

LE STUDIUM

Loire Valley
Institute for Advanced Studies

SCIENTIFIC REPORT 2020

ANNUAL REPORT 2020

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L'ÉDITORIAL DU PRÉSIDENT

Irrigateur de recherche en région Centre-Val de Loire, porte d'entrée de chercheurs qui apportent de loin leur expertise au sein des laboratoires sur ce territoire, Le Studium poursuit sa mission pour leur offrir une haute qualité de recherches et une riche expérience de vie. En collaboration avec ses partenaires, Le Studium aura été en capacité d'accueillir en 2020 quarante chercheurs dans le cadre du Smart Loire Valley Programme et des programmes ARD 2020 qui repartiront ambassadeurs de l'intelligence et de l'art de vivre propres à la Vallée de la Loire.

La qualité de la science se joue dès le départ sur l'arbitrage que rend le conseil scientifique du Studium, organe international et indépendant, puis sur l'accueil des chercheurs en résidence et au sein des laboratoires hôtes. Elle se joue également en créant les conditions de l'échange des savoirs au travers de conférences internationales et de séminaires. Ces rencontres inscrivent « l'esprit Studium » dans cette communauté, celui d'une expertise curieuse aussi des autres domaines. L'Hôtel Dupanloup à Orléans et les appartements soignés dont ceux du Château de la Motte-Sanguin sont des marques de respect que Le Studium offre à ses invités, et qu'ils ne pourront oublier.

Bien sûr, cette année aura été marquée par l'épidémie Covid19 qui aura rompu ce lien précieux des échanges en face à face et sollicité l'organisation du travail à distance. Quelques bons fruits auront néanmoins surgi puisque l'audience des conférences aura été supérieure à celle d'un mode présentiel et l'accès en différé via des enregistrements rendu possible. 2020 aura confirmé l'attractivité résultant de l'action du Studium. La qualité personnalisée de l'accueil des chercheurs invités et les contacts qu'ils ont pu nouer sur place ont facilité pour certains le retour en France après un long séjour à l'étranger, pour d'autres l'installation définitive. C'est ainsi que quatre d'entre eux ont fait le choix du Centre-Val de Loire à l'issue de leur séjour.

En parallèle, Le Studium travaille de concert avec ses partenaires pour faciliter le dépôt de projets Européens et l'obtention de financements internationaux au sein du réseau EUCLIDE. Après avoir montré pendant plusieurs années les apports de son initiative, Le Studium initie en lien avec ses partenaires, une nouvelle réflexion stratégique pour les sept prochaines années, qui vise la pertinence d'une action concertée entre les acteurs de la recherche sur ce territoire pour une lisibilité Européenne et une signature remarquée de son statut d'institut d'études avancées (IAS).

Le Studium œuvre pour une « Science Ouverte » par la mise en ligne des publications des chercheurs en résidence, le « Le Studium Multidisciplinary Journal » qui rend accessible rapports d'activités de fin de séjour et les publications liées et permet de percevoir la qualité et la diversité des recherches réalisées avec l'appui du Studium. Cette vitrine permet de mieux saisir l'originalité de l'institut : celui d'un espace et d'un temps de dialogue interdisciplinaire, à l'image d'un Leonardo de Vinci qui, à cinq siècles de nous, testait à lui seul le potentiel de fertilisation croisée du dialogue des savoirs, aujourd'hui fortement inspirant pour notre époque et dans la vision Studium.

En remerciant chaleureusement nos chercheurs invités qui ont apporté leur expertise et un autre regard, nos partenaires qui ont soutenu ces résidences et événements et l'équipe du Studium qui, par son implication quotidienne, a permis et conçu ce rapport scientifique 2020, je vous souhaite une belle promenade dans la diversité des laboratoires de la Région Centre-Val de Loire, lieux de curiosité et de découvertes, tout comme la rencontre de ces hommes et de ces femmes de cultures diverses qui partagent la passion d'éclairer, de comprendre, et d'admirer.

M. Yves-Michel Ginot,
Président

THE PRESIDENT EDITORIAL

As a real the gateway for international researchers who bring their expertise to research laboratories from afar, le Studium is pursuing its mission of internationalization of research in Centre-Val de Loire. The institute offers them a high quality of research collaboration and a rich experience of life. In alliance with its partners, Le Studium has welcome 40 researchers in 2020 as part of the Smart Loire Valley Programme and the ARD 2020 regional programmes, who will leave as ambassadors of the intelligence and art of living specific to the Loire Valley.

The quality of the science is decided from the outset by the Le Studium's Scientific Council, an international and independent body, and then by the reception of the researchers in residence and in the host laboratories. It also depends on creating the conditions for the exchange of knowledge through international conferences and seminars. These meetings bring the «Le Studium spirit» into this community, that of an expertise that is also curious about other fields. The Hôtel Dupanloup in Orléans and the well-kept flats, including those of the Château de la Motte-Sanguin, are marks of respect that Le Studium offers its guests, and that they will never forget.

Of course, this year is marked by the Covid19 pandemic, which has broken this precious link of gatherings and called for the organisation of distance work. Nevertheless, some good fruits have emerged since the audiences of conferences have been greater than that of a face-to-face mode and deferred access via recordings has been made possible. 2020 has confirmed the attractiveness resulting from the Le Studium's action. The personalised quality of the welcome given to the invited researchers and the contacts they were able to make on site made it easier for some to return to France after a long stay abroad, and for others to settle permanently. This is how four of them chose the Centre-Val de Loire at the end of their stay.

At the same time, Le Studium works with its partners to facilitate the submission of European projects and the obtaining of international funding within the EUCLIDE network. After several years of demonstrating the contribution of its initiative, Le Studium, in conjunction with its partners, is initiating a new strategy for the next seven years. The plan aims at the relevance of a concerted action between all research actors on this territory for a European legibility and a noticeable signature of its status as an institute of advanced studies (IAS).

Le Studium is working towards an «Open Science» by putting the publications of the researchers in residence online: «Le Studium Multidisciplinary Journal» offers access to the end-of-stay synthesis reports and related publications. Going through these pages makes it possible to perceive the quality and diversity of the research carried out with Le Studium support. This showcase gives a better grasp of the originality of the institute: that of a space and a time for an interdisciplinary dialogue, in the image of Leonardo da Vinci who, five centuries away from us, was testing the potential for cross-fertilisation of the dialogue of knowledge, an highly inspiring vision that matches Le Studium principles.

I am warmly thanking our invited researchers who have contributed their expertise and a different perspective, our partners who have supported these residencies and events and the Le Studium team who, through their daily involvement, have enabled and designed this scientific report 2020. I wish you a beautiful walk through the diversity of the laboratories of the Centre-Val de Loire Region, places of curiosity and discovery, as well as the meeting of these men and women from diverse cultures who share the passion to enlighten, understand and admire.

