (medicine, pharmacology, sciences, university institute of technology). We explore different modes of molecular and cellular actions and the impact of specific lipids on mitochondrial function, cancer cell lines properties, and the relation between tumor and its host. As a consequence, the knowledge gained by these studies may be transmitted to patients who have chemical-resistant and/or metastasized cancers. The goals of the project are to better understand the metabolism of cholesterol and use this knowledge to develop new methods to target the development of tumors.

This project provides the opportunity to work in a network of nationally and internationally recognized laboratories of region Centre-Val de Loire. Benefiting from the international scientific environment of région Centre-Val de Loire and work under the leadership of the UMR1069 «Nutrition, Growth and Cancer» research unit, University François-Rabelais in Tours. This position provides me with the opportunity to be part of a team to build on and extend the ARD 2020-Biotherapeutics funded initiative of Région Centre-Val de Loire (2014-2016).

### HOST SCIENTIST



Philippe G. Frank obtained his PhD in 1998 at the University of Ottawa, in Ontario, Canada in lipoprotein studies. He then joined the Albert Einstein College of Medicine as a post-doctoral fellow. There, his work focused on the role of caveolin proteins in cancer and

atherosclerosis, in addition to lipoprotein and cholesterol metabolism. In 2006, he joined the Kimmel Cancer Center as Assistant Professor at Thomas Jefferson University in Philadelphia, Pennsylvania where he started a program to examine the role of lipoproteins and cholesterol during cancer development and progression.

Recently, he was appointed as a senior research investigator at the University François-Rabelais of Tours to build on and extend the ARD 2020-Biopharmaceuticals funded initiative of region Centre-Val de Loire (2014-2016), in the research project entitled «Lipids as modulators of the response to biodrugs». His research project is hosted within the Nutrition, Croissance et Cancer (N2C) INSERM research team of Professor Stéphane Chavalier. He is currently serving as Associate Editor of The American Journal of Pathology and of Frontiers in Cardiovascular Medicine (Lipidology and Metabolism).



# COSMetics in Orléans (COSMO)

LE STUDIUM RESEARCH CONSORTIUM



Professor Salvatore MAGAZÙ is, since 2002, Full Professor in Experimental Physics and Head of the research group in Structure of Matter and Biophysics at the Physics and Earth Sciences Department of the University of Messina, Italy. S. Magazù is author of more than 300 articles in international journals; more than 40 invited communications and more than 200 communications in conferences. For his research, focused on the molecular mechanisms of some biological processes, such as bioprotection, denaturation and stabilization of biomolecules, investigated by a joint use of complementary spectroscopic techniques, such as mainly light and neutron scattering, he has received several international and national awards, such as the 2000 Scientia Europaea Prize by the French Academy of Sciences and Aventis.

The COSMO Consortium has enabled the formation of a virtual team of five internationally competitive researchers sharing the common research goal of planning and putting into action a series of initiatives to promote applied research at the interface with industries of the Pole of Competitiveness - Cosmetic Valley. It is well established that research plays a key role within Cosmetic Valley and in this framework COSMO closely interacts with actors from cosmetic enterprises and with research teams from universities. The basic assumption is that, in the cosmetics industry, innovation is in rapid turnover and only a structured research approach can allow the development of new cosmetic products that answer market needs while integrating the latest technological discoveries.

Cosmeceuticals comprise a new category of products that rely on advances in skin biology and nanotechnology to deliver clinically proven active ingredients to the skin. These products are very popular and represent the fastest growing area of the skin care market. There is ongoing debate about the efficacy and the safety of these cosmeceuticals so it is clear that research is necessary to understand the mechanism of action of these products.

In this frame, COSMO is mainly focused on the optimization of innovative cosmetics and cosmeceutic products, to the clarification of some therapeutic aspects in cosmetics, to the characterization of biomarkers and to develop new types of drug delivery systems, which have great potential for achieving the goal in drug targeting.

As far as the research activities are concerned, these will follow these main lines: 1) Physical-chemistry in cosmetics and cosmeceutics; 2) Formulations; 3) Drug vectorization and targeting; 4) Biomarkers and safety; 5) Dermocosmetics and therapeutics.

More in detail, cosmetic products are composed of multiple ingredients of different physico-chemical properties (including solubility/miscibility, melting point, specific gravity, viscosity) that in the process of formulation lose their intrinsic identity. Cosmetics formulation is more than just simple mixing of all ingredients. Physics and chemistry allow all ingredients to take shape in a balanced way into a specific physical form, therefore the elucidation of the structural, dynamical and functional properties of the cosmetic products represent the three fundamental aspects in formulations. On the other hand, it is fundamental therefore to develop submicronic systems (nanoparticles, liposomes) for bioactives molecules transport, which allows for optimal efficacy of the active ingredients and reduces side effects. In addition, safety biomarkers can be optimized for these new technologies for the creation of new medications and new medical interventions. In such a research, the inclusion of systems or pathway modeling into the selection and interpretation of safety biomarkers represents an attractive new aspect.

Two COSMO meetings have been so far held in Orléans (14th-18th October 2013 and 16th-20th June 2014) where research activities, dissemination activities, instrumentation development, collaborations to be activated, structure of the COSMO web site and International proposals for public-private research projects to be presented, were discussed. In particular, the Consortium is working on two EU calls, the Metagenomic call and the Bioinformatics call.

## CONSORTIUM PARTNERS



### PR CHANTAL PICHON

is a Full Professor of Biotechnology, Molecular and Cellular Biology at the Centre de Biophysique Moléculaire, CNRS and University of Orléans, France; she has a strong expertise in delivery systems by chemical vectors and the development of ultrasound based delivery method, which in the Consortium is used for vectorization and targeting as well as for studies on stratum corneum lipids interactions and different types of formulations.



### PR BEATA VERTESSY

is a Full Professor at the Department of Applied Biotechnology, Budapest Technical University and Institute of Enzymology, Hungarian Academy of Sciences, Budapest, Hungary; she has a strong expertise in biophysical, thermodynamic, enzyme kinetic characterization of biomolecular systems (i.e. DNA damage recognition and repair, lipid biosynthesis), which in the Consortium is used for the characterization of liposome formation and transient kinetics characterization of the biophysical processes underlying micelle formation.



### PR ARABINDA CHAUDHURI

is a Full Professor at the Division of Lipid Science and Technology, Indian Institute of Chemical Technology, Hyderabad, India; his research activities are centered on organized surfactant assemblies and on the development of efficient novel lipid-based non-viral drug/gene delivery systems, which in the Consortium is used for developing efficient vectorization for delivery of cosmeceutics as well as for enhancing both stability and biomembrane fusibility of the liposomal formulations of cosmetics and cosmeceutics.



### PR EMMA SPARR

is a Full Professor of Physical Chemistry and Colloidal Biology at the Division of Physical Chemistry, Lund University, Lund, Sweden; her research activities are focused on the link between the material properties and the barrier function of stratum corneum membrane and on the effect on these properties of hydration in cosmetic or pharmaceutical formulations, which in the Consortium is used for formulations and humectants, and their interaction with the skin membrane.

## COMMUNICATIONS RELATED TO THE PROJECT

### Scientific publications

- ◆ Migliardo, F.; Caccamo, M. T.; Magazù, S. Thermal Analysis on Bioprotectant Disaccharides by Elastic Incoherent Neutron Scattering, *Food Biophysics*, **2014**, *9*, 99.
- ◆ Barreca, D.; Laganà, G.; Magazù, S.; Migliardo, F.; Gattuso, G.; Bellocco E. FTIR, ESI-MS, VT-NMR and SANS study of trehalose thermalstabilization of lysozyme, *Int. J. of Biol. Macromol.*, **2014**, *63*, 225.



2<sup>nd</sup> meeting of the COSMO project



# STUDIUM Consortium for Research and Training in Reproductive Sciences (sCORT)

LE STUDIUM RESEARCH CONSORTIUM



Eric Reiter is research director at INRA Nouzilly. He has a long-standing experience of GPCR biology and pharmacology. In 2009, he co-founded ReproPharm, of start-up from INRA. He has published 67 peer-reviewed papers that have been cited more than 3150 times. He has mentored numerous students and coordinated research projects funded by Région Centre, ANR and INRA. He has acted as an expert for national and international agencies (AERES, ERC, ESF, BBSRC,...)

In the framework of Pr A. Ulloa-Aguirre's tenure as a LE STUDIUM RESEARCH FELLOW hosted in the BIOS Group at the INRA Nouzilly from 2009 to 2010, under the supervision of Dr E. Reiter, LE STUDIUM, jointly with the INRA, organised a LE STUDIUM CONFERENCE in June 2010. Experts in the field of gonadotropins and gonadotropin receptors from France, England and USA together with local scientists participated. As an outcome of the discussions that arose during the meeting, the idea of creating an international consortium for research in reproductive sciences comprising Dr E. Reiter and the BIOS group (France), Professors I. Huhtaniemi (UK), J.A. Dias, G. Bousfield (USA) and Dr Alfredo Ulloa-Aguirre (Mexico and formerly LE STUDIUM fellow) emerged. This is how the first LE STUDIUM research consortium was initiated.

Its ambition was to create a multinational consortium that would implement a highly integrated, interdisciplinary approach to develop fundamental research in reproductive sciences, with particular emphasis on the regulation of gonadal function by gonadotropins and gonadotropin receptors. The ultimate goal was to promote the development of targeted pharmacological and molecular therapeutics for reproductive disorders and fertility control. The consortium by its complementary resources and overall scientific excellence was expected to gain a leadership position in the field and to help answer frontier questions related to gonadotropin physiology, pathology and pharmacology that none of the members would have been able to tackle alone.

sCORTS has had four one-week meetings during which open discussions and brain storming sessions led to a series of outputs ranging from writing of papers and exerting collective

editorial activities and organizing an international conference in Tours, the 3rd International Conference on Gonadotropins & Receptors (ICGRIII). In addition, a real friendship and mutual trust developed between the members has resulted in many collaborative projects, which are continuing. Connections with industry were also greatly facilitated.

From the BIOS's group perspective, sCORTS has been an efficient way to strengthen its international visibility, networking and overall leadership in the field of gonadotropin hormones and receptors. The added value for our group is substantial and will only continue to grow in the future thanks to the foundations that have been built since the first consortium meeting in 2011.

## COMMUNICATIONS RELATED TO THE PROJECT

### Oral communications

- Huhtaniemi, I. Function and dysfunction of the pituitary-gonadal axis, ICGRIII, Tours (France), September 7-10, 2014.
- Bousfield, G. FSH glycoforms, ICGRIII, Tours (France), September 7-10, 2014.
- Reiter, E.  $\beta$ -arrestin-biased agonism at the FSH receptor, ICGRIII, Tours (France) September 7-10, 2014.
- Dias, J. Negative allosteric modulators at the FSH receptor, ICGRIII, Tours (France) September 7-10, 2014.
- Ulloa-Aguirre, A. Concluding remarks, ICGRIII, Tours (France), September 7-10, 2014.

## Scientific publications

- Special issue: Dias, J. A.; Ulloa-Aguirre, A.; Bousfield, G. R.; Reiter, E.; Dias, J. A.; Ulloa-Aguirre, A.; Bousfield, G. R.; Reiter, E., Novel endocrine mechanisms in the regulation of reproduction, *Mol. Cell. Endocrinol.*, **2014**, *382*, 385-6.
- Landomiel, F.; Gallay, N.; Jégot, G.; Tranchant, T.; Durand, G.; Bourquard, T.; Crépeux, P.; Poupon, A.; Reiter, E.; Biased signalling in follicle stimulating hormone action, *Mol. Cell. Endocrinol.*, **2014**, *382*, 452-9.
- Jiang, X.; Dias, J. A.; He, X. Structural biology of glycoprotein hormones and their receptors: insights to signaling, *Mol. Cell. Endocrinol.*, **2014**, *382*, 424-51.
- Ulloa-Aguirre, A.; Zariñán, T.; Dias, J. A.; Conn, P. M. Mutations in G protein-coupled receptors that impact receptor trafficking and reproductive function, *Mol. Cell. Endocrinol.*, **2014**, *382*, 411-23.
- Ulloa-Aguirre, A.; Reiter, E.; Bousfield, G.R.; Dias, J. A.; Huhtaniemi, I. Constitutive Activity in Gonadotropin Receptors, *Adv. Pharmacol.*, **2014**, *70*, 37-80.

## CONSORTIUM PARTNERS



**PROFESSOR ALFREDO ULLOA-AGUIRRE**  
UNAM, Mexico City, Mexico

is an internationally recognized expert in the field of gonadotropin hormones and their receptors. His research activities cover both basic work on mechanistic features of these hormones and receptors and clinical aspects. He spent one year in the BIOS group (2009-2010) as a LE STUDIUM fellow and was instrumental in the initiation of sCORTS.



**PROFESSOR ILPO HUHTANIEMI**  
Imperial College London, London, UK

is a world class leader in reproductive biology. Among many other things, he brought a panel of unique transgenic mice models targeting the hypothalamus-pituitary-gonad axis.



**PROFESSOR GEORGE BOUSFIELD**  
Wichita State University, KS, USA

is the best expert worldwide concerning the heterogeneity of glycosylation of gonadotropin hormones. He is able to purify and characterize native isoforms, making them available for functional studies.

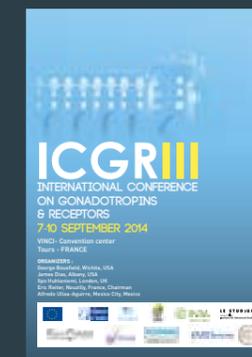


**PROFESSOR JAMES DIAS**  
Albany State University, Albany, NY, USA

is one of the prominent experts of the signalling triggered by gonadotropin hormones in gonadal cells. He notably brought industrial connections and small molecule ligands to the consortium.



LE STUDIUM LECTURES, 9 September 2014



## LE STUDIUM CONFERENCES

### 3RD INTERNATIONAL CONFERENCE ON GONADOTROPINS & RECEPTORS (ICGRIII)

7-10 September 2014  
Tours, France

The ICGRIII was held in Tours from September 7th to September 10th 2014. The scientific programme included the main challenges and advances encountered by clinicians and basic scientists working in the field of gonadotropins.

The meeting was jointly organised by five reproductive biologists, all partners of the LE STUDIUM RESEARCH CONSORTIUM sCORT: George Bousfield, Wichita, USA; James Dias, Albany, USA; Ilpo Huhtaniemi, London, UK; Eric Reiter, Tours, France and Alfredo Ulloa-Aguirre, Mexico City, Mexico. The aim of this conference was to shine light on current and emerging research trends on questions related to gonadotropins and their receptors by gathering internationally acknowledged specialists of these areas.

## LE STUDIUM LECTURES

### HORMONES GONADOTROPES: BIOMÉDICAMENTS DE LA REPRODUCTION

9 September 2014  
Hôtel de Ville, Salle des Mariages,  
Tours, France

**Dr Yves Combarnous**  
Directeur de Recherche émérite CNRS - Reproductive  
Physiology and Behaviours Laboratory

Biopharmaceuticals include various classes of drugs whose common point is to use a biological source as raw material of the active ingredient they contain. They are complementary to "traditional drugs" whose active ingredient is derived from chemical synthesis and which remain the most widely used drugs.

Among biopharmaceuticals, there are a number of gonadotropins. These play an important role in the regulation of reproduction in vertebrates.