Mr Yves-Michel Ginot,
President



IDENTITY & MISSION

*LE STUDIUM Loire Valley Institute for Advanced Studies (IAS):
a unique transdisciplinary approach to support research
and innovation in the Centre-Val de Loire region and a
multidisciplinary intellectual and human space favouring
international scientific exchanges*

Established in 1996 and inspired by the historical, geographical and human cultures of the Loire Valley, LE STUDIUM Loire Valley Institute for Advanced Studies (IAS) is an internationally recognised regional agency, whose mission is to create in the Centre- Val de Loire region an outward looking dynamic for the scientific community that includes public and private research stakeholders. The institute has welcome hundreds of highly qualified scientists, contributes to the strengthening of human capital for research, development and innovation and participates in the valorisation of regional scientific research and economic influence.

The programmes designed by LE STUDIUM enable the institute to support international collaborative research projects and the mobility of experienced international researchers across all scientific disciplines. The selections and recruitments happen through calls for applications and call upon high standards applying to LE STUDIUM Scientific Council and human resources management. The institute develops in parallel a rich scientific programme with the organisation of international conferences, workshops, transdisciplinary seminars, and events for the promotion of the scientific culture and knowledge. Each selected researcher benefits from a dedicated assistance to facilitate her/his smooth and efficient integration in the region and from a fully furnished housing adapted to the configuration of her/his family.

The SMART LOIRE VALLEY general programme, for the period 2015-2021, operates with a co-financing from the European Union in the framework of the Marie Skłodowska-Curie Actions (COFUND) for the mobility of experienced researchers, increasing its selection and recruitment capacity. As an appreciated partner supporting the smart specialisation

strategy (S3) of the Centre-Val de Loire Regional Council, the IAS covers a wide array of key strategic scientific topics in the framework of the Ambition, Research and Development 2020 programmes (ARD2020).

Based in city center of Orléans at the Hôtel Dupanloup, the International University Centre for Research, the IAS maintains deep interactions with all regional cities, research structures and stakeholders. It enjoys prestigious premises and exceptional facilities offering visiting and regional researchers a memorable experience and increasing its attractiveness to welcome high-level talents in the Central-Val de Loire region. At the interconnection between fundamental research and innovation, LE STUDIUM benefits from a strong regional network of scientific partners, and works in close collaboration with all regional research stakeholders and intermediaries:

- **Higher education and research institutions:** University of Orléans, University of Tours, INSA Centre-Val de Loire, ESAD Orléans
- **National research institutes:** BRGM, CNRS Centre Limousin Poitou-Charente, CEA Le Ripault, Centre INRAE Val de Loire, Inserm
- **Poles of Competitiveness:** Cosmetic Valley, Polymeris, Dream, S2E2, Polepharma, Vegepolys
- **Other clusters and organisations:** Euclide, Dev'Up, Centre-Sciences, CCI, etc...

LE STUDIUM Loire Valley Institute for Advanced Studies' awards are selected thanks to the support and expertise of the LE STUDIUM Scientific Council composed of twenty-five renowned scientists who regularly dedicate some of their precious time to evaluate research projects and candidacies.

LE STUDIUM Loire Valley Institute for Advanced Studies offers visiting researchers an original 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.





SCIENTIFIC VISION & SURROUNDINGS

From fundamental research to innovation and socio-economic development

LE STUDIUM Loire Valley Institute for Advanced Studies is strongly imbedded in the Centre-Val de Loire region's research landscape. With 24 years of experience and holding a prestigious portfolio of regional and international research programmes, LE STUDIUM activities continue to grow and spread light on its actors and partners. The focus of its mission remains to build the human capacity for research and scientific knowledge and to foster socioeconomic development and innovation. As a matter of fact, LE STUDIUM's expertise lies in attracting, managing a growing flow of global research exchanges, creating new scientific value chains, and contributing to the emergence of innovative, collaborative research and enterprise activities. The impact of new knowledge on the economy is incremental, but the cumulative effect is substantial.

In November 2015, LE STUDIUM was awarded by the European Union Horizon 2020 COFUND scheme in the category of the Marie Skłodowska-Curie Actions for mobility of scientists. The Smart Loire Valley Fellowship Programme (SLV) enabled LE

STUDIUM to select and attract a larger number of experienced scientists who come to spend a one-year full time residency in the Centre-Val de Loire region. This award brought a five-year co-financing to the initial support provided by the Centre-Val de Loire Regional Council of and brought substantial benefits and visibility to hosting laboratories and to the entire regional research ecosystem.

LE STUDIUM Scientific Council reviews each year all the filed applications in the Smart Loire Valley general Programme for the Research Professorship, the Research Fellowship, the Visiting Researcher and the Research Consortium Awards. Other recruitments and awards happen in the framework of the ARD 2020 smart specialisation programmes initiated by the Centre-Val de Loire Regional Council in which LE STUDIUM contributes as a key partner for the international dynamics and scientific exchanges.

This past year, LE STUDIUM has attracted and welcomed thirty-eight international researchers coming from thirteen countries. These awards were

across diverse disciplines from the social sciences, natural sciences and engineering.

The monthly transdisciplinary seminars, LE STUDIUM Thursdays, praised by all participants have become over time a not-to-miss intellectual space for exchanges. They enable Research Fellows to advance their presentation skills, to gain a deeper understanding of all regional research activities, to experiment concrete transdisciplinary exchanges and to enhance visibility of host laboratories. PhD students are invited to attend, an opportunity that allows them to validate transversal credits and increase their scientific culture and knowledge. Events were organised in 2020 have again demonstrated the diversity of research projects represented in the faculty of fellows and the creative interactions that emerged in all discussions. Their virtual digital format even engaged a larger community to connect and participate in.

Awards of selected candidates include the opportunity to see LE STUDIUM finance the organisation of Conferences and Workshops; these multidisciplinary events organised in partnership with regional host laboratories attract a large number of leading international researchers to the Centre-Val de Loire region each year. Their medium

sized format and peculiar specificity offer the ideal scenery for the creation of close and fruitful discussions, which often result in new ideas for research and international collaborations. This past year Again the digital format of events at the era of Covid-19 appeared as a new dynamic, enabling connections worldwide. The online storage and accessibility of presentations beyond the conference time contributese even more to the general public's awareness of research and facilitates the transfer of scientific knowledge to a wider audience; these events keep the local community informed about regional research activities and have become increasingly popular. Partnerships with universities and other local actors, have been essential to guaranty visibility and participation to these events. LE STUDIUM is an international outward looking partner offering opportunities to access and develop fundamental research projects. These are essential to lead to new knowledge and create the fund from which the practical application of knowledge must be drawn. LE STUDIUM's mission nurtures this process closely linked to innovation, together with the laboratories of our members, to achieve quality socio-economic outcomes for the Centre-Val de Loire region.

THE SMART LOIRE VALLEY PROGRAMMES

The Smart Loire Valley General Programme

The Smart Loire Valley Programme call for applications, open from November each year to February next year, operates with a co-financing from the European Union in the framework of the Marie Skłodowska-Curie Actions - COFUND (Co-Funding of regional, national and international programmes for the mobility of experienced researchers) for the period 2015 to 2021. The Smart Loire Valley Programme is designed to foster international scientific exchanges and collaborations and to build human capacity and scientific knowledge for research, development and innovation in the Centre-Val de Loire region. It is open to all scientific disciplines and is a precious tool to access funding to develop fundamental research projects and extend international collaborations.

Events and networking actions organised by LE STUDIUM aim at creating synergies between academic disciplines and links with the industrial world in order to increase interdisciplinary research and translational research to stimulate socioeconomic development. Independent external peer reviewers and an international independent Scientific Council Scientific projects assess and select the best candidates and innovative research projects. To be eligible, applicant researchers must be nationals or long-term residents of a country other than France and comply with the European mobility rules.

LE STUDIUM RESEARCH

FELLOWSHIP *

This award enables experienced international researchers to work in a host laboratory for 12 consecutive months. The award is designed to offer internationally competitive researchers the opportunity to discover and work in nationally accredited laboratories with international renown in the Centre-Val de Loire region. A salary, a fully furnished housing, logistic and administrative support, and funding to organise an international event are associated to the award.

LE STUDIUM RESEARCH

PROFESSORSHIP

This award enables an experienced international Professor to participate in research, research team building and postgraduate teaching. The Professorship residency consists in four periods of three months in the Centre-Val de Loire region (12 months in total in 4 consecutive years). A salary, a fully furnished housing, logistic and administrative support and funding to organise an international event are associated to the award.



LE STUDIUM RESEARCH

VISITING RESEARCHER

This award enables experienced international researchers already having an opportunity to work in a host laboratory of the Centre-Val de Loire region to enter LE STUDIUM scientific community. The award offers a fully furnished housing, full logistic and administrative relocation support and integration in the region for 3 to 9 months of residency.

LE STUDIUM RESEARCH

CONSORTIUM

This award enables the creation of a team of five researchers (including one researcher or research team from the region Centre-Val de Loire) and funds its regular gatherings for a full week twice a year over 2 years (4 meetings in total). The consortium projects have well-defined research objectives, a work plan to implement and milestone goals to achieve between meetings.

The Ambition Research & Development 2020 Programmes (ARD 2020)

The long-term Socio-economic development of the Centre-Val de Loire region, 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's 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, job creation and socioeconomic dynamism in the territory.

Through these large research programmes, the Centre-Val de Loire Regional Council supports the strengthening of quality research in five targeted strategic domains to foster the development of world-class poles to enhance research and innovation activity in the region:

- ➔ ARD 2020 Biomédicaments (biopharmaceuticals),
- ➔ ARD 2020 Cosmetosciences (cosmetics),
- ➔ ARD 2020 LAVOISIER (renewable energies),

- ➔ ARD 2020 PIVOTS (environmental engineering),
- ➔ ARD 2020 Intelligence des Patrimoines (Cultural and Natural).

LE STUDIUM stands as the official partner of these five regional ARD 2020 programmes, leading on the internationalisation dynamic by providing expertise and services to recruit international experienced researchers and organise actions and events to boost international scientific exchanges and collaborations and valorize research works carried out in the region.

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 organisms' intrinsic biologics. By definition, a biopharmaceutical is any drug whose active substance is a therapeutic macromolecule produced by living organisms. Biopharmaceuticals are overwhelmingly protein-based, mainly represented by non-living vaccines, therapeutic antibodies, enzymes, protein hormones and growth factors. As proteins, their injection is today mandatory by injection. The proportion of biopharmaceuticals in the drug market has dramatically increased over the past decade. The Centre-Val de Loire region is at the cutting edge of research in the pharmaceutical sector and has included the development of biopharmaceuticals in its smart specialisation strategy for the period 2013-2020. The regional government has injected a strong financial support in research to facilitate innovative inter-sectorial industrial development and partnerships for socioeconomic development beyond 2020. The ARD 2020 Biopharmaceuticals programme aimed to further develop and strengthen the Centre-Val de Loire regional biopharmaceuticals industry by capitalising on the recognised capabilities of the multidisciplinary research teams from the regional research institutions in the view to:

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

The Biopharmaceuticals Programme creates a dynamic, mobilising actors in the pharmaceutical sector, from fundamental research to production, to jointly develop the tomorrow's biopharmaceutical treatments in the Centre-Val de Loire region. It focuses on the design and biosynthesis of biomolecules for preclinical and clinical development by including the search for synergies with conventional chemically synthesised drugs. A number of innovative projects including academic and industrial partnerships covering a wide spectrum of biological molecules and domains are directly financed to bring immediate outcomes: vaccines, therapeutic antibodies, nucleic acids, lipoproteins, bio-production of medicines...

Since 2014, LE STUDIUM has recruited nine scientists for long-term residencies who have highly contributed to the objectives of the programme. A new phase of development is under preparation for the period 2021-2024.

ARD 2020 COSMETOSCIENCES



In an international framework characterised by changing regulatory regimes and increasing harsh competition, research and innovation are key factors to ensure smart specialisation and sustainable economic development of territories and stakeholders. In the very well-established perfume and cosmetic industry of the Centre-Val de Loire region, the COSMETOSCIENCES programme aims at giving a significant impetus to research projects with a strong character of innovation to unlock industrial development blockages by opening the door to new concepts and enabling the creation of new startups. It fosters French leadership in the sector and the leadership of the Centre-Val de Loire region, particularly with regard to sustainable cosmetics. Anchored in the Centre-Val de Loire region, this project revolves around the structuring of research at the national level on this cosmetic theme, including the research group (GDR) Cosmactifs, set up by CNRS in January 2015. It brings forty-eight laboratories together and is driven by the University of Orléans. Focused on economic development, this project shares in the international influence of the French cosmetics industry across the region Centre-Val de Loire.

Together with the Cosmetic Valley competitiveness cluster and in conjunction with the cosmetic industry, the programme creates the centre of expertise for the cosmetics Industry. Located at the very heart of the territory covered by Cosmetic Valley, its mission is to support business growth in the perfume and cosmetics sector with research, training and development activities and services specifically targeting very small and medium sized enterprises (VSEs and SMEs). The We Lab Cosmetic incubator and training laboratory was successfully established.

The programme focused on three complementary developmental axes:

- Cosmétopée and Sustainable Cosmetic
- Glycochemistry and Glycobiology
- Innovation in Formulation, Cellular Tools and Technologies

The programme is funded by the Region Centre-Val de Loire for the period 2015-2020.



ARD 2020 INTELLIGENCE DES PATRIMOINES



An interdisciplinary research programme dedicated to innovation, training and scientific development, Intelligence des Patrimoines offers a new understanding of cultural and natural heritage.