In his public lecture, Professor Yves Combarnous, from INRA Nouzilly, explained how this hormone acts on reproduction in males and females, the consequence of a disruption of the hormone by external disturbances (environmental particularly) and its possible use to treat pathologies related to reproduction.



# EARTH, ECOLOGY AND ENVIRONMENTAL SCIENCES

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# LABORATORIES FOR EARTH, ECOLOGY AND ENVIRONMENTAL SCIENCES

**Institut de Recherche  
sur la Biologie de  
l'Insecte (IRBI) - UMR  
7261 - Université  
François Rabelais de  
Tours, CNRS**

 The laboratory is a mixed CNRS – University François-Rabelais of Tours research centre. It was first created as the Institut de Biocénologie Expérimentale des Agroécosystèmes (IBEAS) in 1960. It is currently a unique research centre in Europe, which is exclusively dedicated to applied and fundamental entomological research. Insects are well-known pests of most human cultivated plants and vectors of parasites. A primary goal of fundamental research is to eradicate insect pests or at least limit their impact. Insects also deserve fundamental investigation because of their fascinating insect ecology and capacity to adapt to environmental changes. Research conducted at the IRBI encompasses the analysis of insect communication systems, adaptation to heat and other environmental, predator-prey interactions, community structure, and host-virus interactions.



**Unité de Recherche  
Zoologie Forestière  
(URZF) - UR 0633 - INRA  
Centre-Val de Loire**

The mission of the laboratory is to study populations of forest insect pests and expansion of their range as a result of environmental changes, with the following objectives: (1) analysis of the mechanisms responsible for the success of biological invasions; (2) study of the genetics, physiology and behaviour of insect populations expanding with global warming or newly introduced in Europe; (3) estimation of the ecological and economical risks of invasive species and design management programs.

The URZF is recognized as a leading centre in ecology and genetics of forest insect pests. It has been involved in a number of major European and international research projects on biological invasions funded by the European Community.



(c) INRA Centre-Val de Loire

**Unité de Recherche Amélioration, Génétique et  
Physiologie Forestières (UAGPF) - UR 0588 - INRA  
Centre-Val de Loire**



This unit brings together expertise in genetics, genomics and physiology applied to the study of forest trees. The research aims to develop forest genetic resources for sustainable production of timber and biomass taking into account the environmental impact on the ecosystem of domesticated populations and a changing climate context. The UAGPF conducts several tree breeding programs and invests in innovative strategies of selection and dissemination of genetic progress.

The UAGPF is involved in the evaluation and management of genetic diversity as well as in the study of the interactions between improved varieties and natural populations, helping to define strategies for the management and conservation of forest genetic resources. The UAGPF is also developing basic research contributing to the study of mechanisms of adaptation to environmental variation, with a particular emphasis on the study of adaptation to climate change based on tree-ring analysis. To fulfill these objectives, an integrative biology approach is developed to better understand the genetic determinism of complex traits involved in tree development and in adaptation to environmental constraints.





# Dr Natalia Kirichenko

LE STUDIUM RESEARCH FELLOW  
Sukachev Institute of Forest & Siberian Federal University, Russia  
In residence at URZF, Orléans – January 2014 to May 2015

Natalia Kirichenko is a forest entomologist, Ph.D., senior research associate at V.N. Sukachev Institute of Forest, Siberian branch of the Russian Academy of Sciences (SB RAS), where she has been working since 1997. Her interests concern various aspects of the ecology and risk assessment of invasive forest insect pests. She has participated in 20 national and international research projects, including EU-funded projects and in postdoctoral programs supported by DAAD (Germany), SNSF (Switzerland) and EGIDE (France) and worked on the ecology of invasive insects in well-known European centers: GAU, Germany; LUBIES, ULB, Belgium; CABI-Europe, Switzerland; INRA, France. She is a deputy of the IUFRO working party 7.03.07 «Population dynamics of forest insects»; division 7 «Forest health». She combines scientific work with teaching, supervising bachelor and master students at the Siberian Federal University. She received a scientific award of academician A.B. Zhukov and a silver breastplate of SB RAS for important research achievements in Siberia.

## Development of advanced molecular tools for identification of invasive forest insects

The number of insects introduced into Europe is increasing dramatically. Remarkably, most of these invasive pests originate from Asia, either with ornamental plants, as stowaways inadvertently transported with the import of goods or on their own following an expansion of their geographic range. The fast and accurate identification of these invading insects is essential for effective plant protection and implementation of quarantine programmes.

In this project, we use DNA barcoding, a tool for species identification based on the use of a single standard DNA marker, to genetically characterize leaf-mining insects whose larvae feed internally within the host plant leaves. This is an important group of herbivores with several important pests and invaders that threaten forests, parks and gardens. The main aims of the project are:

- (I) to develop and deliver a comprehensive DNA barcoding reference library for leaf-mining insects of Siberia;
- (II) to develop a DNA barcoding reference library of European species of Gracillariidae micromoths colonizing woody plants in France;
- (III) to study of invasion genetics of the lime leaf-miner *Phyllonorycter issikii*, as a representative case study of a leaf-miner that has invaded Europe from Asia.

To date, we have DNA barcoded 270 specimens belonging to 54 species and morphospecies of leaf-mining insects from the orders Lepidoptera, Coleoptera, Hymenoptera and Diptera. We are currently expanding the DNA barcoding library. Integration of molecular data with ecological characteristics of leaf-miners, particularly larval and pupal morphology, and

## HOST SCIENTISTS



Alain Roques (D.Sc., Ph.D.) is a forest entomologist with 31 years experience in the biology, ecology and behavior of forest insects. He studies mechanisms of biological invasions and the effect of global warming on the populations of insect pests. He has participated in many EU-funded projects on biological invasions. He published 150 peer-reviewed papers, 18 books and book chapters, and presented many communications at conferences.



Sylvie Augustin (Ph.D.) is a forest entomologist with 28 years experience in the biology, ecology and behavior of forest insects. Her research activity has been focused on the ecology and management of invasive insect species in Europe. She has participated in 25 national and international research projects, including EU-funded projects. She has published 41 papers in ISI journals, 6 book chapters and presented 69 communications at conferences.



Carlos Lopez-Vaamonde is an entomologist working on molecular and evolutionary ecology of forest insects. He has published 37 papers in ISI journals, 9 book chapters and 1 co-edited book. He participated in 23 national and international projects and presented his research at a number of conferences.

diagnostic characteristics of mines will accelerate the detection and tracking of these insect pests.

The integrative approach, combining morphological and ecological data with mitochondrial and nuclear sequence data, allowed us to detect several undescribed species of leaf-mining moths colonizing woody plants in Eurasia, particularly plants from the families Salicaceae, Fabaceae and Malvaceae.

## COMMUNICATIONS RELATED TO THE PROJECT

### Oral and Poster communications

- ◆ Kirichenko, N. I.; Augustin, S.; Lopez-Vaamonde, C.; Roques, A.; Baranchikov, Yu. N. Using molecular genetic approach to identifying leafmining moths developing on woody plants in Siberia, International workshop «Molecular genetics in forest management: status, problems and prospects of application», Moscow (Russia), May 28-29, 2014.
- ◆ Kirichenko, N. I.; Augustin, S.; Roques, A.; van Nieukerken, E. J.; Doorenweerd, C.; Lopez-Vaamonde, C. Development of DNA barcoding reference library for fast and accurate identification of immature stages of potential forest insect pests. North Asian leafminers as an example, Forest ecosystems of the boreal zone: geography, structure, function and dynamics, Krasnoyarsk (Russia), September 16-19, 2014.
- ◆ Kirichenko, N. I.; Triberti, P.; Augustin, S.; Roques, A.; Lopez-Vaamonde, C. Phylogeography and genetics of invasion of the lime leafminer *Phyllonorycter issikii*, International symposium on Gracillariidae, Wakayama (Japan), September 26-28, 2014.
- ◆ Kirichenko, N. I.; Triberti, P.; Augustin, S.; Roques, A.; Lopez-Vaamonde, C. The lime leafminer *Phyllonorycter issikii*, a highly invasive pest in Europe: genetics of invasion and systematics, 8th International Conference on Biological Invasions NEOBIOTA, Antalya (Turkey), November 3-8, 2014.
- ◆ Baranchikov, Yu. N.; Kirichenko, N. I. Invasive insect pests: a new challenge to forest protection in the XXI century, 24th Working group meeting of the Montréal process criteria and Indicators for the conservation and sustainable management of temperate and boreal forests, Krasnoyarsk (Russia), August, 17-22, 2014.
- ◆ Kirichenko N. Ecological and molecular genetic aspects of the study of leaf-mining insects and their relationships with woody plants in Siberia, The Kataev Memorial Readings – VIII. Pests and Diseases of Woody Plants in Russia, Saint Petersburg (Russia), November 18–20, 2014.



Experiment of DNA extraction at URZF laboratory



### LE STUDIUM CONFERENCES

## INSECT INVASIONS IN A CHANGING WORLD

17 – 19 December 2014  
Orléans, France

The objective of the conference was to provide an international, high-level forum to discuss recent advances in studying various aspects of insect invasions. In the last century, despite increasing regulations, the number of introduced insects has grown dramatically in many regions of the world. Early detection, accurate identification of insect invaders, elucidation of distribution pathways, and genetic and ecological studies of invasions in relation to on-going climate change are essential for understanding the underlying mechanisms of invasions processes, as well as for implementation of quarantine programs and effective conservation of native ecosystems. The conference provided an important opportunity for dialogue to strengthen cooperation among the multinational scientific community that was present.

### LE STUDIUM LECTURES

## LES INSECTES EXOTIQUES ENVAHISSANTS: POURQUOI SOMMES-NOUS TOUS CONCERNÉS?

17 December, 2014  
Orléans, France

### Dr Marc Kenis

Head of the Risk analysis and invasion ecology section at CABI-Europe, Switzerland

Dr Kenis is highly experienced in applied and environmental entomology, particularly in the field of ecology and management of invasive insects. In his lecture, Dr Kenis explained how invasive insects threaten our environment, economy and health and presented examples of the most recent insect invasions and of exotic species that are likely to invade Western Europe in the near future. Finally, he proposed solutions to manage invasive insects and, in particular, to prevent new introductions.



# Dr Alejandro Martinez-Meier

LE STUDIUM RESEARCH FELLOW

INTA Bariloche, Argentina

In residence at UAPGF, Orléans – January 2014 to January 2015

Alejandro Martinez-Meier started his career in forest tree breeding and improvement in the Forest Genetics Groups at INTA Bariloche, Argentina. Together with his PhD which he completed in Orléans in 2009 he received the "Médaille des thèses de l'Académie d'Agriculture de France". His research work focuses on forest genetic improvement, quantitative genetic, phenotypic plasticity and tree adaptation to climate change using wood properties as a record of tree response to climatic variation. In Argentina he created a new research group at INTA Bariloche, to study adaptation of forest trees to climate and initiated new collaborations with other INTA laboratories, universities in Argentina and between private forest associations and development and management state agencies, by organizing and promoting forest and wood filial and public conferences in collaboration with the departmental forestry agencies in Argentina.

## Adaptation of forest trees to climate warming: a case study on douglas-fir

Increase of forest mortality in a variety of biomes is frequently associated with increased temperature and/or water stress. In some cases forest species are pushed over the limits of their adaptation capacity by extreme heat and drought events. The study of adaptation mechanisms requires the measurement of the variation of tree response to drought not only at the species level but also at the intra-species level.

In the case of Douglas-fir (*Pseudotsuga menziesii*, introduced in France from North-West America), high wood density is related to high resistance to cavitation in tree conduits. Compared to other species, Douglas-fir tends to keep stomata open and maximize carbon fixation. Therefore its resistance to drought relies more on xylem resistance to cavitation. Other species have alternative mechanisms, a drought-response mechanism enabling them to maintain their hydraulic integrity at the expense of carbon fixation.

Tree mortality and dieback in the context of climate change gave us the possibility to study these adaptation mechanisms. We took advantage of forest dieback to compare wood morphological traits of surviving and dead trees after a drought and therefore to identify putative adaptive traits. Wood is a tissue integrating multiple processes, which we used to study how trees can acclimate and adapt to environmental constraints. Certain basic properties as density are involved in functional processes related to xylem structure and thus are important for survival. We used microdensity profiles, never before used, to predict the survival capacity of trees to climatic constraints up to now.

In the framework of LE STUDIUM fellowship project, we have incorporated two complementary species: the "ciprés de la

## HOST SCIENTIST



Dr Philippe Rozenberg has taken part in ten European projects, eight national projects and three bilateral projects. He has coordinated one European project (Alfa GEMA 'GENetica de la Madera'), seven bilateral projects (Canada, Mexico, Portugal, Spain and Argentina), four French research projects (INRA EFPA 2005, Ministère de l'Agriculture 2007, Région Centre 2009 and Ministère de l'Ecologie 2011). He is or has been a member of scientific committees and organiser or co-organiser of four international conferences and workshops. He is the leader of the 'Adaptation' group of the AGPF unit of INRA Orléans, a member of the scientific council of this unit and of that of the EFPA department of INRA.

cordillera" (*Austrocedrus chilensis*, hereafter cypress) and the ponderosa pine (*Pinus ponderosa*). The first is an endemic drought-avoiding conifer species of the Patagonian region in Argentina and Chile with a distribution area covering a vast latitudinal gradient. The second is a drought-avoiding species introduced in the same ecotone region as cypress in Argentina and native of western North America with an extended natural area covering very variable climates. During the last 50 years the climate in Patagonia has become drier and warmer than during the preceding 250 years. Drought and heat events have affected the composition and structure of the current populations of cypress. In the case of ponderosa pine, the observed decline and mortality can be seen as a failure of a forest production system with a marked negative impact on the regional economy.

The principle goal of this project was to estimate the adaptive meaning of wood density, a trait involved in the survival capacity of trees experiencing drought. The results found in this study infer the existence of an adaptive potential in trees exposed to dryer climatic conditions. In Douglas-fir, there is a positive relationship between wood density and resistance to drought. In Cypress this relationship is negative. The underlying hypothesis is that in Douglas-fir a higher density confers a higher resistance to cavitation during drought, while in cypress a lower density would correspond to an improved recovery after drought. In both species, wood density is involved in the surviving capacity to drought, but differently.

The ponderosa pine is a species that avoids drought so we expected similar results to that of cypress: higher wood density in dead trees. However, results were not as expected and more complex. A higher wood density may confer ponderosa pine a greater resistance to drought, similar to the case of Douglas-fir. This result needs to be corroborated to understand the underlying mechanisms involved in the functional hydraulic properties of ponderosa pine facing drought. In this species, wood microdensity has also been shown to be a useful tool for the examination of adaptive traits of response to drought. Our multidisciplinary approach incorporating ecophysiological sciences has proved to be very useful in the study of adaptation.

## COMMUNICATIONS RELATED TO THE PROJECT

### Scientific publications

- ◆ Dalla-Salda, Guillermina.; Fernández, M. E.; Sergent, A.-S.; Rozenberg, P.; Badel, E.; Martinez-Meier, A. Dynamics of cavitation in a Douglas-fir tree-ring: transition-wood, the lord of the ring?, *Journal of Plant Hydraulics*, **2014**, 1: e-0005.
- ◆ Azpilicueta, M. M.; Pastorino, M.; Puntieri, J.; Barbero, F.; Martínez-Meier, A.; Marchelli, P.; Gallo, L. Robles, in Lagunas de Epulauquen, Argentina: previous and recent evidence of their distinctive character. *Revista Chilena de Historia Natural*, **2014**, 87, 24.