INTELLIGENCE DES PATRIMOINES is an interdisciplinary scientific research and innovation programme serving the tourism heritage economy in the Centre-Val de Loire region and offering new education and employment perspectives. It consists in an unprecedented approach to the promotion of the territory combining the scientific research with the socio-economic world to design new innovative services and products. It reunites the efforts of thirty-three laboratories and three hundred and sixty researchers from Tours and Orléans, led by the Centre for Higher Studies of the Renaissance (CESR) in Tours.

The Intelligence des Patrimoines Programme is articulated around five major interdisciplinary topic projects of research for the development of interdisciplinary scientific activities:

- Chambord Chateaux
- Vine and Wine
- Gastronomy, Health and Wellbeing
- Loire and Rivers
- Monuments, Parks and Urban Gardens

and proposes a transversal heterogenous digital data platform that collects and presents all developed activities and products (HeritageS platform). It offers new multidisciplinary and professional training courses at Master and Research Doctoral levels (École supérieure en Intelligence des Patrimoines) and has created a thematic academic incubator – the Smart Tourism Lab - for the development of startups on the regional territory and to support entrepreneurial projects dedicated to promote and renew the tourist experience around heritage. Through a unique transdisciplinary approach, it has developed valorization and mediation tools offering new experiences for visitors.

The programme is funded by the Centre-Val de Loire Regional Council for the period 2015-2021. A continuation of this programme for the period 2021-24 is under development.



ARD 2020 PIVOTS



PIVOTS - Environmental Technology Innovation, Development and Optimisation Platforms project

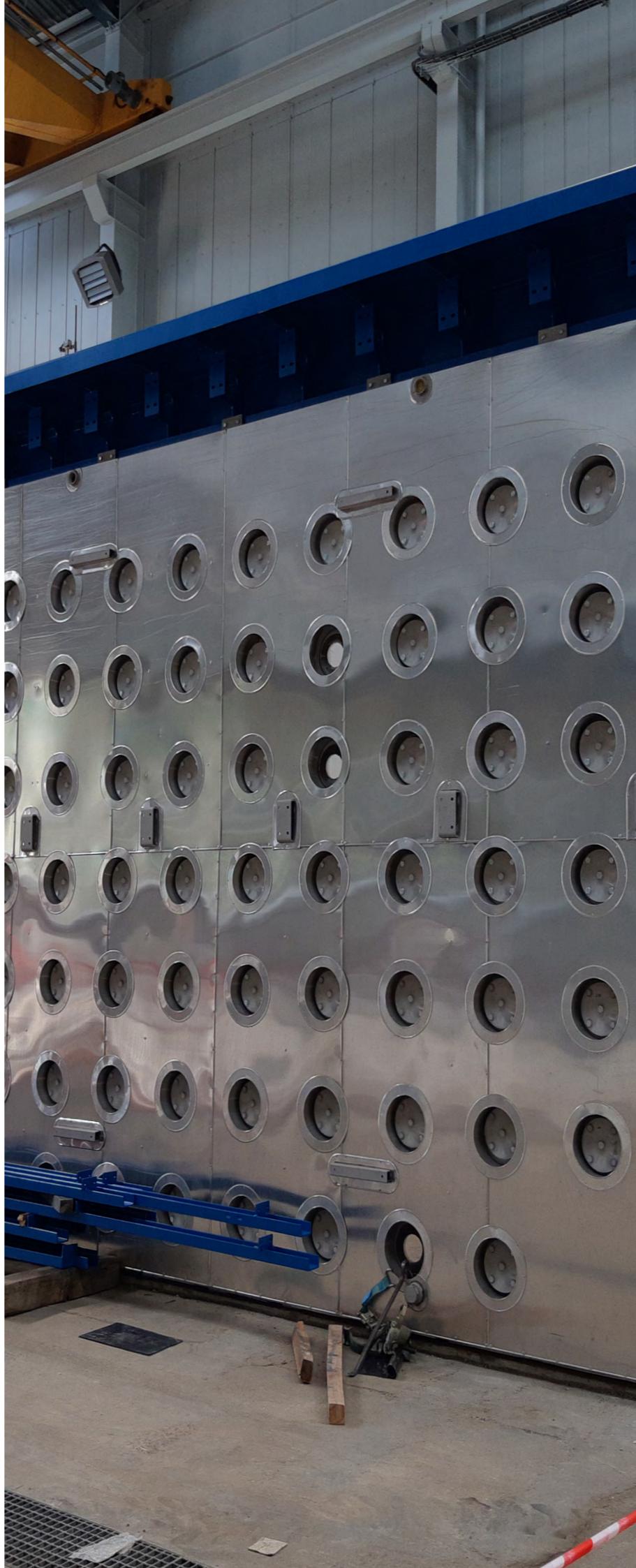
The PIVOTS project is a coordinated set of seven experimental and analytical platforms focused on environmental quality monitoring and sustainable management of natural resources (soil, subsurface, surface water, groundwater, sediment and air) within a context of global change (increased anthropogenic pressure and climate change).

The innovation through PIVOTS is founded on an integrated approach based on excellent research by academic and industrial experts together at all stages of the value chain, from fundamental research to validation of products and services.

The platforms are identified as:

- DECAP: Development of Environmental Sensors and Pollutants Removal Processes
- PRIME: Remediation and Innovation in the Service of Environmental Metrology
- O-ZNS: Observatory of transport in the Unsaturated Zone
- PERMECA: Testing and Research Platform in Collaborative and Applied Environmental Mechanics
- PESAT: Soil - Atmosphere exchanges in peat bogs
- PESAA: Soil - Atmosphere exchanges in Agricultural soils
- PRAT: Atmospheric Reactivity

The teams involved originate from BRGM (French Geological Survey), University of Orléans, CNRS (National Center for Scientific Research), INRAE (National Institute for Agricultural Research), Antea Group (consulting and engineering), DREAM (cluster of enterprises) and LE STUDIUM (Loire Valley Institute for Advanced Studies).



ARD 2020 LAVOISIER

LAVOISIER Laboratory with a Vocation for Innovation of the Safety and Industrialisation 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 CEA (Centre for Alternative Energies) Le Ripault AlHyance platform is dedicated to joint research efforts (Universities, CNRS, industrials) in the field of non-emitting greenhouse gases energies, particularly in the hydrogen field (fuels and hydrogen storage cells). The research themes are the following: design and materials expertise, safety and effectiveness of the systems, synthesis and characterisation, and methods and implementations.

The LAVOISIER programme led by CEA Le Ripault covers activities through research to transfer of technologies and is supported by the Centre-Val de Loire Regional Government over 7 years till March 2021 in the view to:

- Gather the conditions to support the tomorrow energies 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 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. 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.



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MATERIALS & ENERGY SCIENCES

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HOST LABORATORIES IN MATERIALS & ENERGY SCIENCES

GROUPE DE RECHERCHES SUR L'ENERGÉTIQUE DES MILIEUX IONISÉS (GREMI) - UMR 7344 - UNIVERSITÉ D'ORLÉANS, CNRS



Created in 1982, the GREMI is a joint University of Orléans/CNRS research unit focusing on plasma and laser processes and their applications in a wide range of fields: energetics, materials, micro-electronics, nanotechnologies, metrology, radiation sources, biomedicine, transport, and the environment. About 30 permanent position professors and researchers develop their research with the help of 10 engineers, technicians and administrative staff. The laboratory also welcomes around 20 PhD students and post-docs. The GREMI is one of the major plasma processing laboratories in France and its expertise is internationally recognized in many areas involving plasma properties. Its facilities comprise a substantial experimental infrastructure dedicated both to the production of plasma media and to state-of-the-art plasma diagnostics. Modeling, strongly linked to experimentation, is also an important aspect of the performed research.



CONDITIONS EXTRÊMES ET MATERIAUX : HAUTE TEMPÉRATURE

ET IRRADIATION (CEMHTI) - UPR 3079 - CNRS



The lab was originally formed in 1969 and renamed the «Centre de Recherche sur les Matériaux à Hautes Températures» in 1998. In 2008, it merged with the Centre d'Etudes et de Recherches par Irradiation laboratory. Its goals are to analyse 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.



LABORATOIRE DE PHYSICO-CHIMIE DES MATERIAUX ET DES ELECTROLYTES POUR L'ENERGIE (PCM2E) EA 6299 - UNIVERSITÉ DE TOURS



The Laboratory of Physics and Chemistry of Materials and Electrolytes for Energy (PCM2E) was created in 2012 and works in the field of energy conversion and storage (batteries, supercapacitors, hybrid photovoltaic, ionic liquids), nanostructured materials and organic electrochromic devices. Located in Tours, The PCM2E laboratory has about 35 people including 14 assistant professors, three professors, a professor emeritus and a lecturer Excellence. It has been strongly renewed since the last four-year contract since nearly half of these members have been recruited since 2007. The overall project of the laboratory is built around competences in electrochemistry, thermodynamics and chemistry of materials. The laboratory has three priority themes:

- Electrolytes, membranes and electrode materials for energy storage
- Organic semiconductors and nanostructured materials
- Ionic Liquids

In addition to the above mentioned directions of research, this laboratory is a unique research organisation owing to its in-depth focus on the design and development of novel electrolyte compositions. The electrolyte properties such as ionic conductivity, thermal behavior, potential range of stability, polarisability and dielectric constant fundamentally impact the performance of all types of batteries and form the core of the research activities.

The beneficial effect of choosing and designing novel materials and compositions of the electrolytes and applying appropriately to different battery systems has been demonstrated through numerous publications and patents at PCM2E.





MODELING OF REACTIVE PLASMAS FOR NANOPARTICLE SYNTHESIS



Prof. Igor Denysenko

LE STUDIUM Research Professor
Smart Loire Valley General Programme

From: V.N. Karazin Kharkiv National University - UA

In residence at: Research Group in the Energetics of Ionized Media (GREMI) - Orléans

Nationality: Ukrainian

Dates: May 2019 to July 2019
November 2019 to December 2020

Prof. Igor Denysenko is working on low-temperature plasma physics and dusty plasma physics and chemistry since more than 25 years and is an expert of their theoretical and numerical modeling. His recent studies concern the growth of nanoparticles in low-pressure plasmas and its effect on the plasmas. He is particularly well-known for his works related to effects of nanoparticles on electron energy distribution in complex plasmas and for the studies of effects of plasma on growth of vertically-aligned carbon nanostructures. In 2003, Prof. Denysenko was awarded by a research fellowship of the Alexander von Humboldt Foundation (Germany). He was project leader of a few international projects (Humboldt Foundation projects and a NATO Collaborative Linkage Grant) and many Ukrainian projects. He is co-author of 63 papers, 2 chapters of books, 2 textbooks and many proceedings. He was co-chairman of two international workshops.

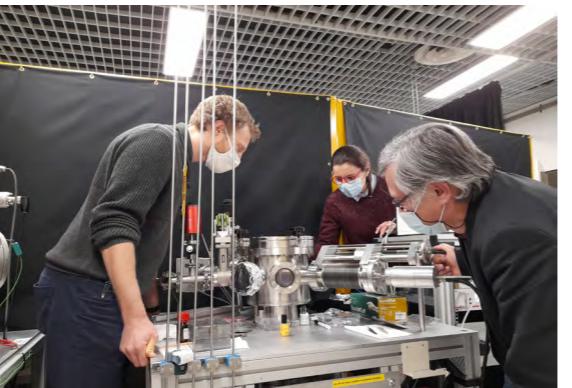


Dr Maxime Mikikian Host Scientist

Dr Maxime Mikikian is working on dusty plasma physics and chemistry since more than 20 years and is an expert of their experimental investigation. The background of his recent studies concerns the growth of nanoparticles in low-pressure plasmas and its effect on the plasma. He is particularly well-known for his work related to nanoparticle formation and dynamics and for his discovery of original dusty plasma instabilities. Co-responsible of the topic Functional Materials by Plasmas and Lasers in GREMI, he was also the coordinator of the national network on low-temperature plasmas in 2015- 2016 («Réseau Plasmas Froids»). Co-author of 45 papers and about 60 proceedings, he gave 9 invited lectures and 14 talks at international conferences. He coordinated 6 national or international research projects, and also participated in the organization of 13 national and international conferences and workshops.

The goals of the project are the development of theories and numerical programs to describe physical and chemical processes in reactive (mixtures of argon with acetylene, ethanol or aniline) steady-state and pulsed plasmas, and on walls, substrates and surfaces exposed to these plasmas. These theories and programs are required for analyses of the experimental data of partner-researches from GREMI and for determination of optimal conditions for the production of nanostructures with desired properties. The theoretical and numerical studies are carried out by the applicant in collaboration with the partners being responsible for experimental studies on the formation of nanostructures. The activity is carried out to get materials with new advanced properties for different applications and is also of fundamental interest for different fields.