Ponderosa pine Huinganco



LE STUDIUM CONFERENCES

## NATURAL AND HUMAN ASSISTED ADAPTATION OF FOREST TO CLIMATIC CONSTRAINTS: THE RELEVANCE OF INTERDISCIPLINARY APPROACHES.

18 – 19 November 2014  
Orléans, France

Forest scientists investigating the adaptation of forest tree species develop new interdisciplinary approaches aiming at better understanding the ongoing process. Adaptive response of individuals and populations to climatic stress, gains from being studied at variable time, demographical and geographical scales, and benefits from the understanding of the basic physiological mechanisms involved. The objective of this conference was to present, compare and discuss practical examples and strategies of interdisciplinary approaches aiming at better understanding the natural adaptation of forest to new climatic constraints associated with the climate change. Special interest was displayed for interdisciplinary approaches dedicated to the development of strategies of human-assisted adaptation. Genomics and quantitative genetic studies, ecological and ecophysiological, sciences of wood studies (e.g. dendrochronological), short and long-term potential adaptation, phenotypic plasticity, evolution of populations, natural (e.g. flux grains and pollen) and assisted migration (human-assisted transplantation) were the principal topics of the conference. Strengthen cooperation among the multinational scientific community that was present.

LE STUDIUM LECTURES

## CHANGEMENT CLIMATIQUE ET IMPACT SUR LE MILIEU FORESTIER

18 November 2014  
Orléans, France

Dr Valérie Daux

Laboratoire des Sciences du Climat et de l'Environnement (LSCE – UMR 8212), l'Université Versailles – Saint Quentin en Yvelines.

Dr Daux spoke about the reconstruction of climatic variability during the last millennium in the continental area by using the isotopic composition of oxygen and carbon. She presented in detail the future climate in France and in the world. Special attention was made to the negative consequences that climate change could have on French forests. An animated discussion followed the presentation, showing the interest of the assisting public.



# Ecological Adaptation to Desert Environment (EADE)

LE STUDIUM RESEARCH CONSORTIUM



*Raphael Boulay is a full professor at the University François-Rabelais of Tours. His previous employments were in Spain at the University of Granada and the Doñana Biological Station of Seville. He teaches Ecology and Environmental Studies at Polytech Tours and conduct his research at the IRBI in evolutionary ecology. His team is composed of a technician, a postdoctorate and two PhD students. Their current research interest is to understand the impact of environmental variables such as temperature and humidity and biotic interactions (competition and mutualisms) on species distribution at different spatial scales. To achieve set goals, they conduct studies both in the field (Spain, French Guiana and Morocco) and in the laboratory using molecular, behavioural and physiological approaches.*

The consortium is composed of Ecologists and Evolutionary Biologists who have conducted numerous studies on the behaviour, physiology, evolution and ecology of the ant genus *Cataglyphis*. This genus, which is distributed along the palearctic deserts, constitutes a particularly interesting model system to investigate organisms' adaptation to hot environments. Our aim is to bring together all the information collected over the past 20 years by each laboratory on this genus and to develop coordinated investigations in order to better understand the evolution of life history traits in response to selection pressures exerted by extremely hot and dry environments.

Hot deserts are among the harshest environments on Earth, imposing extreme temperatures, temperature variations, and hydric stresses on organisms. Human-driven climate change is now altering many temperate and sub-tropical habitats in arid and desert areas, making life increasingly difficult for local populations. In response to these new selection pressures organisms adapt, migrate or become extinct, which greatly transforms local ecological communities. Identifying species' adaptations to warm and dry habitats and determining the processes by which they evolve, constitutes an important question in biodiversity studies. *Cataglyphis* ants, because of their extraordinary mode of life, are a perfectly suited model system to study ecological adaptation to heat.

The first meeting of the consortium held in March 2014, was an opportunity for the involved researchers to expose their past and current results and present future projects. The meeting involved Pr Paul Graham (University of Sussex, UK), Pr Abraham Hefetz (Tel Aviv University, Israel), Dr Xim Cerdà (Doñana Biological Station, Seville, Spain) and Pr Serge Aron (Free

University of Brussels, Belgium). Five guests, with specialist expertise, were also invited to attend part of the meeting (Pr Thibaud Monnin and Pr Claudie Doums, Pierre & Marie Curie University of Paris), Dr Irene Villalta (Seville), Dr Laurianne Leniaud (Tours) and Mr. Hugo Darras (Brussels). At the end of this unique occasion of exchange, the consortium members agreed to prepare a review of research on the multifaceted adaptation of *Cataglyphis* ants to desert and arid environment for submission to the Annual Review of Entomology, one of the top journals in the field.

The next meeting of the consortium was in December 2014. It was again an opportunity to exchange information and experiences on our research, and to start the redaction of the revision. In addition, we welcomed Pr Rüdiger Wehner as a special guest. Pr Wehner is emeritus professor and former director of the Institute of Neurobiology of the University of Zurich. We also started planning and detailed discussion for the preparation of RISE and ITN projects within the new H2020 Marie Curie framework.



2<sup>nd</sup> meeting of EADE project

## CONSORTIUM PARTNERS



### DR XIM CERDÀ

is a field Ecologist at the Estación Biológica de Doñana, specialist of ant behaviour and interaction with their environment in Mediterranean ecosystems.



### PR ABRAHAM HEFETZ

is a Zoologist at the University of Tel Aviv (Israel), a specialist in behavioural and chemical ecology. He is also involved in Nature preservation in Israel.



### PR SERGE ARON

is a molecular ecologist and sociobiologist, at the University of Brussels. He is particularly interested in the evolution of social organization of ants, using several genera as model systems. He has been working on *Cataglyphis* desert ants for several years in Iran, Israel, Morocco and Spain.



### PR PAUL GRAHAM

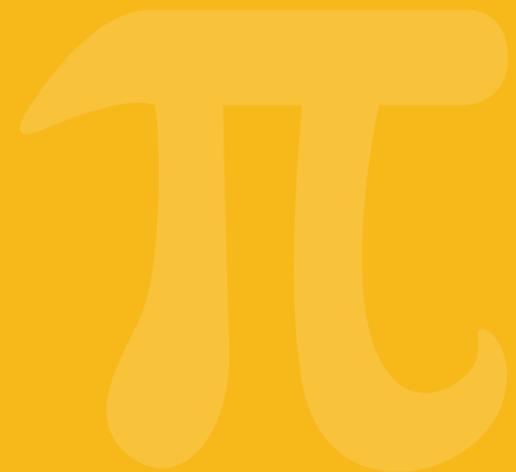
is at the University of Sussex. His main expertise resides in the analysis of insect navigation and orientation using experimentation, simulation and artificial intelligence techniques. His field of research is at the frontier between biological and computer science.



## COMPUTER SCIENCE, MATHEMATICS AND MATHEMATICAL PHYSICS

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  - ◆ PR KARI ASTALA
  
  - ◆ PR GARY GIBBONS



# LABORATORIES FOR COMPUTER SCIENCE, MATHEMATICS AND MATHEMATICAL PHYSICS

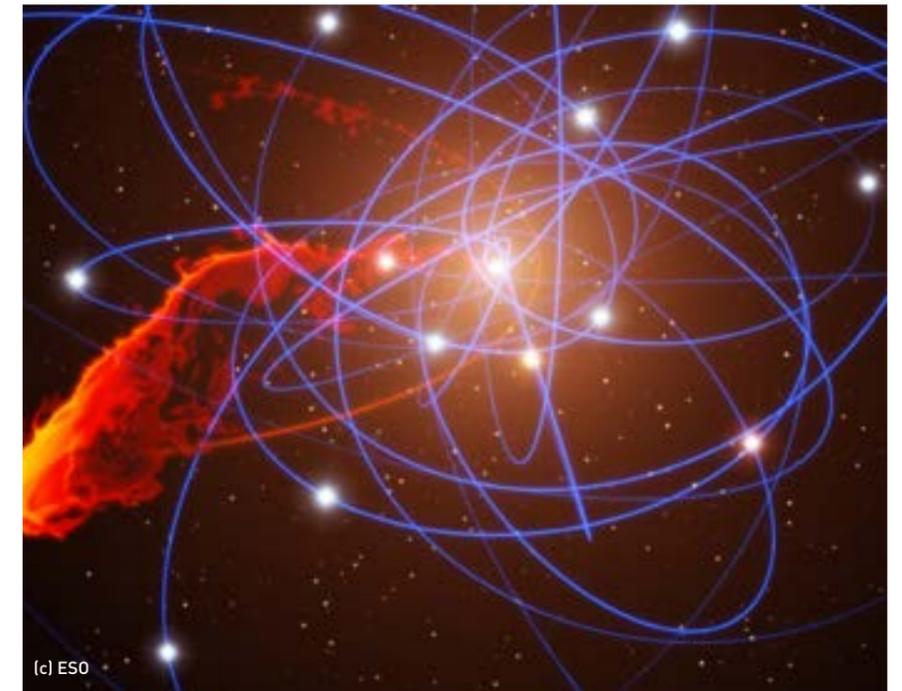
## Mathématiques - Analyses, Probabilités et Modélisation (MAPMO) - UMR 7349 - CNRS, Université d'Orléans



The creation of MAPMO (Mathématiques Appliquées et Physique Mathématique d'Orléans) laboratory goes back to 1994. It consisted of the combination of PMMS (Physique Mathématique, Modélisation et Simulation), a CNRS laboratory, and two teams of mathematicians in the University of Orléans. In 1996, with the creation of a UMR including an additional team of mathematicians of the University of Orléans, MAPMO became Mathématiques et Applications, Physique Mathématique d'Orléans. Today MAPMO laboratory, has once more been renamed as Mathématiques - Analyse, Probabilités, Modélisation - Orléans and is largely focused on probability, statistics and mathematical models while being underpinned by fundamental mathematics.

Initially, MAPMO aimed to promote collaboration between applied mathematicians and physicists. Over time, the collaborations developed by MAPMO mathematicians have evolved to become strong collaborations with researchers in the physical and social sciences. As a result, MAPMO participates in numerous programmes of research by interacting with the many the laboratories on the CNRS-University of Orléans campus, on problems related to mathematical modelling. In 2006, MAPMO together with LMPT of the University François-Rabelais of Tours, which includes the team of theoretical physicists, created the Federation Denis Poisson.

The MAPMO laboratory of the University of Orléans and CNRS, has a long history of experience in problems related to harmonic analysis,  $C^*$ -algebras, statistics, partial differential equations, probability theory and statistics, image analysis, dynamics, control and spectral theory. In particular, MAPMO also has an internationally recognized expertise in various areas of analysis of dynamical systems including potential theory, conformal methods and random geometry, harmonic measure and percolation.



## Laboratoire de Mathématiques et Physique théorique (LMPT) - UMR 7350 - CNRS, Université François Rabelais de Tours



The emergence of LMPT started in the 1970s with first the arrival of Claude Barrabes and then the arrival of Bruno Boisseau. Professor Barrabes and Boisseau, both theoreticians, were interested in gravitational physics and for some time were the only members of the gravity group. Since the late 1980s the group has expanded to include Peter Horvathy and later Peter Forgacs, David Polarsky and Hector Giacomini. At around this time the idea to create a CNRS laboratory was proposed. This was the motivation to unify the theoretical physics group with the group of mathematicians. Claude Barrabes on the physics side and Laurent Veron on the mathematics side were instrumental in achieving this goal and in the early 1990s the two groups became a CNRS laboratory under the name LMPT. Since then the laboratory has grown to be one of the larger theory groups in France.

LMPT is a unique pluridisciplinary laboratory at the University François-Rabelais of Tours, France. It unifies two groups, one working in mathematics and one in theoretical physics. The research in theoretical physics is focused on gravitation, classical and quantum field theory and integrable models. On the other hand, research in mathematics is focused on algebra, non-linear analysis and partial differential equations, Riemann geometry and, probability and ergodic theory. The mission of the laboratory is to provide an excellent education program in mathematics and theoretical physics and to conduct outstanding research on the front line of modern physics and mathematics.



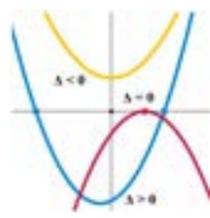


## Dr Mourad Bellasoued

LE STUDIUM RESEARCH FELLOW  
Faculty of Sciences of Bizerte, Tunisia  
In residence at MAPMO, Orléans – January 2013 to January 2014

Mourad Bellasoued completed his PhD at the University Paris 11 (Orsay) in France in 2000. A Full Professor at University of Carthage, Tunisia. One of his main research topics is the solution of the coefficient inverse problem, especially by means of Carleman estimates. The coefficient inverse problem is the determination of spatially varying coefficients by limited data of solutions to evolutionary equations, and is one of the most important inverse problems. He has solved various problems involving the above, based on his knowledge of microlocal analysis theories of PDE. Moreover, he generalized the applicability of Carleman estimates for hyperbolic equations to Riemannian manifolds.

### Control and inverse problems for partial differential equations



Quadratic Equations

The fellowship focused on the application of the Carleman estimates in inverse problems and the unique continuation property for the partial differential equations (PDE), more specifically the general problem for elliptic partial differential equations. Carleman estimates are weighted a priori inequalities for the solutions of a PDE, where the weight is of exponential type.

To this day, Carleman estimates remain an essential method to prove unique continuation properties. In more recent years, the field of applications of Carleman estimates has gone beyond the original domain; they are also used in the study of:

- ◆ Inverse problems, where Carleman estimates are used to obtain stability estimates for the unknown sought quantity (e.g. coefficient, source term) with respect to norms on measurements performed on the solution of the PDE. Carleman estimates are also fundamental in the construction of complex geometrical optic solutions that lead to the resolution of inverse problems such as the Calderon problem with partial data.
- ◆ Control theory for PDEs; through unique continuation properties, Carleman estimates are used for the exact controllability of hyperbolic equations. They also yield the null controllability of linear parabolic equations and the null controllability of classes of semi-linear parabolic equations.

In the first instance, we sought a Carleman estimate in the neighborhoods of a point on the boundary. The estimate exhibits additional terms that account for the boundary conditions. The focus was on the case of general elliptic operators, yet allowing for complex coefficients.

### HOST SCIENTIST



Jérôme Le Rousseau defended his PhD thesis on the Mathematical analysis of seismic imaging, in October 2001 in Colorado USA. He was appointed Senior lecturer in Marseille in 2002. His interests range from pure mathematics (microlocal analysis, analysis of PDEs), applied mathematics (control theory, inverse problems, and numerical analysis) to applications (imaging, geophysics).

From 2004, his interests move towards control theory and inverse problems for partial differential equations. He was appointed Professor in 2008. He is the director of the Fédération Denis Poisson. Jérôme Le Rousseau is interested to work in interdisciplinary projects. From his educational background he is often inclined to tackle research questions with different points of view, ranging for physics, numerical analysis to pure mathematics aiming at comprehensive studies.

The treatment of transmission problems for elliptic operators is a natural extension of this work. If elliptic operators are given on both sides of an interface and interface operators give transmission conditions, the potential derivation of a Carleman estimate is a natural question. This question was studied for second-order elliptic operators for the purpose of stabilization of the associated wave equations and the controllability of the associated heat equation.



## Pr Kari Astala

LE STUDIUM RESEARCH CHAIR  
University of Helsinki, Finland  
In residence at MAPMO, Orléans – September 2014 to April 2015

Kari Astala, Professor at University of Helsinki, Finland, received the Salem prize in 1994 and the Finnish Cultural Foundation prize of recognition in 2011. In 2006-2011 he was nominated as an Academy Professor by the Academy of Finland. He is working in pure mathematics, and internationally known for his work on geometric analysis, partial differential equations, quasi-conformal mappings, complex and harmonic analysis, and other related fields in mathematics.

### Harmonic Analysis, Conformal Structures and Random Geometry

Conformal and quasi-conformal maps are basic tools in harmonic analysis and in the study of elliptic operators. Besides their own fundamental properties, they provide a key ingredient in a large number of modern and classical topics in mathematics.

Conformal invariance is for instance, a fundamental property of Brownian motion, optimal transport, and percolation and of many random growth processes (SLE etc, DLA). More recently, these tools have been applied in image processing through the inverse Calderon problem. In general, the project studies different mathematical structures, where a common theme is conformal invariance in its various appearances. The goals of the project include topics in complex dynamics, random structures arising from statistical physics as well as themes in geometric analysis and in harmonic analysis. An interesting new theme is the multifractal analysis for objects with two-dimensional range. Here completely new ideas and methods are to be developed.

The project in Arriving at MAPMO in late September 2014, the project started with work on analysis and dynamical systems. So far the research has concentrated mainly on dimension distortion in fractal deformations.

### COMMUNICATIONS RELATED TO THE PROJECT

#### Oral communications

- ◆ Astala, K. Rotational multifractal spectra for bilipschitz deformations, Journées du GDR Analyse Multifractale, Nouan le Fuzelier (France), September 21-24, 2014
- ◆ Astala, K. Julia sets, snowflakes and distortion of dimension under a holomorphic motion of a circle, Seminary COOL (Créteil-Orsay-Orléans-Lille) at Institut Henri Poincaré, Paris (France), October 10, 2014
- ◆ Astala, K. Rotational multifractal spectra for bilipschitz deformations, MAPMO Seminars, Orléans (France), October 23, 2014

### HOST SCIENTISTS



Athanasios BATAKIS is an Assistant professor (MdC HDR) at the MAPMO laboratory of the University of Orléans since 1998. His research topics touch the domains of potential theory, geometric measure theory, dynamical systems and multifractal analysis. During the last years he has been interested in the stochastic modeling of natural and social phenomena such as city growth and diffusion in porous materials.

He prepared his PhD under the direction of Alano Ancona at Orsay (France) and his HDR in Orléans in 2010. He completed his graduate studies at the Universities of Crete, Paris VI, Paris XI where he also undertook teaching activities. He has advised or co-advised 2 defended PhD thesis and also a 3rd one ongoing.

Since 2011 M. Batakis is at the Head of the mathematics department of the University of Orléans.



Pr Michel Zinsmeister was Senior Lecturer in Rouen, then Professor in Bordeaux and Orléans since 1992. He was invited Professor at the University of Michigan (USA), at the University of Warsaw (Poland) and the Academy of Sciences of China.

Following his PhD on harmonic analysis matters, he worked on conformal representations of rectifiable areas properties on holomorphic dynamics. He recently specialized on Schramm-Loewner process. The common interest of all his works concerns complex analysis and geometric theory of functions.



# Pr Gary Gibbons

LE STUDIUM RESEARCH PROFESSOR  
University of Cambridge, United Kingdom  
In residence at LMPT, Tours – March 2014 to May 2014

Gary Gibbons, Fellow of the Royal Society since 1999, is one of the rare universal theoreticians. He started his studentship, in Cambridge, under the supervision of D. Sciama and S. Hawking, two outstanding figures of Relativity. It is under the direction of the latter that he defended his Ph. D., in 1972, on Gravitational Radiation and Gravitation Collapse. Fruitful collaboration with S. Hawking has resulted in several top-level publications which have practically shaped the understanding of modern Cosmology and Quantum Gravity.

Subsequently, while maintaining his close contacts with S. Hawking, he managed to broaden his scientific horizon by making a profound contribution to String Theory. He not only knows about relativity, but also about dynamical symmetries in general and of soliton scattering in particular, group theory, topology and differential geometry applied to physics.

## Classical and Quantum Space-Time and Its Symmetries

In this project it is proposed to study theoretically both the classical and quantum properties of space-time and its symmetries, focusing our efforts at this extremely promising direction of contemporary research. This project has made a very good start. We have established the working groups and have started the realization of our research program. The focus in this first trimester, namely March, April, and May 2014, was mainly on the symmetries.

In particular, we have studied the non-relativistic symmetries and the possible relation to the non-relativistic anti-de Sitter spaces/conformal field theories (AdS/CFT) correspondence. The other direction was to study geometrical aspects of the entanglement entropy. In particular, we have established an interesting relation between the problem of maximization of the entropy and the old Willmore conjecture (proved by mathematicians in 2012). This opens the possibility for further interplay of geometry and physics in the context of the entanglement entropy.

During his stay in Tours he collaborated, had fruitful discussions and wrote papers with members of the LMPT laboratory.

Pr Gibbons will be back in region Centre-Val de Loire in the three next years for a three-months residence per year.

### HOST SCIENTIST



Sergey Solodukhin studied physics at the Moscow State University where his PhD adviser was D. D. Ivanenko, the soviet physicist who theoretically predicted the synchrotron radiation. He held a postdoctoral position at the University of Waterloo as a NATO Postdoctoral Fellow and a then moved to the University of Alberta in Canada. From Canada he have moved to the University of Utrecht, in the Netherlands, where he worked in the group of Professor G. 't Hooft for two years during which time Professor 't Hooft received the Nobel prize in physics. He then moved to the Ludwig Maximilian University of Munich, Germany, where he worked in the group of Slava Mukhanov, and later to the University of Bremen, Germany. Since 2007 he has been at the University François-Rabelais of Tours, France where he is a professor in LMPT. In recent years his work has focused on the study of entanglement entropy and its applications to conformal field theories and the black hole physics.

## COMMUNICATIONS RELATED TO THE PROJECT

### Scientific publications

- ♦ Cariglia, M.; Gibbons, G. W.; van Holten, J.-W.; Horvathy, P. A.; Kosinski, P.; Zhang, P.-M. Killing tensors and canonical geometry, *Class. Quant. Grav.*, **2014**, *31*, 125001.
- ♦ Duval, C.; Gibbons, G. W.; Horvathy, A. Conformal Carroll groups and BMS symmetry, *Class. Quant. Grav.*, **2014**, *31*, 092001.
- ♦ Duval, C.; Gibbons, G. W.; Horvathy, P. A. Conformal Carroll groups, *J. Phys. A.*, **2014**, *47*, 335204.
- ♦ Astaneh, F.; Gibbons G. W.; Solodukhin, S. N. What surface maximizes entanglement entropy? *Phys. Rev. D.*, **2014**, *90*, 085021.
- ♦ Barrow, J. D.; Gibbons, G. W. Maximum Tension: with and without a cosmological constant, *Mon. Not. Roy. Astron. Soc.*, **2014**, *446*, 3874.



Black hole with corona, X-ray source (c) NASA/JPL-Caltech



LE STUDIUM CONFERENCE, 20-23 May 2014



LE STUDIUM CONFERENCES

## GRAVITATION, SOLITONS AND SYMMETRIES

20 - 21 - 22 - 23 May, 2014  
Tours, France

This workshop marked the first 3-months stay of Gary Gibbons as a LE STUDIUM RESEARCH PROFESSOR at LMPT, University François-Rabelais of Tours, in Tours. We organized an international gathering of leading experts in the field of classical and quantum gravity, symmetries and solitons - three topics that have been the research focus of Gary Gibbons over the years. The scientific goal of this workshop was to discuss recent progress and future prospects for research in this very rapidly evolving field.

LE STUDIUM LECTURES

## SI EINSTEIN M'ÉTAIT CONTÉ: REGARDS SUR LA RELATIVITÉ

21 May, 2014  
Tours, France

Professor Thibault Damour  
IHES, Bures-sur-Yvette, France

Thibault Damour was graduated from the Ecole Normale Supérieure - rue d'Ulm - where he presented in 1974 his PhD in theoretical physics focusing on «classical theory renormalization». His doctoral thesis in physical sciences, which he gets in 1979, describes «Some mechanical properties, electromagnetic, thermodynamic and quantum of black holes.»

From 1977 to 1989 he was manager then director of research at CNRS (Astrophysics Group, Observatory of Paris -Meudon ). Since 1989, Thibault Damour is a tenured professor in theoretical physics at the Institut des Hautes Etudes Scientifiques (IHES). Expert in general relativity and string theory, his work has earned him numerous national and international awards, including the Grand Prize of the Academy of Sciences (1990) and Albert Einstein Medal of the Society Einstein of Berne (1996). He is a member of the Academy of Sciences and the Institute of France.

We know that Einstein created physics in the 20th century with his work about relativity and quanta. But do we know exactly the essential ideas given by Einstein? How did he imagine it? What should we remember actually the conceptual changes inaugurated by him?

The talk presented Einstein's life as well as his scientific work and reminded us daily applications of his ideas: the principle of laser, localisation system by satellite, dispersion of aerosols in the atmosphere...



## HUMAN AND SOCIAL SCIENCES

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- ◆ CONSORTIA & WORKSHOPS
  - POWER AND THE PARATEXT IN MEDIEVAL MANUSCRIPT CULTURE

# LABORATORIES FOR HUMAN AND SOCIAL SCIENCES

## Pouvoir, Lettres, Normes (PoLeN) - EA 4710 - Université d'Orléans



The PoLeN (Power, Letters, Norms) laboratory is a multidisciplinary team that emerged from the collaboration of literary historians belonging to the laboratories META and Centre de recherche Littératures et civilisations and Savoirs et pouvoirs de l'Antiquité à nos jours. This multidisciplinary grouping, which allows a synergy of forces, promotes dynamic research.

The laboratory brings together a pluridisciplinary group of researchers from the fields of history, literature, linguistics, anthropology and law. This research laboratory comprises three main research centres: 1) on late medieval culture; 2) on early modern culture; and 3) on modern and contemporary culture. Each of these research centres is dedicated to investigation of the ways in which texts from a range of historical periods engage with questions of power and authority, particularly as regards their role in the dissemination of the discourses that prescribe societal norms in any given period and in the potential resistance to these norms.



(c) David Darrault - Université François-Rabelais de Tours.



(c) David Darrault - Université François-Rabelais de Tours.



(c) David Darrault - Université François-Rabelais de Tours.

## Centre d'Études Supérieures de la Renaissance (CESR) - UMR 7323 - Université François Rabelais de Tours, CNRS



The Center for Superior Studies of the Renaissance (CESR) is the Education and Research Unit (UFR) University François-Rabelais of Tours and Mixed Research Unit (UMR) 7323 affiliated with the CNRS.

Set up through the initiative of Gaston Berger in 1956 and affiliated at that time with the University of Poitiers, the CESR became an integral part of the newly established University François-Rabelais of Tours in 1970. Successive agreements in 1983 and 1992 enhanced the institutional links between the CESR and the CNRS, while in 1996 the CESR re-affirmed its commitment to interdisciplinary research into key themes of European patrimony (for instance, around musicology, art history and the history of the book), in an accord with the French Ministry of Culture, the CNRS and University François-Rabelais of Tours. The CESR celebrated its half-centennial in 2006.

The CESR is an education and research centre which welcomes students and researchers wishing to acquire an initial or additional university education in all domains of the Renaissance. The CESR enjoys a double status, being at once a UFR (Education and Research Unit) within the University François-Rabelais of Tours and a UMR (Mixed Research Unit 7323) affiliated with the CNRS (National Research Institute). The CESR's research programmes are structured according to disciplinary teams (history, history of art, French, neo-Latin and European literature, philosophy, musicology, history of science and techniques), research fields and team projects.





# Pr Erminia Ardissino

LE STUDIUM RESEARCH FELLOW  
University of Torino, Italy  
In residence at CESR, Tours – December 2014 to December 2015

Erminia Ardissino (Ph.D., Yale University; Dottorato di Ricerca, Università Cattolica, Milan) is Associate Professor at the University of Turin. Her research deals with Italian literature from Dante to the seventeenth century, with particular attention to the relationship with the history of ideas and religious experience. Currently she is exploring poetry in form of prayer, a genre present in Italian literature from its origins to the present, but never investigated as such, and Biblical reading and writing in Italian Renaissance, focusing especially on women interpretative communities in Venice and Florence. She has received numerous awards, including Newberry Library Weiss-Brown Subvention Award; Renaissance Society of America Fellowship; Italian Academy for Advanced Studies at Columbia University (NY) Fellowship; Fulbright Distinguished Lectureship at the University of Chicago.

## The laity and the bible: Religious reading in early modern Europe

The aim is to investigate the connection between the laity and the Bible in Europe and especially in Italy in the period between 1470 and 1600, which saw several dramatic cultural and religious changes: the development of the printing, the literary affirmation of vernacular languages, the spreading of new religious doctrines and the formation of various confessional identities. Recent research has demonstrated that participation of the laity in biblical culture was wide in medieval and early modern Europe and has challenged the traditional view of scholars, its ideological paradigms and its chronological turning points. The research project is in direct connection with these results and will add to them with a focus on Italy, where the Roman Catholic Church had a particular weight of influence. Indeed, even if decisive studies have highlighted the complex and non-linear history of ecclesiastical censorship against vernacular biblical books, the field of Italian vernacular biblical culture and literature remains largely under explored.