During his first visit to France in May-July 2019, Igor Denysenko in collaboration with the project partners developed a theoretical model and a numerical program for description of properties (densities of ions, electrons, neutrals and atoms in different excited states, radical and ion fluxes to plasma walls, effective electron temperature and nanoparticle charge) of Ar/C₂H₂ complex nonstationary plasma. The pulsed regime and the plasma with growing nanoparticles were considered. The models for Ar/C₂H₂ complex plasma account for various processes of production and loss of main species in the plasma in different binary collisional processes, as well as for their loss due to diffusion to the walls and collisions with nanoparticles. Analyzing effects of external conditions on the densities of species taking part in the nanoparticle nucleation (negative and positive hydrocarbon ions and hydrocarbon radicals), it was found that Ar/C₂H₂ plasmas with low electron density, moderate input flux of acetylene and an electron energy distribution function (EEDF) close to the Druyvesteyn EEDF are the most suitable for the production of carbonaceous nanoparticles. The time-dependent properties of an Ar/C₂H₂ dusty plasma were studied for conditions corresponding to experiments on nanoparticle growth of partner-researches from GREMI. The calculated density evolution for C₂H₂, H₂ and C₄H₂ molecules were compared with time-resolved measurement of the mass peaks of the neutral species and the effects of the dust density on the plasma properties were analyzed. Time evolutions of the main positive and negative ions were also obtained thanks to the calculations. As a consistency check the time-dependence of the dust radius was also obtained numerically, assuming that an increase of the dust radius was due to deposition of hydrocarbon ions and C₂H radicals on the surface of dust particles. It was shown that for conditions corresponding to the experiment, the ions are the main contributor to the particle growth. The calculated dust growth rate was compared to the time-dependence of the dust particle size obtained in the experimental measurements. The results of the numerical calculations were found to be in a good qualitative agreement with the experimental data. The work on development of a spatially-averaged model for argon-ethanol plasma was also started this year.



Dr Georgios Nikiforidis

LE STUDIUM Research Fellow
ARD 2020 LAVOISIER Programme

From: King Abdullah University of Science and Technology (KAUST) - SA

In residence at: Physical Chemistry of Materials and Electrolytes for Energy (PCM2E) - Tours

Nationality: Greek

Dates: January 2020 to January 2021

An accomplished researcher with a particular focus on materials science and electrochemical energy storage systems. My area of scientific interest lies in exploring the properties of novel materials and electrolytes on energy storage devices for fundamental understanding and direct application in industry. Throughout my academic and professional career, I systematically studied various electrochemical energy storage and generating devices, spanning from redox flow batteries, photo-assisted flow cells, aqueous and non-aqueous metal batteries, supercapacitors, biofuel cells to organic electrochemical transistors. This has led me to 23 publications from which 18 I am first or co-author and 1 book chapter. I have demonstrated the ability to adapt to new environments, work with diverse teams, and effectively communicate with people of different backgrounds. My credentials also include setting up and maintaining the functionality of laboratories, writing and managing research projects, and mentoring undergraduate and postgraduate students.



Prof. Mériem Anouti Host Scientist

Prof. Mériem Anouti is a Professor in the PCM2E laboratory at the University of Tours. Her research focuses on electrolytes for electrochemical energy storage with a particular emphasis on room temperature molten salts as ionic liquids, deep eutectic solvents and their mixtures. She also applies ionic liquids for nanomaterials synthesis and studies fundamental properties including dissolution of gases. Based on the use of ionic liquids, she formulates electrolytes for improving the lifetime of energy storage systems, especially by enhancing the voltage and operating temperature range and by controlling the phenomena at the electrode/ electrolyte interface. She coordinates numerous ANR, regional funded and industrial research projects while also supervising PhD students. Her industrial research includes contracting with national and multinational companies.

A HIGHLY CONCENTRATED VANADIUM PROTIC IONIC LIQUID ELECTROLYTE FOR THE VANADIUM REDOX FLOW BATTERY

Since the volumetric capacity in a Redox Flow Battery (RFB) is directly related to the soluble redox species, it is essential to boost the anolyte and catholyte concentration to improve the energy density. The nature of the solvent introduced in the battery determines the solubility and stability of the numerous vanadium species of the solution. Ergo, ionic liquids (ILs), either pure or mixed with other solvents, is a promising alternative to aqueous electrolytes. ILs are organic salts composed entirely of ions and possess a low melting point (<100 °C). Protic Ionic Liquids (PILs) are formed by proton transfer from a Brønsted acid to a Brønsted base and represent the protic subgroup of ILs. The critical properties of PILs lie in their ionic conductivity and supercooling character, allowing them to be liquid over a wide temperature window. The goal of this study was to delineate protic ionic liquids (PILs) as solvents for high energy density redox flow battery systems. Despite being less conductive than standard aqueous electrolytes, PILs are thermally and chemically stable and equally dense as typical aqueous solvents. Most importantly, we found that the IL containing 20% mass of pyrrolidinium can solubilize 6 mol L⁻¹ of vanadyl sulfate, thus increasing the Vanadium RFB energy density by a factor of 2.5 (i.e., reaching a theoretical energy density of 122 Wh L⁻¹). To this end, we report a VRFB that uses for the first time aqueous electrolytic mixtures based on protic ionic liquids. The physicochemical characteristics of the PIL(aq)/vanadium electrolyte are defined throughout a wide operating temperature range (i.e., -20 to 80 °C) and found to be stable for several weeks. Electrochemical measurements reveal comparable quasi-reversible kinetics to those observed in standard sulfuric acid electrolytes. A proof-of-concept vanadium redox flow (VRFB) cell with a PIL electrolyte was reported for the first time at 25 and 45 °C, showing comparable thermal stability and performance to that of the conventional aqueous electrolyte. The cell yielded acceptable energy and coulombic efficiencies of the order of 65% and 93%, respectively, a nominal capacity of 1250 mAh at current densities up to 60 mA cm⁻² along with moderate cycleability (i.e., 150 cycles combined). The results gleaned from this study provide a platform and serve as a benchmark for the development of new generation VRFBs and, at the same time, pave the way to utilize PILs in other redox couples such as cerium [Ce(III)/Ce(IV)] and bromine (Br²/Br⁻).



DESIGN, FORMULATION AND CHARACTERISATION OF NEW SAFER ELECTROLYTES FOR ELECTROCHEMICAL STORAGE OF ENERGY

Dr Arunabh Ghosh

LE STUDIUM Research Fellow
ARD 2020 LAVOISIER Programme

From: Tata Steel Advanced Materials Research Centre - IN

In residence at: Physical Chemistry of Materials and Electrolytes for Energy (PCM2E) - Tours

Nationality: Indian

Dates: February 2019 to January 2021

Dr Arunabh Ghosh obtained his PhD from the SKKU Advanced Institute of Nanotechnology, Sungkyunkwan University, South Korea in July 2013. He is an M.Sc. in physics from IIT Kanpur, India (2008). After PhD, he worked as Senior Research Fellow in the National University of Singapore (Since Aug 2013). In February 2018, he joined Tata Steel Advanced Materials Research Centre, India, and worked as Application Engineer (senior manager), before starting his current position in LE STUDIUM Loire Valley Institute for Advanced Studies (since Feb 2019). Here he is working in collaboration with PCM2E laboratory of University of Tours. His research interest is focused on the development of nanomaterials and electrolytes for supercapacitors and batteries. He worked extensively on translational research, and industry-academia collaborations. He was involved in several industrial projects with companies like Nippon, Murata, Hoshen Corp., Tata Motors and others. He has a strong interest in performance-cost modeling of the battery packs for electric vehicle applications, and he is actively involved in real-life projects.



Prof. Fouad Ghamouss Host Scientist

Prof. Fouad Ghamouss is an associate professor in PCM2E Lab in the University of Tours. He is involved in several activities within the general area of electrochemical storage. He currently has a sub-grouping of ca 12 Master's thesis, PhD students and postdocs and takes parts in several national and international projects, especially for Li-ion batteries and supercapacitors. He is co-author of more than 80 peer-reviewed articles, patents, conference proceedings, and reports in the field of electrochemical storage. Fouad Ghamouss has supervised 14 PhD thesis and more than 30 master's students in electrochemistry, material sciences, and electrochemical storage. His main interest is the development and the study of advanced electrolytes and electrodes materials for Li-ion batteries and beyond Li-ion as well as supercapacitors.

The goal is to develop another new electrolyte composition, which is much safer compared to the commercially available benchmark for supercapacitive energy storage applications. This new electrolyte would be capable of working in ultra-low temperatures.

Beyond having a large potential window and high ionic conductivity, there are many other requirements, such as electrochemical stability, high ionic conductivity, suitable viscosity, that an electrolyte needs to meet in order to be promising for the performance of the device. Besides these, the electrolyte must have a large liquid range temperature, which is the main deciding factor of the device's operating temperature range. Furthermore, the volatility and flammability of the electrolyte are the keys to deciding the safety grades of supercapacitor devices.

In this context, we have formulated and designed new set of electrolytes, one is based on a new organic solvent, and the other one is based on mixture of two ionic liquids. The target is to fulfill application needs in sub-ambient temperatures, presenting good mobility, low flammability and wide working potential window.

The new organic solvent-based electrolytes exhibited higher potential window stability up to 3 V; also, it is noteworthy that this 3 V potential window was obtained using symmetric supercapacitor configuration only. Besides, each optimized electrolyte has shown significantly improved fire safety compared to commercially available ACN-based electrolytes, which is reflected by significantly higher flash points compared to those based ACN. In addition, we have demonstrated that each selected new electrolyte is capable of low-temperature supercapacitor operations. On the other hand, the second type of developed electrolyte was used in conjugation with vertically aligned carbon nanotube (VCNTs) based electrodes for supercapacitor applications, and we have demonstrated ultra-low temperature operations, along with higher safety compared to any commercially available electrolytes.

In both cases, we have finished all detailed characterizations, like determination of conductivities, viscosities, flash points, and obtained detailed electrochemical performances.

In order to obtain even stronger scientific conclusions, we have performed further works, including theoretical calculations and some other experimental characterizations. We supported key structural descriptors by density functional theory and COnductor-like Screening Model for Real Solvents (COSMO-RS) calculations, which was associated to the physical and electrochemical properties of the resultant electrolytes.

In parallel, the second work based on VCNTs was continued. We continued testing supercapacitor devices in a wide temperature range (- 40°C to 60°C) with both the commercially available ACN based electrolyte, as well as with the ionic liquid mixtures. Here, we have introduced a set of VACNT electrodes which were of different heights, and of different compositions. The compositional variations were introduced by the relative amount of amorphous carbon contents within the VCNT electrodes. At least 8 different type of compositions were used and corresponding supercapacitor devices were fabricated and thereafter tested using commercial electrolyte and in the above temperature ranges. Multiple cells were fabricated to ensure reproducibility of the system.

In addition, I decided to write two review articles based on the current scientific developments and related trends on different electrolytes for battery applications.

I have been involved in few other ongoing projects in the host laboratory, PCM2E since the beginning of LE STUDIUM fellowship. These projects were based on polymer-electrolyte based microbattery, Natural-coal based amorphous carbon and its application as CO₂ capture material, and other two amorphous carbon (Anthracite and Argon shells) based supercapacitor electrodes.



LE STUDIUM CONFERENCES

TOWARDS FUTURISTIC ENERGY STORAGE; PAVING ITS WAY THROUGH SUPERCAPACITORS, LI-ION BATTERIES AND BEYOND



This international conference organized by LE STUDIUM Loire Valley Institute for Advanced will focus on basics aspects as well as most recent advances in Li-ion, Beyond Li-ion batteries (e.g. Li-S, Na batteries) and supercapacitors. The Conference will cover different topics linked to these technologies including materials synthesis and characterization, interfacial phenomena, systems and materials optimization and modeling. Leading scientists and researchers will share their recent progress and stimulate discussions on interdisciplinary electrochemical storage.

The program of the conference will include plenary lectures, keynote lectures, invited talks, orals and a poster session.

A posters session will be organized during the conference with an award for the best poster.

This international conference is organised in the framework of the ARD 2020 Lavoisier Programme.

Scientific Publications

- Flavien Ivol, Marina Procher, Arunabh Ghosh*, Johan Jacquemin, Fouad Ghamouss, "Phenylacetonitrile (*C*6*H*5*CH*2*CN*) Ionic Liquid Blends as Alternative Electrolytes for Safe and High-Performance Supercapacitors", *Molecules* 2020, 25(11), 2697. DOI:10.3390/molecules25112697
- Arunabh Ghosh, Fouad Ghamouss*, "Role of electrolytes in the stability and safety of lithium-titanate based batteries," *Frontiers in Materials*, 2020, 7(186). DOI:10.3389/fmats.2020.00186
- O Boujibar, F Ghamouss*, A Ghosh, O Achak, T Chafik*, "Excellent CO₂ capture by ultra-high microporous activated carbon made out from Natural Coal", *Chemical Engineering & Technology*, 2020, DOI: 10.1002/ceat.202000138.



Dr Laura Piveteau

LE STUDIUM Guest Research Fellow

From: Department of Chemistry and Applied Biosciences, ETH Zurich - CH

In residence at: Extreme Conditions and Materials: High Temperature and Irradiation [CEMHTI] - Orléans

Nationality: Swiss

Dates: September 2019 to June 2021

Laura Piveteau completed her bachelor and master studies in chemistry at ETH Zurich (Switzerland) and earned her doctoral degree at the same institution in the group of Maksym V. Kovalenko. Her doctoral studies were supported by the Fund of the Swiss Chemical Industry (SSCI) with a Scholarship. She was awarded the ETH medal for her doctoral thesis and her research revolved around developing, adapting and applying nuclear magnetic resonance (NMR) spectroscopy to colloidal semiconductor nanocrystals and perovskite materials. She is currently a postdoc in the CEMHTI lab at CNRS Orléans, where she is developing NMR techniques to visualize structures and order in the intermediate range under the supervision of Dominique Massiot. Her postdoc is rendered possible by an Early Postdoc.Mobility fellowship financed by the Swiss National Science Foundation (SNSF).