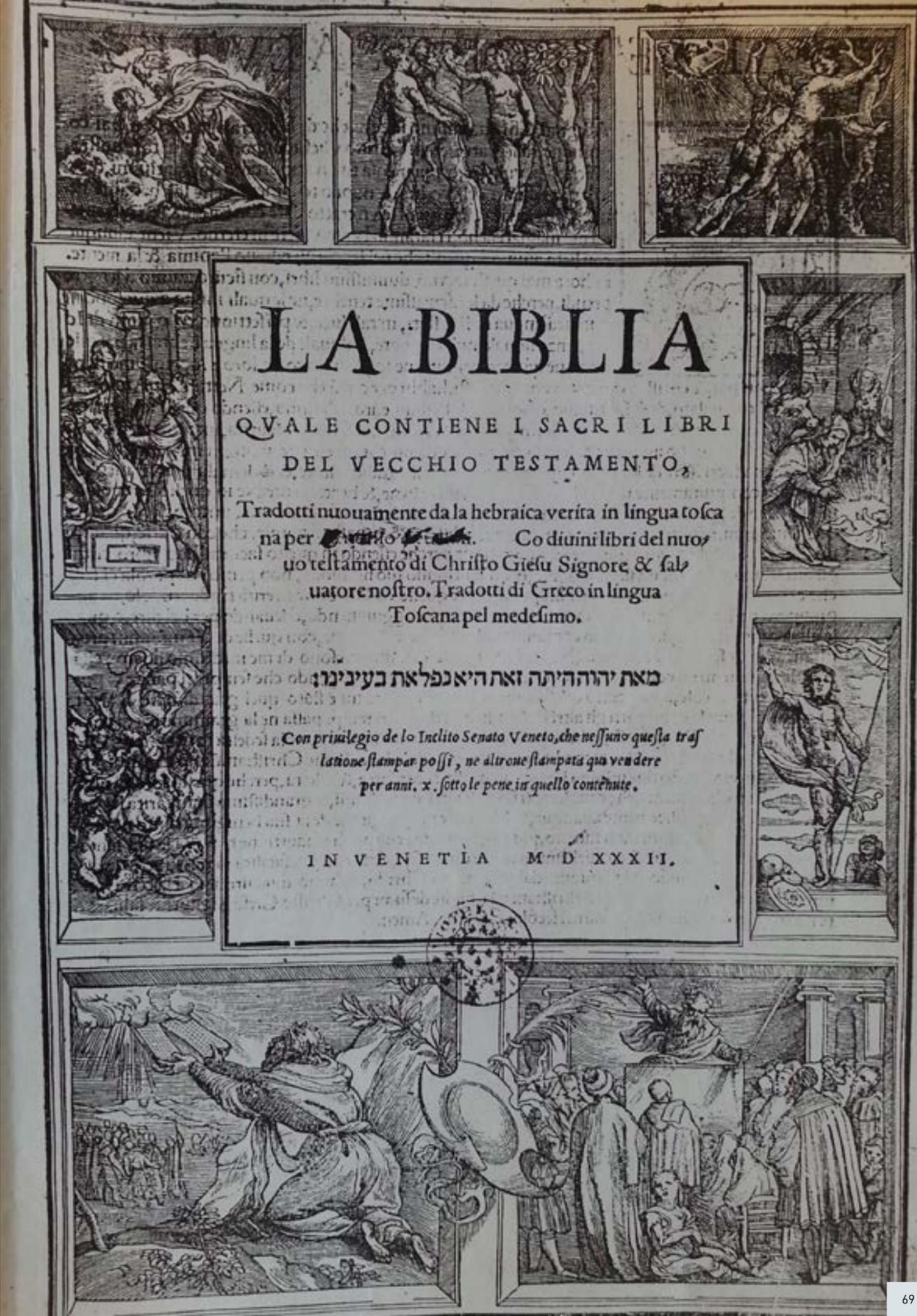
The evolution of this field has to be considered in the long period which goes from the beginning of the printing era (i.e. long before the spreading of Luther's thought in Italy in the years 1520s) to the last decades of the sixteenth century (i. e. long after the creation of the Roman Inquisition in 1542 and the end of the Council of Trent in 1563). Further investigation also needs to cross historical, bibliographical and literary methods, combining a quantitative approach with a qualitative one. The research project considers a wide range of texts (translations, commentaries, paraphrases, anthologies, devotional writings, poetry and dramatic works), as all these genres were not independent from each other and most texts overlapped in terms of authorship and readership, genre and style. Paying attention to both the apparatus and the text in itself, the research project will contextualize and clarify the participation of laypeople answering the following questions: Who wrote for lay readers and what was the proportion of lay authors and how did it evolve in time? What were the religious and cultural purposes

### HOST SCIENTIST



Élise Boillet is CNRS researcher at the CESR of Tours. Her field of research is Italian Renaissance religious culture. She first dealt with lay authors active in Venice in the years 1530s (she was awarded the 'Prix Marie-Louise Arconati-Visconti de la Chancellerie des Universités de Paris' for her doctoral thesis on the subject). She is the author of *L'Arétin et la Bible* (Genève, Droz, 2007) and the scientific editor of Antonio Brucioli. *Humanisme et évangélisme entre Réforme et Contre-Réforme* (Paris, Champion, 2008). She is currently dealing with vernacular books on the psalms printed in XVIth century Italy. At the CESR, she coordinates the multidisciplinary activities connected with the theme 'Profane and Sacred'. She is also a coordinator of a Working Group within the COST Action IS1301 'New Communities of Interpretation: Contexts, Strategies and Processes of Religious Transformation in Late Medieval and Early Modern Europe' (2013-2017).

of addressing lay readers? What were the literary and ideological forms and contents of biblical books intended for laypeople? What uses of these books were recommended or prohibited? Was the lay authorship and lay readership promoted in a polemical way against religious authority or in a collaborative manner? What kinds of collaboration through time existed between lay and religious authors and readers? The aim is to reconstruct the possibilities and impossibilities of access for laity to biblical books and the multiple aspects of the lay participation to the religious culture and the formation of Italian and European modern identities.





# Dr Magnus Williamson

LE STUDIUM RESEARCH FELLOW  
University of Newcastle Upon Tyne, United Kingdom  
In residence at CESR, Tours – November 2013 to November 2014

Magnus Williamson is Senior Lecturer in Music at Newcastle University. Since 2008 he has been General Editor of the British Academy series, *Early English Church Music*. He is currently Principal Investigator of the AHRC project, *Tudor Partbooks: the manuscript legacies of John Sadler, John Baldwin and their antecedents (2014-17)*. During his fellowship his research drew upon several research projects on the soundscape of the pre-Reformation parish, and the printing of music books.

Often mutually antagonistic, but culturally interconnected, Renaissance France and early-Tudor England make for interesting comparisons, not least in their divergent responses to religious change.

## DIPERMUR: Dispositifs de la Performance Musicale à la Renaissance

The DIPERMUR project focuses on musical performance and listening practices within the geographical limits of royal France (Val-de-Loire and the Parisian region) during the early modern period. The project is conceived as a tool to be used in the domain of cultural politics: as such, it will help to define new ways of valorising the architectural heritage of the Centre Region, notably by participating in the development of the CESR's CUBICULUM MUSICAE ® equipment.



Ruins of Rievaulx Abbey, Yorkshire, 1803, John Sell Cotman

The principal objective of the DIPERMUR project is to promote deeper understanding of the organisation of vocal and/or instrumental performances, including their public, during the Renaissance. The performers and listeners of musical events will be studied in terms of their repartition, their relationships with the musical objects present (scores, rostrum), their mobility, their reactivity and even their pluriactivity during the performance.

More generally, the project seeks to re-establish the exact modalities of the way in which the musical art fitted into the totality of the audio and visual components of festivals, religious ceremonies and diverse forms of domestic sociability. To this end, it intends to reflect on the dialectic between space and sound, in terms of both its public and private, as well as its symbolic and performative dimensions. The results of this

## HOST SCIENTIST



Xavier Bisaro is Professor of musicology at the University François-Rabelais of Tours and researcher in the Centre d'Études Supérieures de la Renaissance (CESR, UMR 7323). Since 2012, he is appointed junior member of the Institut Universitaire de France (IUF). His main publications are focused on the musicological history of divine worship and on liturgical erudition in modern France.

He currently collaborates with several projects dedicated to social history of church musicians (MUSEFREM Project) and to operatic sound studies. He also manages the project Cantus Scholarum ([www.cantus-scholarum.univ-tours.fr](http://www.cantus-scholarum.univ-tours.fr)) devoted to school singing in modern Europe.

analysis will establish the basis for a cultural history of the musical event of the modern period and thus open the way towards a better understanding of musical mediation within social rapports, as well as of the construction of symbolic representations of constituted bodies and power structures.

Finally, the DIPERMUR project comprises a practical line of research dedicated to the precise reconstitution of the material and acoustic conditions of musical productions during the Renaissance. The predicted results of the project may thus be expected to help develop the cultural potential of the architectural sites concerned.

## COMMUNICATIONS RELATED TO THE PROJECT

### Oral communications

- Williamson, M. The Printed Sarum Antiphoner, 1519-20: an international collaboration, Plainsong & Medieval Music Society AGM, London (United Kingdom), March 29, 2014.
- Williamson, M. Finding, writing, keeping: polyphonic sources in English cathedrals, 1440s-1640s, Cathedral Libraries in the Middle Ages, King's Manor, York (United Kingdom), July 4, 2014.
- Williamson, M. Print, polyphony and episcopal leadership: Le Mans around 1500, Medieval & Renaissance Music Conference, Birmingham (United Kingdom), July 6, 2014.
- Williamson, M. Praying for a safe delivery: Mary Tudor, Thomas Tallis and the Chronology of Tudor Music, Seminar series in medieval and renaissance music, All Souls College, Oxford (United Kingdom), December 4, 2014.
- Williamson, M. Notes on a Sarum Processional, Study day on printed music, King's College, Cambridge (United Kingdom), December 6, 2014.



## LE STUDIUM CONFERENCE RECONSTRUCTING LOST SPACES: ACOUSTIC, SPATIAL, CEREMONIAL CONTEXTS

30 -31 October 2014  
Tours, France

This conference brought together an international team of musicologists, archaeologists, liturgiologists, historians and art historians with interests in the medieval spaces. In what ways did the ceremonial functions of buildings and landscapes determine their physical layout? And how were these sites adapted to suit changing needs? In many cases these spaces have been lost or damaged beyond physical restoration: ecclesiastical sites, for instance, destroyed during Reformation or Revolution, or medieval townscapes that fell victim to industrial and urban development. Computer modelling permits the virtual reconstruction of these lost spaces and contexts, enabling them to be investigated and experienced once again. The symposium considered how the humanities might contribute to the public understanding of the histories that lie beneath our feet.

The symposium enabled us to forge and consolidate several networks of scholars with congruent interests. For instance, Prof. Andrew Kirkman (Birmingham) and Dr Philip Weller (Nottingham), who have since set up a network on music and the fixed image in the late middle ages; Prof. John Harper (liturgiologist) and Prof. Sam Turner (archaeologist) who will collaborate on an investigation of Old Sarum; Dr Geoffrey Webber, who will collaborate with Magnus Williamson in making a CD recording at St Lawrence, Ludlow, in July 2015. From Poitiers we welcomed Dr Bénédicte Palazzo-Bertholon (Archéologie du Son) whose work on acoustic pots feeds directly into a research project currently being devised by Magnus Williamson with Dr Paul Barnwell (Oxford). We hope to establish a LE STUDIUM Consortium on the theme of ceremonial, acoustic and architectural spaces.

## LE STUDIUM LECTURES VISUALISER L'HISTOIRE: LA RECONSTRUCTION DES ESPACES MÉDIÉVAUX DISPARUS

30 October 2014  
Tours, France

Xavier Bisaro  
Professor of Musicology, Centre d'Études Supérieures de la Renaissance

This lecture considered the impact and implications of a humanities-led investigation of historic spaces. There has been resurgence in recent years of interest in the digital reconstruction of lost buildings and spaces (as in the CESR's endeavours at Dijon); the public lecture considered how these reconstructions might enhance both our experience as visitors and also the public understanding of the humanities' contribution.



Glastonbury - Lady Chapel



LE STUDIUM CONFERENCE, 30-31 October 2014



# Power and the paratext in medieval manuscript culture

LE STUDIUM RESEARCH CONSORTIUM



Rosalind Brown-Grant is Professor of Late Medieval French Literature at the University of Leeds, UK. Her major publications include: *Christine de Pizan and the Moral Defence of Women: Reading beyond Gender* (Cambridge, 1999); *French Romance of the Later Middle Ages: Gender, Morality, and Desire* (Oxford, 2008); and a translation of Christine de Pizan's *Book of the City of Ladies* for Penguin Classics (Harmondsworth, 1999). She is co-editor, (with Anne D. Hedeman and Bernard Ribémont), of *Textual and Visual Representations of Power and Justice in Medieval France: Manuscripts and Early Printed Books*, forthcoming with Ashgate (2015); and (with Rebecca Dixon), of *Text/Image Relations in Late Medieval French and Burgundian Culture (14th c. - 16th c.)*, forthcoming with Brepols (2015). Her research has been funded by awards from the Arts and Humanities Research Council, the Leverhulme Trust, and the British Academy, and she was a LE STUDIUM Research Fellow in Orléans from 2011-12.

The research team examines the elements that go towards orientating a reader's reception of a text, such as the title of a work, its layout on the page, the physical appearance of a manuscript, the presence or absence of glosses, chapter headings, tables of contents, etc.

The chief ambitions of the consortium are two-fold: a) to hold a major international conference in 2016 that will bring together specialists in the field from the different disciplinary areas of medieval studies; and b) to organise a virtual exhibition to go live in 2017 based on manuscripts held at a number of different libraries around the world.

A consortium meeting was held 2nd to 6th June 2014 during which a number of different activities were undertaken. These included sessions where we discussed key critical readings in the field and how paratext relates to our particular research interests in fictional, historical, medical, legal, or liturgical texts. We organised individual workshops on specific paratextual elements, such as prologues, glosses, rubrics, notes, and images, which each of us led in turn. This was followed by a hands-on session at the Bibliothèque municipale in Orléans where we consulted a variety of manuscripts held in its collections. We also gave a group presentation on the work of the consortium to the Studium researchers.

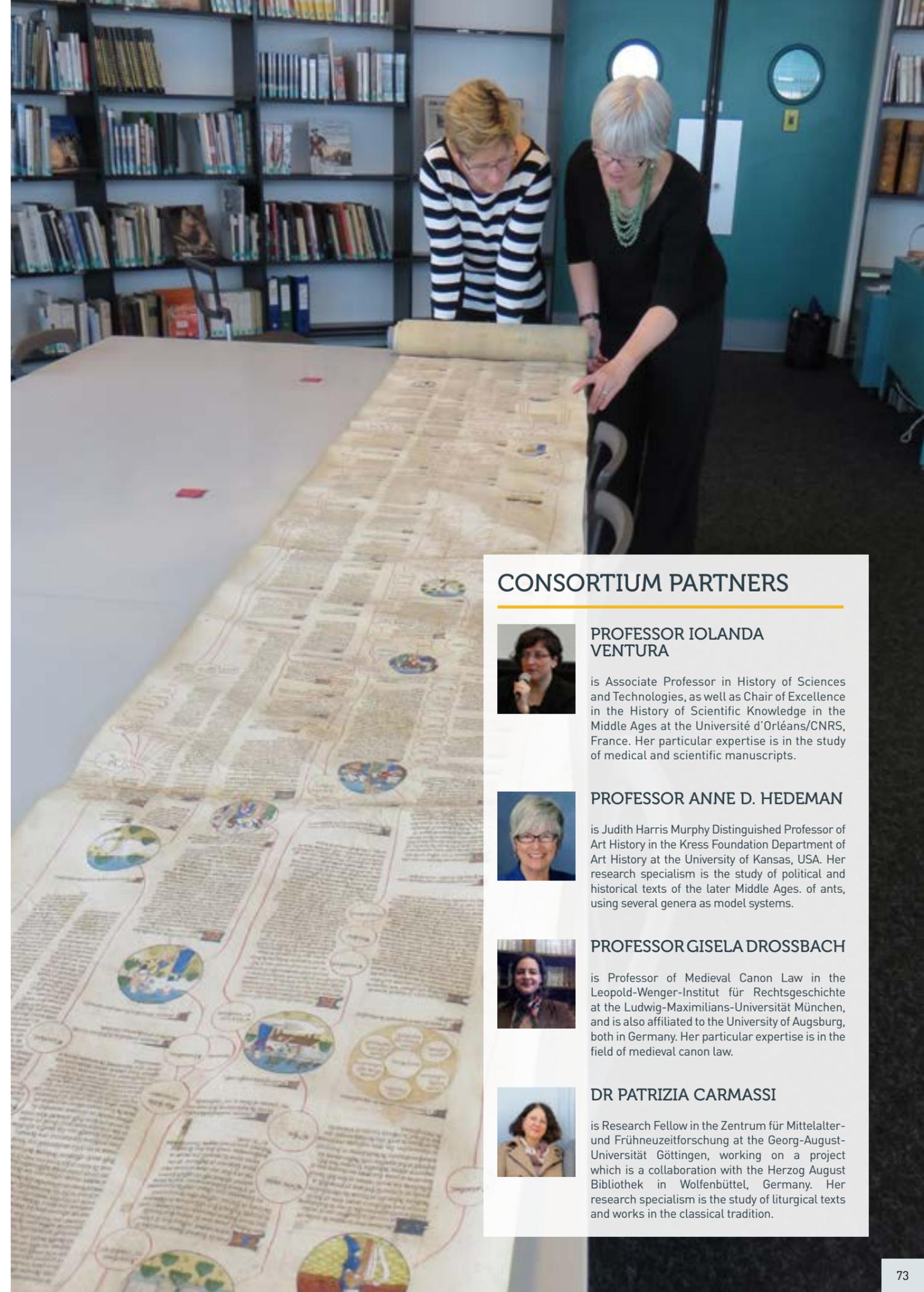
Perhaps most importantly, what paratextual analysis revealed to us during this first meeting are the power relations at play between makers of books, authors, readers (whether real or imagined), purchasers of books, commissioners of books, and translators. More fundamentally still, our work has enabled us to

break down the boundaries which scholars of medieval studies are all too ready to erect between works written in Latin and those written in the vernacular, between works dealing with the realm of the sacred, and those dealing with the realm of the secular, and, to some extent between works that are preserved in manuscript and those in early printed form. We are thus determined to take the insights developed in literary studies, where the idea of paratext was first mooted, and apply them to a multiplicity of intellectual domains, in some of which the study of paratext has barely even begun, such as the history of law and medicine.

## COMMUNICATIONS RELATED TO THE PROJECT

### Oral communications

- ♦ Brown-Grant, R. Historical writing at the court of Valois Burgundy: a paratextual approach, Seventh International Medieval Chronicle Conference, University of Liverpool (United Kingdom), July 7-10, 2014.
- ♦ Carmassi, P. Mögliche Querschnittsthemen und -Analysen anhand der Handschriftensammlung von Marquard Gude. Das Beispiel der Prologe, Themen und Tendenzen der Forschung im Bereich der Lateinischen Philologie» organised by the Seminar für Lateinische Philologie des Mittelalters und der Neuzeit of the University of Göttingen, June 12, 2014.
- ♦ Hedeman, A. D. The power of saintly images in the Grandes chroniques de France: the case of Saint Louis, Seventh International Medieval Chronicle Conference, University of Liverpool (United Kingdom), July 7-10, 2014.



## CONSORTIUM PARTNERS



### PROFESSOR IOLANDA VENTURA

is Associate Professor in History of Sciences and Technologies, as well as Chair of Excellence in the History of Scientific Knowledge in the Middle Ages at the Université d'Orléans/CNRS, France. Her particular expertise is in the study of medical and scientific manuscripts.



### PROFESSOR ANNE D. HEDEMAN

is Judith Harris Murphy Distinguished Professor of Art History in the Kress Foundation Department of Art History at the University of Kansas, USA. Her research specialism is the study of political and historical texts of the later Middle Ages, of arts, using several genera as model systems.



### PROFESSOR GISELA DROSSBACH

is Professor of Medieval Canon Law in the Leopold-Wenger-Institut für Rechtsgeschichte at the Ludwig-Maximilians-Universität München, and is also affiliated to the University of Augsburg, both in Germany. Her particular expertise is in the field of medieval canon law.



### DR PATRIZIA CARMASSI

is Research Fellow in the Zentrum für Mittelalter- und Frühneuzeitforschung at the Georg-August-Universität Göttingen, working on a project which is a collaboration with the Herzog August Bibliothek in Wolfenbüttel, Germany. Her research specialism is the study of liturgical texts and works in the classical tradition.

# TRANSDISCIPLINARY APPROACH: LE STUDIUM THURSDAYS



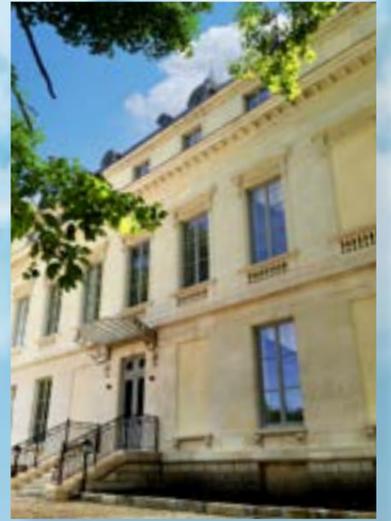
Emblematic of the transdisciplinary approach put in place by LE STUDIUM since 2010 to energize the regional scientific community exchanges are LE STUDIUM THURSDAYS monthly meetings. These cross-disciplinary meetings take place every first Thursday of the month, gathering LE STUDIUM RESEARCH FELLOWS in residence, their laboratory hosts and guests from the scientific, industrial and institutional sectors. All foreign researchers visiting the region Centre-Val de Loire are welcome to attend these international meetings.



# LIFE OF FOREIGN RESEARCHERS IN THE REGION CENTRE-VAL DE LOIRE

In Blois, Orléans or Tours, all LE STUDIUM Research Fellows benefit from exceptional living and working conditions. Well established research institutions and laboratories offer their facilities in the region Centre-Val de Loire and LE STUDIUM maintains or rent high-quality residences for its guests.

In Orléans where LE STUDIUM headquarters are located, fellows are welcomed in the heart of the city of Orléans in December 2013 in the prestigious Hotel Dupanloup, which was renamed the International University Centre for Research. This 16th century former bishop's residence has been brightly renovated to offer a prestigious modern and ancient décor for all scientific events.



Walking distance from the Hotel Dupanloup in Orléans, LE STUDIUM hosts Research Fellows in a newly renovated castle of the 18th century, Le Chateau de la Motte Sanguin. This impressive castle offers seven top-class apartments with a view on the Loire river and a delicious terrace and garden to relax.



Scientifically, it is an incredible opportunity for me to pursue research in my field of expertise by participating in a highly ambitious project benefiting from the excellent research environment provided by the MabImprove LabEx and the ARD 2020 "Biopharmaceuticals" as well as from the highly stimulating international community brought together by LE STUDIUM.

- Mohammed Ayoub



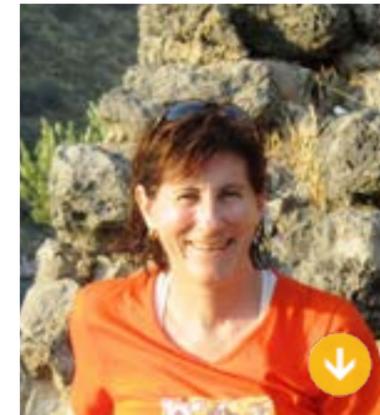
I was particularly impressed with the monthly LE STUDIUM® presentations on all different areas of expertise as well as the opportunity to discuss different ideas in detail with the other LE STUDIUM Fellows.

I have found that I look for possible solutions to problems more outside a specific discipline than previously.

- Robin Beech

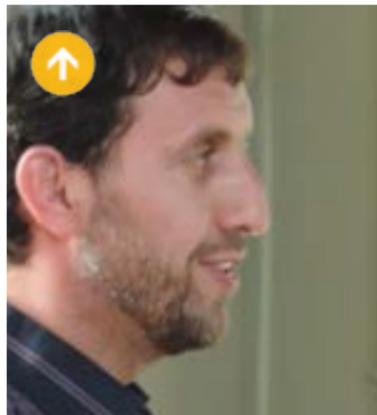
The French and European approaches to metallurgical research and development are different. This has given me an opportunity to think differently about my field and has given me new research ideas/directions. On a personal level, I made good friends in Orléans, as did my family. These friendships, and the experiences we shared in France, will stay with us as we continue our lives in Canada.

- Edouard Asselin



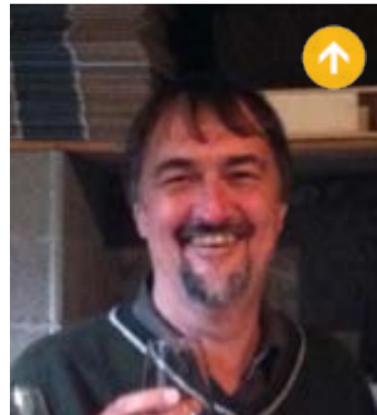
The MAPMO laboratory has opened new views for research as well as strongly increased my interaction with the French mathematical community.

- Kari Astala



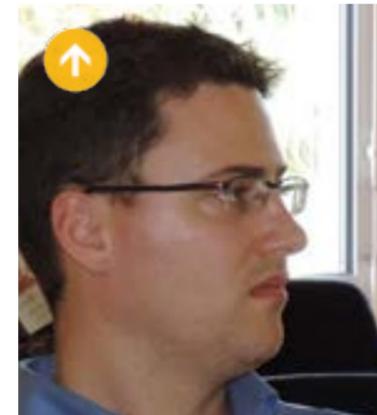
I appreciate LE STUDIUM's programme that enables a diverse group of research fellows, their host laboratories and local researchers to be regularly brought together.

- Arayik Hambarzumian



The experience associating with LE STUDIUM organization and the other fellows expanded my horizons and showed me the universality of exploration and discovery as a meaningful and worthwhile human endeavour.

- Kathleen Campbell



Besides all the professional benefits for myself and the host laboratory, LE STUDIUM project has been a significant step in integrating and strengthening links between French and Russian academic societies, particularly in the field of forest entomology and biological invasions.

- Natalia Kirichenko

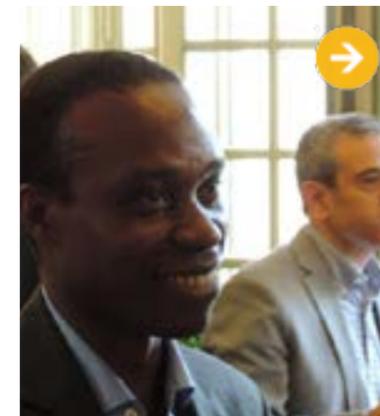


The quality of life in the region Centre-Val de Loire is very high and the excellent produce of Les Halles will long remain in the memory – and on the waistline.

- Magnus Williamson

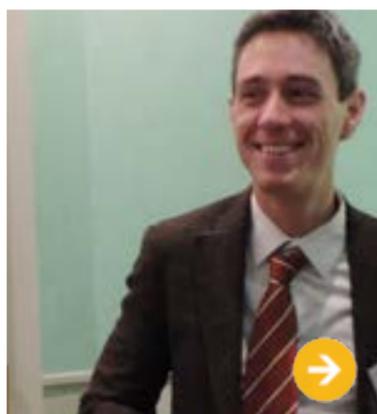
I would like to remark, the dynamic and renowned team of INRA Centre-Val de Loire – Orléans, particularly Dr Philippe Rozenberg, and the laboratory staff, who helped me develop my scientific project. We have never felt so cared for by LE STUDIUM support team, characterized not only by their professionalism, but also by their human values.

- Alejandro Martinez-Meier



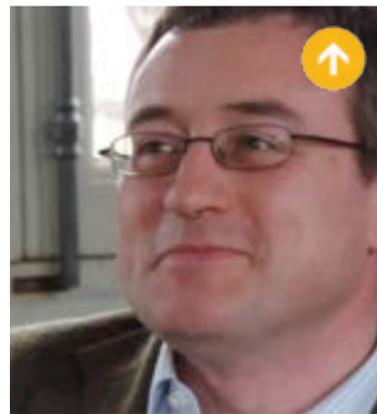
The energy, enthusiasm and willingness to exchange ideas that was engendered by the success of our LE STUDIUM conference has been a revelation. It has expanded my network of local, national and international collaborators (academic and industrial) and allowed me to participate in exciting new areas of micro-bubble research.

- Charles Sennoga



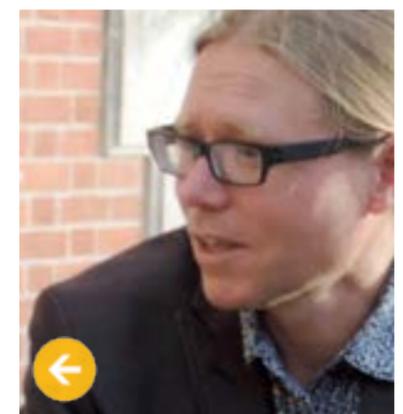
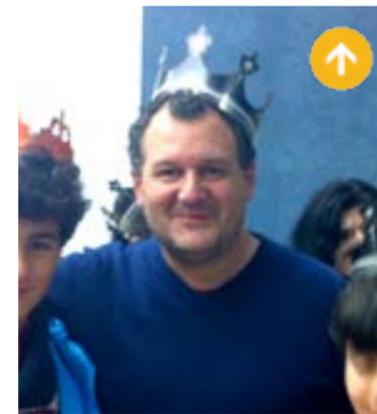
My experience as a LE STUDIUM researcher has greatly broadened the scope of my research and has brought France, Europe, and the rest of the World closer together in terms of scientific communication and investigation.

- Christopher Oshman



The interdisciplinary and cross-cultural environment of LE STUDIUM encourages personal and professional development.

- Scott Kroeker



# Governance

LE STUDIUM Loire Valley Institute for Advanced Studies is a non-profit organisation of Law 1901 registered in 1996 in Orléans, France. It is administered by a **General Assembly of Members**, a **Board of Directors**, an **Orientation Committee** and a Management team.

The **General Assembly** of members is composed of 3 collegia:

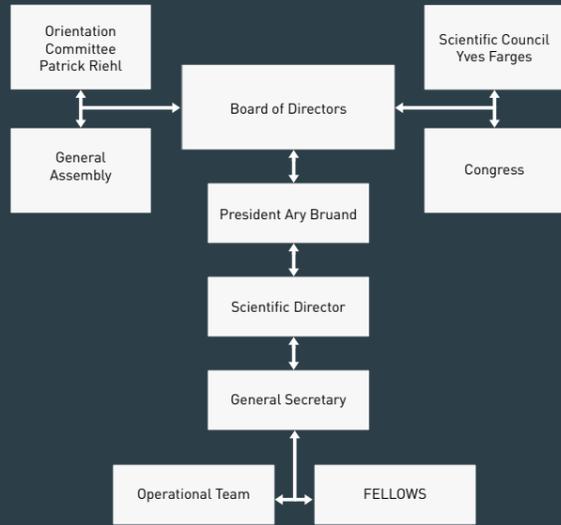
- ◆ representatives of research institutions and universities,
- ◆ representatives of businesses
- ◆ qualified personalities

and meets annually to review the year's activities. Every four years, this **General Assembly** reviews the composition and elects a **Board of Directors**.

Local and regional institutions are represented at LE STUDIUM **Orientation Committee**.

The **Board of Directors** and the **Orientation Committee** meet 3 to 4 times a year to review the activities and prepare reports and orientation decisions for the **General Assembly**.

The **President** of LE STUDIUM is appointed for 4 years and reports to the **Board of Directors**. LE STUDIUM President supervises the activities performed by a small dynamic team based in Orléans.



Governance Structure of LE STUDIUM

# Scientific Council

LE STUDIUM Scientific Council ranks awarded fellowships. It is composed of independent external researchers who gather once a year in June to validate the scientific reviews performed by a pool of more than 250 experts and researchers and to finalize the selection of the Smart Loire Valley General Programme fellows that will come in residence for the following year. The Scientific Council members are also regularly consulted to bring their expertise and perform independent evaluations in the course of punctual recruitments occurring across all programmes.

For the campaign 2014-2015, LE STUDIUM Scientific Committee members were:

Chairman: Yves FARGE, Académie des Technologies, Paris, France.

- ◆ Patrick ARTUS, Professor, Economist, Director of Studies Research NATIXIS Paris, France.
- ◆ Jean-Claude BERNIER, Professor, Chemistry, France.
- ◆ Fabrizio CORICELLI, Professor, Economist, Paris School of Economics, Paris, France.
- ◆ Marie-Françoise COUREL, Professor, Geographer, Studies Director, Ecole Pratique des Hautes Etudes, Paris, France.
- ◆ Pierre KHURI-YAKUB, Engineer, Stanford University, School of Engineers, California, USA.
- ◆ Patrick GALLOY, Director, STMicroelectronics (Electronics industry), Tours, France.
- ◆ Yves-Michel GINOT, Director of analytical division, Servier Group (Pharmaceutical industry), Orléans, France.
- ◆ Dominique LANGEVIN, Physicist, CNRS Research Director, University Paris Sud, France.
- ◆ David OGDEN, Director of Research, Laboratory of brain physiology and biophysics, University of Paris-Descartes, France.
- ◆ Alain PAVE, Professor, Biodiversity, Bio-mathematics, University of Lyon, France.
- ◆ Laurent PERRET, President of Research Group Servier (Pharmaceutical industry), Paris, France.
- ◆ Christian PESKINE, Professor, Mathematics Institute, Paris, France.
- ◆ Yveline PONCET, Geographer, Développement Durable des Territoires, France.
- ◆ Léandre POURCELOT, Professor, Faculty of Medicine, Head of the Department of Nuclear Medicine and Ultrasound, University François-Rabelais, Tours, France.
- ◆ Michel VAN DER REST, Professor, Biochemistry and Biophysics, Lyon, France.
- ◆ Friedrich-W WELLMER, Professor, former President of the Federal Institute for Geosciences and Natural Resources of Germany.

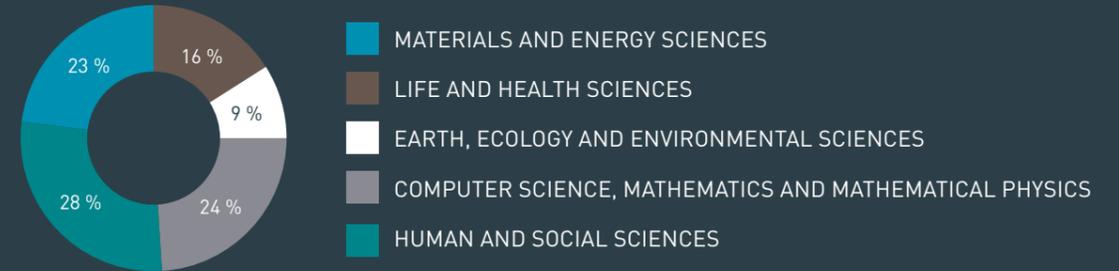
# KEY STATISTICS

## ORIGIN OF FOREIGN LE STUDIUM RESEARCHERS IN REGION CENTRE-VAL DE LOIRE

CUMULATED DATA SINCE 1996



## THEMATICS

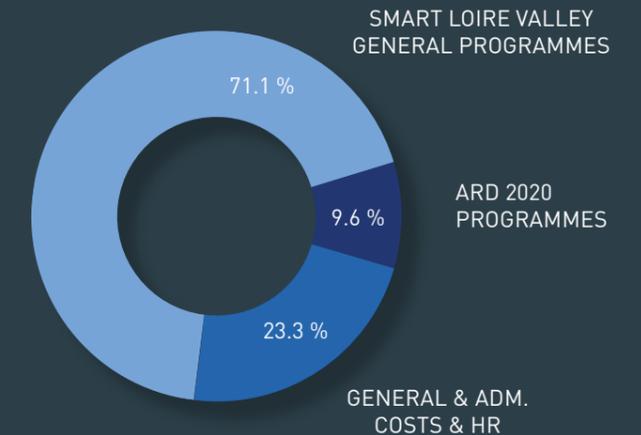


## 2014 FINANCIAL DATA

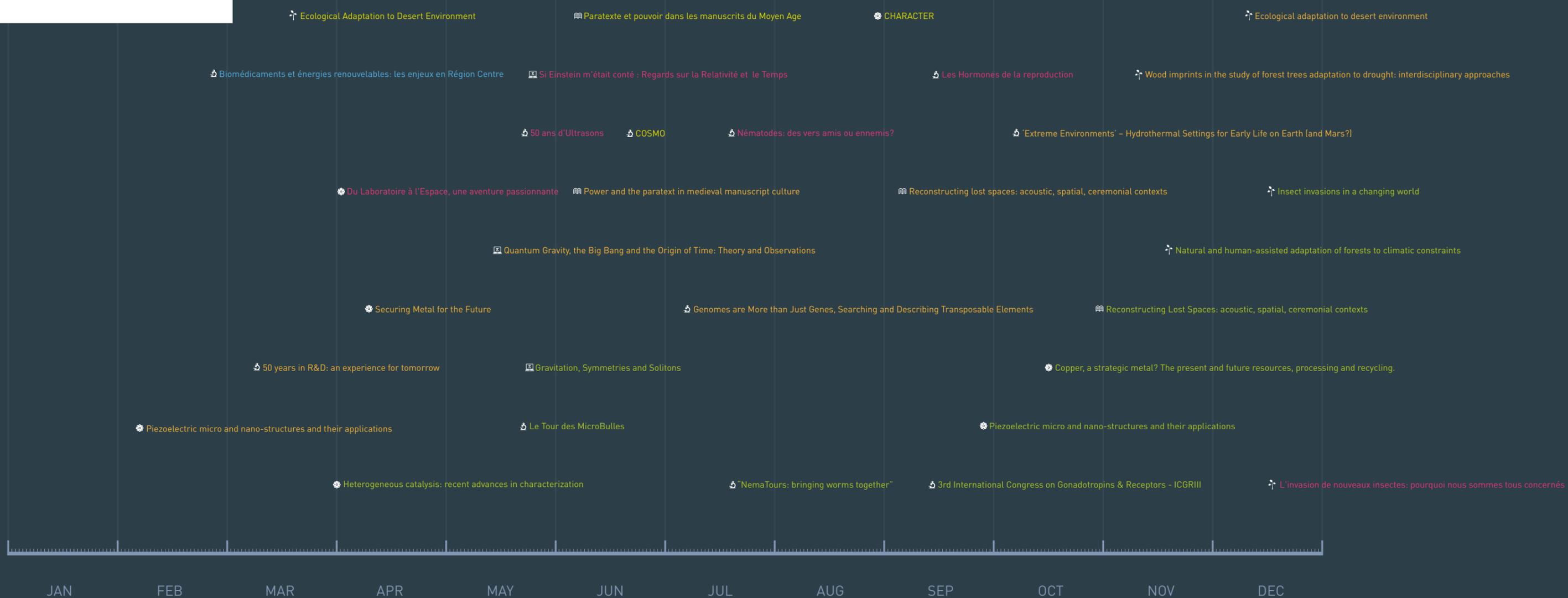
LE STUDIUM benefits from the longstanding support of the local, regional and European institutions - City of Orléans, Loiret General Council, Region Centre-Val de Loire and European Regional Development Funds (ERDF) - as well from contributions coming from its members (universities, research institutions...) and private contributions.

2014 RESOURCES	1 831 118 €
CENTRE REGION	52,8%
EUROPEAN REGIONAL DEVELOPMENT FUNDS	31,5%
UNIVERSITY FRANÇOIS-RABELAIS OF TOURS	4,5%
LOIRET GENERAL COUNCIL	3,5%
CITY OF ORLEANS	3,3%
PRIVATE CONTRIBUTIONS	3,3%
INRA-AGREENSKILL	0,9%
OTHERS	0,1%

## 2014 EXERCICE



# LE STUDIUM EVENTS IN 2014



LECTURES CONFERENCES THURSDAYS RENCONTRES LÉONARDO CONSORTIUM

LIFE AND HEALTH SCIENCE EARTH, ECOLOGY AND ENVIRONMENTAL SCIENCE

MATERIALS AND ENERGY SCIENCE HUMAN AND SOCIAL SCIENCE

COMPUTER SCIENCE, MATHEMATICS AND MATHEMATICAL PHYSICS

# LIST OF RESEARCHERS IN RESIDENCE IN 2014

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FEBRUARY 2013 - JANUARY 2014

## Pr Mourad Bellassoued

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From: Tunisia  
Project: On control and inverse problems for partial differential equations  
In residence at: MAPMO (Laboratoire de Mathématiques - Analyse, Probabilités, Modélisation)  
Host Scientist: Pr Jérôme Le Rousseau

JUNE 2013 - JUNE 2014

## Dr Igor Leontyev

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From: Russia  
Project: In situ combined investigations of nano-particles nucleation and growth processes of platinum carbon supported electro-catalysts for low-temperature fuel cells  
In residence at: CEMHTI (Condition Extrême et Matériaux : Haute Température et Irradiation)  
Host Scientist: Dr Louis Henet

AUGUST 2013 - DECEMBER 2015

## Dr Charles Sennoga

---

From: United Kingdom  
Project: Targeted drug delivery to brain  
In residence at: IC (Imagerie et Cerveau)  
Host Scientist: Dr Ayache Bouakaz

SEPTEMBER 2013 - SEPTEMBER 2014

## Pr Robin Beech

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From: Canada  
Project: Nicotinic receptors in parasitic nematodes: a pharmacological target for next generation anthelmintics  
In residence at: IASP (Infectiologie Animale et Santé Publique)  
Host Scientist: Dr Cédric Neveu

SEPTEMBER 2013 - SEPTEMBER 2014

## Dr Edouard Asselin

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From: Canada  
Project: Advanced bio-hydrometallurgy for recovery of metals from complex deposits  
In residence at: BRGM Orléans  
Host Scientist: Dr Patrick d'Hugues

OCTOBER 2013 - OCTOBER 2014

## Dr Christopher Oshman

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From: USA  
Project: Investigation of the feasibility of strain sensing and energy harvesting with piezo-semiconducting nanostructures  
In residence at: GREMAN (Groupe de Recherche en matériaux, Microélectronique, Acoustique et Nanotechnologies)  
Host Scientist: Dr Guylaine Poulin-Vittrant

NOVEMBER 2013 - NOVEMBER 2014

## Dr Magnus Williamson

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From: United Kingdom  
Project: DIPERMUR – Dispositif de la PERformance Musicale à la Renaissance  
In residence at: CESR (Centre d'Études Supérieures de la Renaissance)  
Host Scientist: Pr Xavier Bisaro

DECEMBER 2013 - SEPTEMBER 2014

## Dr Peter Arensburger

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From: USA  
Project: Impact of space segregation between micro and macrochromosomes on distributions of both kinds of transposable elements in avian genomes  
In residence at: PRC (Physiologie de la Reproduction et des Comportements)  
Host Scientist: Dr Yves Bigot

JANUARY 2014 - JANUARY 2015

## Dr Alejandro Martinez-Meier

---

From: Argentina  
Project: Adaptation of forest trees to climate warming: a case study on Douglas-fir  
In residence at: Unité de Recherche Amélioration Génétique et Physiologie Forestières  
Host Scientist: Dr Philippe Rozenberg

JANUARY 2014 - MAI 2015

## Dr Natalia Kirichenko

---

From: Russia  
Project: Development of advanced molecular tools for identification of invasive forest insects  
In residence at: URZF (Unité de recherche Zoologique Forestière)  
Host Scientists: Dr Alain Roques, Dr Carlos Lopez-Vaamonde, Dr Sylvie Augustin

JANUARY 2014 - DECEMBER 2014

## Pr Kathleen Campbell

---

From: New Zealand  
Project: The importance of hydrothermal systems for early life  
In residence at: CBM (Centre de Biophysique Moléculaire)  
Host Scientist: Dr Frances Westall

MARCH 2014 - MAY 2014

## Pr Gary Gibbons

---

From: United Kingdom  
Project: Classical and quantum space-time and its symmetries  
In residence at: LMPT (Laboratoire de Mathématiques et Physique Théoriques)  
Host Scientist: Pr Sergey Solodukhin

JULY 2014 - JUNE 2017

## Dr Mohammed Ayoub

---

From: Saudi Arabia  
Project: Targeting of G protein-coupled receptors by modulator antibodies  
In residence at: PRC (Physiologie de la Reproduction et des Comportements)  
Host Scientist: Dr Eric Reiter

AUGUST 2014 - AUGUST 2015

## Pr Scott Kroeker

---

From: Canada  
Project: High temperature nuclear magnetic resonance spectroscopy of devitrification process in nuclear waste glasses  
In residence at: CEMHTI (Condition Extrême et Matériaux : Haute Température et Irradiation)  
Host Scientist: Dr Pierre Florian

SEPTEMBER 2014 - APRIL 2015

## Pr Kari Astala

---

From: Finland  
Project: Conformal methods in random geometry  
In residence at: MAPMO (Laboratoire de Mathématiques - Analyse, Probabilités, Modélisation)  
Host Scientist: Dr Athanasios Batakis, Pr Michel Zinsmeister

SEPTEMBER 2014 - DECEMBER 2015

## Dr Arayik Hambardzumyan

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From: Armenia  
Project: The impact of adsorption layer structure and chemical composition on the stability of encapsulated product in emulsions  
In residence at: ICMN (Interfaces, Confinement, Matériaux et Nanostructures)  
Host Scientist: Dr Sylvie Bonnamy

DECEMBER 2014 - JUNE 2017

## Dr Jorge Gutierrez

---

From: USA  
Project: Lipids as modulators of the response to biodrugs  
In residence at: N2C (Nutrition Croissance et Cancer)  
Host Scientist: Dr Philippe Frank

DECEMBER 2014 - DECEMBER 2015

## Pr Erminia Ardissino

---

From: Italy  
Project: The laity and the Bible: Religious reading in early modern Europe  
In residence at: CESR (Centre d'Études Supérieures de la Renaissance)  
Host Scientist: Elise Boillet

# LIST OF LE STUDIUM CONSORTIA MEETINGS IN 2014

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These research teams consist in five members -one regional laboratory researcher and four international researchers- working on related topics but with different and complementary approaches. They frequently involve a former LE STUDIUM RESEARCH Fellow. These teams set goals, - validated by the Scientific Council of LE STUDIUM - to be attained over a two-year period. The designed format of LE STUDIUM RESEARCH CONSORTIA enables them to meet for one week every six months over two years.

The rule is that this week is totally devoted to the project, in conditions excluding any peripheral external perturbation, to ensure maximum intellectual concentration. The Region Centre-Val de Loire offers high quality locations provided with exceptional material conditions conducive to this initiative such as the former bishopric of the cathedral where LE STUDIUM has its headquarters in Orléans or the Centre d'Etudes Supérieures pour la Renaissance in Tours. These research projects are focussing on a long-term perspective with the constitution of research groups at the interface with industries and clusters, the establishment of interdisciplinary projects and the organisation of workshops, building of H2020 European projects etc...

17<sup>TH</sup> TO 21<sup>ST</sup> MARCH 2014

## Ecological Adaptation to Desert Environment

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Coordinator: Pr Raphaël Boulay  
Host Laboratory: IRBI (Institut de Recherche sur la Biologie de l'Insecte)

2<sup>ND</sup> TO 6<sup>TH</sup> JUNE 2014

## Power and the paratext in medieval manuscript culture

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Coordinator: Pr Rosalind Brown-Grant (former LE STUDIUM Fellow)  
Host Laboratory: POLEN - (Pouvoirs Lettres, Normes)

16<sup>TH</sup>-20<sup>TH</sup> JUNE 2014

## COSMO: COSMetics in Orléans

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Coordinator: Pr Salvatore Magazu (former LE STUDIUM Fellow)  
Host Laboratory: CBM (Centre de Biophysique Moléculaire)

25<sup>TH</sup>-28<sup>TH</sup> AUGUST 2014

## CHARACTER: Cooling of Hypersonic Advanced Reacting Applications: Coupled Transient Evaluation of Reactions

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Coordinator: Pr Nicolas Gascoin  
Host Laboratory: PRISME

1<sup>ST</sup>-5<sup>TH</sup> DECEMBER 2014

## Ecological Adaptation to Desert Environment

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Coordinator: Pr Raphaël Boulay  
Host Laboratory: IRBI (Institut de Recherche sur la Biologie de l'Insecte)

# LIST OF LE STUDIUM CONFERENCES IN 2014

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Each LE STUDIUM RESEARCH Fellow has the opportunity to organise one international conference called LE STUDIUM CONFERENCE. These two to three-day international conferences are co-organised by the resident researchers, their host laboratory and LE STUDIUM, which is providing scientific and organisational support. The theme of these conferences is directly related to the fellow's research topic. Fellows are asked to demonstrate their originality in design, bringing together complementary approaches generally not covered in conventional conferences, in order to develop new skills, adopt a differentiated position while communicating. LE STUDIUM CONFERENCES include up to 20 invited guest speakers with at least half being foreign delegates and an average of 40 additional attendees. That means, several hundred foreign researchers are welcomed each year in the Region Centre-Val de Loire, to enrich the complementarities and interactions within LE STUDIUM network of fellows, creating international links between local and international laboratories, leading to new research areas and career opportunities.

19<sup>TH</sup> TO 20<sup>TH</sup> MAY 2014

## MicroBulles Tour

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Research Fellow: Dr Charles Sennoga  
Host Scientist: Dr Ayache Bouakaz  
Laboratory: IC (Imagerie et Cerveau)

31<sup>ST</sup> MARCH TO 1<sup>ST</sup> APRIL 2014

## Heterogeneous catalysis: recent advances in characterization

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Research Fellow: Dr Igor Leontiev  
Host Scientist: Dr Louis Hennet  
Laboratory: CEMHTI (Condition Extrême et Matériaux : Haute Température et Irradiation)

20<sup>TH</sup> TO 23<sup>RD</sup> MAY 2014

## Gravitation, Symmetries and Solitons

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Research Fellow: Pr Gary Gibbons  
Host Scientist: Pr Sergey Solodukhin  
Laboratory: LMPT (Laboratoire de Mathématiques et Physique Théoriques)

17<sup>TH</sup> TO 18<sup>TH</sup> JULY 2014

## NemaTours: bringing worms together

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Research Fellow: Dr Robin Beech  
Host Scientist: Dr Cédric Neveu  
Laboratory: IASP (Infectiologie Animale et Santé Publique)

7<sup>TH</sup> TO 10<sup>TH</sup> SEPTEMBER 2014

## 3rd International Congress on Gonadotropins & Receptors - ICGRIII

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Host Scientist: Dr Eric Reiter  
Laboratory: PRC (Physiologie de la Reproduction et des Comportements)

25<sup>TH</sup> TO 26<sup>TH</sup> SEPTEMBER 2014

## Piezoelectric micro and nano-structures and their applications

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Research Fellow: Dr Christopher Oshman  
Host Scientist: Dr Guylaine Poulin-Vitran  
Laboratory: GREMAN (Groupe de Recherche en matériaux, Microélectronique, Acoustique et Nanotechnologies)

14<sup>TH</sup> TO 15<sup>TH</sup> OCTOBER 2014

## Copper, a strategic metal? The present and future resources, processing and recycling

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Research Fellow: Dr Edouard Asselin  
Host Scientist: Dr Patrick d'Hugues  
Laboratory: BRGM Orléans

30<sup>TH</sup> TO 31<sup>ST</sup> OCTOBER 2014

## Reconstructing lost spaces: acoustic, spatial, ceremonial contexts

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Research Fellow: Dr Magnus Guy Williamson  
Host Scientist: Pr Xavier Bisaro  
Laboratory: CESR (Centre d'Etudes Supérieures de la Renaissance)

18<sup>TH</sup> TO 19<sup>TH</sup> NOVEMBER 2014

## Natural and human-assisted adaptation of forests to climatic constraints: the relevance of interdisciplinary

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Research Fellow: Dr Alejandro Martinez-Meier  
Host Scientist: Dr Philippe Rozenberg  
Laboratory: URAGPF (Unité de Recherche Amélioration, Génétique et Physiologie Forestières)

17<sup>TH</sup> TO 19<sup>TH</sup> DECEMBER 2014

## Insect invasions in a changing world

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Research Fellow: Dr Natalia Kirichenko  
Host Scientists: Dr Alain Roques, Dr Carlos Lopez-Vaamonde, Dr Sylvie Augustin  
Laboratory: URZF (Unité de Recherche Zoologique Forestière)

# LIST OF LE STUDIUM THURSDAYS IN 2014

LE STUDIUM THURSDAYS aim to energize to the regional scientific community through transdisciplinary exchanges. These cross-disciplinary meetings take place every first Thursday of the month, gathering LE STUDIUM RESEARCH FELLOWS in residence, their laboratory hosts and guests from the scientific, industrial and institutional sectors. All foreign researchers visiting the Region Centre-Val de Loire and local researchers are welcome to attend these international meetings.

6<sup>TH</sup> FEBRUARY 2014

## Piezoelectric micro and nano-structures and their applications

Speaker: Dr Christopher Oshman  
Host Scientist: Dr Guylaine Poulin-Vittran  
Laboratory: GREMAN (Groupe de Recherche en matériaux, Microélectronique, Acoustique et Nanotechnologies)

6<sup>TH</sup> MARCH 2014

## 50 years in R&D: an experience for tomorrow

Speaker: Pr Yves Farges (President of LE STUDIUM Scientific Council)

3<sup>RD</sup> APRIL 2014

## Securing Metal for the Future

Speaker: Dr. Edouard Asselin  
Host Scientist: Dr. Patrick D'Hugues  
Laboratory: BRGM Orléans

15<sup>TH</sup> MAY 2014

## Quantum gravity, the Big Bang and the origin of time: Theory and observations

Speaker: Pr Gary Gibbons  
Host Scientist: Pr Sergey Solodukhin  
Laboratory: LMPT (Laboratoire de Mathématiques et Physique Théoriques)

5<sup>TH</sup> JUNE 2014

## Power and the paratext in medieval manuscript culture

Speaker: Pr Rosalind Brown-Grant  
Host Scientist: Pr Iolanda Ventura  
Laboratory: POLEN - (Pouvoirs Lettres, Normes)

26<sup>TH</sup> JUNE 2014

## Genomes are more than just genes, searching and describing transposable elements

Speaker: Dr Peter Arensburger  
Host Scientist: Dr Yves Bigot  
Laboratory: PRC (Physiologie de la Reproduction et des Comportements)

4<sup>TH</sup> SEPT 2014

## Reconstructing lost spaces: Acoustic, spatial, ceremonial contexts

Speaker: Dr Magnus Guy Williamson  
Host Scientist: Pr Xavier Bisaro  
Laboratory: CESR (Centre d'Etudes Supérieures de la Renaissance)

2<sup>ND</sup> OCTOBER 2014

## 'Extreme environments' – Hydrothermal settings for early life on Earth (and Mars?)

Speaker: Pr Kathleen Campbell  
Host Scientist: Dr Frances Westall  
Laboratory: CBM (Centre de Biophysique Moléculaire)

6<sup>TH</sup> NOVEMBER 2014

## Wood imprints in the study of forest trees adaptation to drought: interdisciplinary approaches

Speaker: Dr Alejandro Martinez-Meier  
Host Scientist: Dr Philippe Rozenberg  
Laboratory: URAGPF (Unité de Recherche Amélioration, Génétique et Physiologie Forestières)

4<sup>TH</sup> DECEMBER 2014

## Ecological adaptation to desert environment

Speaker: Pr Raphaël Boulay  
Laboratory: IRBI (Institut de Recherche sur la Biologie de l'Insecte)

# LIST OF LE STUDIUM LECTURES IN 2014

In the framework of LE STUDIUM CONFERENCE, LE STUDIUM RESEARCH Fellow is tasked to organise a public event, a LE STUDIUM LECTURE. These lectures are in French language and aim to present to the general public a research area or project in connection with the research topic of the conference or research project of the LE STUDIUM RESEARCH Fellows in residence. These public lectures consists in an opportunity to bring scientific knowledge to non-specialists and to give visibility to the research activities undertaken in the Region Centre-Val de Loire and involved laboratories and research teams. Topics are usually attractive for the general public but nonetheless treated with high scientific expertise. These lectures are largely advertised through different public and private networks and attract up to hundred participants each time.

19<sup>TH</sup> MARCH 2014

## 50 ans d'Ultrasons

Speaker: Pr Léandre Pourcelot  
Laboratory: Emeritus Professor at Université François Rabelais, Tours

22<sup>ND</sup> MARCH 2014

## Si Einstein m'était conté : Regards sur la relativité et le temps

Speaker: Pr Thibault Damour  
Laboratory: Institut des Hautes Etudes Scientifiques - Bures sur Yvette

31<sup>ST</sup> MARCH 2014

## Du laboratoire à l'espace, une aventure passionnante

Speaker: Pr Charles Kappenstein  
Laboratory: IC2MP (Institut de Chimie des Milieux et Matériaux de Poitiers)

17<sup>TH</sup> JULY 2014

## Les Nématodes, des vers amis ou ennemis ?

Speaker: Pr Pierre Abad  
Laboratory: Agrobiotech, Nice

9<sup>TH</sup> SEPTEMBER 2014

## Hormones Gonadotropes : Biomédicaments de la reproduction

Speaker: Pr Yves Combarrous  
Laboratory: PRC (Physiologie de la Reproduction & des Comportements), Tours

25<sup>TH</sup> SEPTEMBER 2014

## Objets « intelligents » et circuits électroniques de dernières générations

Speaker: Pr Laurent Montes  
Laboratory: PHELMA/IMEP-Lahc (Institut de Microélectronique Electromagnétisme et Photonique et le Laboratoire d'Hyperfréquences et de Caractérisation), Grenoble

30<sup>TH</sup> OCTOBER 2014

## Visualiser l'histoire: la reconstruction des espaces médiévaux disparus

Speaker: Dr Magnus Williamson & Pr Xavier Bisaro  
Laboratory: CESR (Centre d'Etudes Supérieures de la Renaissance)

18<sup>TH</sup> NOVEMBER 2014

## Changement climatique & impact sur le milieu forestier

Speaker: Dr Valérie Daux  
Laboratory: University of Versailles Saint-Quentin-en-Yvelines

17<sup>TH</sup> DECEMBER 2014

## Les insectes exotiques envahissants: pourquoi sommes-nous tous concernés?

Speaker: Dr Marc Kenis  
Laboratory: CABI (Centre for Agricultural Bioscience International), Switzerland

# AFFILIATED EVENTS

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LE STUDIUM brings scientific inputs and its support to many events organised in the prestigious Hôtel Dupanloup. These affiliated events reflects the engagement of LE STUDIUM to connect various sectors and disciplines and to create bridges between the scientific community and stakeholders in the region.

13<sup>TH</sup> MARCH 2014

## Journée d'Etude 'Ecrire l'Espace'

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Partner: ÉSAD (École Supérieure d'Art et de Design d'Orléans)

20<sup>TH</sup> MAY 2014

## Applications Industrielles des Isotopes

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Partner: Société Française des Isotopes stables  
Scientist: Dr Jérémie Jacob

27<sup>TH</sup> JUNE 2014

## Journée d'Etude 'Design au futur en Région Centre'

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Partner: ÉSAD (École Supérieure d'Art et de Design d'Orléans)

1<sup>ST</sup>-4<sup>TH</sup> JULY 2014

## Workshop - Reaction Kinetics in Soft and Condensed Matter

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Partner: CBM (Centre de Biophysique Moléculaire)  
Scientist: Pr Francesco Piazza

22<sup>ND</sup> OCTOBER 2014

## Workshop - Recyclage et valorisation des céramiques réfractères usagées

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Partner: CEMHTI (Condition Extrême et Matériaux : Haute Température et Irradiation)  
Scientist: Pr Jacques Poirier

24<sup>TH</sup> OCTOBER 2014

## Livraison de l'étude sur la filière santé en région Centre: L'Équipement médical

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Partner: Centréco

# SCIENTIFIC COUNCIL SELECTION FOR THE 2014-2015 CAMPAIGN

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LE STUDIUM Scientific Council met the 18th & 19th June 2014 in Orléans in order to evaluate and rank the proposal received in the framework of the LE STUDIUM campaign 2014/2015. Are listed below the projected supported by LE STUDIUM for the campaign 2014/2015.

## LE STUDIUM RESEARCH FELLOWSHIP – LABORATORY APPLICATIONS

### Pr Isabelle DIMIER POISSON

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Selection and evaluation of toxoplasma gondii antigens suitable for designing a subunit vaccine to prevent toxoplasmosis in humans

Host laboratory: UFR des Sciences Pharmaceutiques

### Dr Eva JAKAB TOTH

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In vivo translation of molecular magnetic resonance imaging probes

Host laboratory: CBM (Centre de Biophysique Moléculaire)

### Pr Francesco PIAZZA

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Cell biology from the colloid physics perspective: a computational study of biomolecular interactions mid-way between the test-tube and the cell

Host laboratory: CBM (Centre de Biophysique Moléculaire)

## LE STUDIUM RESEARCH FELLOWSHIP – EXTERNAL APPLICATION

### Pr Peter BENNET

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Music, liturgy and power: Louis XIII's Paris and provincial entrées, 1610

From: Case Western Reserve University, USA  
Host laboratory: CESR (Centre d'Etudes Supérieures de la Renaissance)  
Host scientist: Pr Philippe VENDRIX

### Pr Marion HARRIS

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Insect reprogrammers: From strategies for manipulating plants to agriculture

From: North Dakota State University, USA  
Host laboratory: IRBI (Institut de Recherche sur la Biologie de l'Insecte)  
Host scientist: Dr David GIRON

### Pr Scott KROEKER

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High-temperature nuclear magnetic resonance spectroscopy of devitrification processes in nuclear waste glasses

From: University of Manitoba, Canada  
Host laboratory: CEMHTI (Condition Extrême et Matériaux : Haute Température et Irradiation)  
Host scientist: Dr Pierre FLORIAN

## LE STUDIUM RESEARCH PROFESSORSHIP

### Pr Eric Antonio GOLES CHACC

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Discrete models of complex systems: computational complexity and (un)predictability, theory and applications

From: Aldofo Ibanez University, Chile  
Host laboratory: LIFO (Laboratoire d'Informatique Fondamentale d'Orléans)  
Host scientist: Pr Nicolas OLLINGER

## LE STUDIUM RESEARCH CONSORTIUM

### Pr Denis MULLEMAN

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Monitoring of monoclonal Antibodies Group in Europe (MAGE) for inflammatory diseases

Host laboratory: GICC (Génétique, Immunothérapie, Chimie et Cancer )



## CONTACTS

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