Dr Dominique Massiot Host Scientist

Dominique Massiot is Directeur de Recherche [CNRS] at the CEMHTI laboratory with an interdisciplinary scientific profile mostly focused on materials sciences and advanced developments of nuclear magnetic resonance spectroscopy. Dominique Massiot published more than 270 articles receiving more than 13000 citations. He mentored more than 20 thesis, and was the coordinator of industrial and European contracts. Among other awards he received the Silver Medal of CNRS (2003), the médaille Berthelot of the French Academy of Sciences (2013), or was received as Docteur Honorifique de l'Université d'Ottawa (2018). He created the CEMHTI laboratory in 2008, was the founding director of the IR-RMNTHC national infrastructure, and was Director of the Chemistry Department at the CNRS headquarters in Paris-France from 2013 to 2017. He is currently one of the four editors of Progress in Nuclear Magnetic Resonance Spectroscopy and member of the "Haut Conseil des Infrastructure de Recherche" at the French Ministry of Science, Paris.

NMR STUDY OF DISORDERED INORGANIC MATERIALS USING SPIN DIFFUSION

The goal of this research project is to obtain a better understanding of chemical, geometrical and topological order in complex, disordered inorganic materials. Building on the atomic or molecular scale resolution obtained from state-of-the-art nuclear magnetic resonance (NMR) experiments (e.g. single pulse, double or multiple quantum selection), we want to develop solid-state NMR experiments based on spin diffusion, a spontaneously occurring spin-polarization transfer process, to extend the accessible spatial distance between nuclei to be correlated and thus characterize inorganic solids at the nanoscale.

NMR is a method of choice to study amorphous and disordered materials. Spin diffusion has proven to be very powerful to characterize organic polymers and protein structures revealing short and middle range structural characteristics in the size range of several Angstroms up to few nanometers, which is not or poorly accessible by other analytical methods. However, proton-free inorganic samples exhibit only very inefficient spin diffusion, which has been seldom observed or eventually becomes unobservable when the dipolar interactions are averaged out by magic angle spinning. Nevertheless, a recent publication by the Emsley group (Björgvinsdóttir et al. J. Am. Chem. Soc. 2018, 140, 7946-7951), taking benefit of surface enhanced dynamic nuclear polarization (DNP), reports efficient spin diffusion in proton-free inorganic solids from surface to the bulk. This finding prompts the prospect to be able to develop solid-state NMR experiments to observe spin diffusion in inorganic materials and to study their structural, compositional and morphological properties at larger spatial scales than previously possible.

We started our study with phosphate materials exploiting the ease to record ^{31}P NMR spectra thanks to the high natural abundance and sensitivity of this nucleus. In proton-free phosphate crystals with known structure, we could observe and investigate natural spin diffusion occurring at the time-scales of several seconds. We attempted to accelerate the spin diffusion process as it is the time-limiting step of the experiment. We achieved this by active reintroduction of dipolar interactions through radio-frequency driven recoupling (rfdr), thus obtaining complete polarization transfer after less than 100 ms. By careful experimental design and basic simulations, the polarization transfer mechanisms and the pathways from one nucleus to another could be traced and understood. Complexity was increased by switching to $\text{PbO-P}_2\text{O}_5$ glasses of various compositions, where phosphorous holds the role of a network former. Since individual chemical species are not resolved anymore in the ^{31}P NMR spectra of such disordered materials, selective experiments must be used. Multi-quantum filters followed by rfdr-driven spin diffusion are a possible approach to obtain spectra within reasonable time. However, their interpretation, which is already complex without spin diffusion, requires the development of analysis tools, which is still on-going work. Furthermore, we observed in these multi-quantum experiments also signals which were considered in the past to be artefacts since they undesirably passed the multi-quantum filter. But, since they originate from a cross-term between the dipole-dipole interaction and the anisotropic chemical shift, these signals are indicative for the proximity of molecular units and thus represent an alternative approach to learn more about mid-range order inside disordered inorganic materials, hence, another approach we follow within this project.



Dr Edurne Serrano-Larrea

LE STUDIUM Research Fellow
ARD 2020 LAVOISIER Programme

From: University of the Basque Country, UPV/EHU - ES

In residence at: Extreme Conditions and Materials: High Temperature and Irradiation [CEMHTI] - Orléans

Nationality: Spanish

Dates: September 2019 to December 2020

Edurne Serrano-Larrea received her PhD in Chemistry by the University of the Basque Country in 2009. Her thesis focused on the search of open inorganic-organic compounds based on the vanadate oxoanion, involving crystal structure resolution and analysis, and the study of their thermal, spectroscopic and magnetic properties. She has specialized on the study of the catalytic properties of inorganic-organic materials. During her postdoctoral trajectory, she has focused on the obtention and study of porous crystal frameworks with open metal sites for enhanced catalytic activity. She has participated in the International Network on Ionic Liquid Deep Eutectic Solvent Based Metal Organic Frameworks Mixed Matrix Membranes MSCA-RISE [Nº 778412] whose aim is to develop new advanced water remediation filters for heavy metals removal. She is coauthor of 32 scientific articles and 2 book chapters.



Dr Conchi Ania Host Scientist

Conchi ANIA received her PhD in 2003 by University of Oviedo (Spain). In 2009 she became Tenured Scientist at Agencia Estatal CSIC, and in 2017 she joined CNRS as Directrice de Recherche. She is a grantee of the European Research Council since 2016 and editor of Carbon journal [Elsevier]. She has a long-standing interest on nanoporous materials with tailored surface chemistry and architectures for energy storage & conversion, wastewater treatment, gas adsorption & separation. She has an H-index of 43 with over 6000 citations.



Dr Encarnacion Raymundo-Pinero Host Scientist

She got her PhD in 2002 at University of Alicante (Spain), and joined the CNRS in 2006. She is currently Directrice de Recherche at CEMHTI. Her research interests are the electrochemical applications of nanoporous materials (supercapacitors, batteries) and the removal of pollutants. She is inventor of 13 patents in electrode materials for electrochemical applications. She has an H index of 39, with over 8000 citations.

ELECTROCHEMICAL ENERGY CONVERSION BASED ON METAL-FREE NANOPOROUS ELECTROCATALYSTS

The production of fuels from renewable energy sources plays a key role in all future energy scenarios, and the rapid inter-conversion of electricity into chemical energy offers an important avenue in the use of renewable energy. In this regard, the generation of electricity in fuel cells from the electrochemical reaction of H_2 and O_2 , coupled with the photoelectrochemical water splitting to produce oxygen and hydrogen gases, offers a viable approach to efficiently produce electricity using water and sunlight. Additionally, CO_2 has the potential to be used in the manufacture of fuels and high added value chemical feedstocks (e.g., formic acid, methanol, methanol), prompting a new economy approach based on lower fossil fuel consumption. However, being a thermodynamically stable molecule, the electrochemical reduction of CO_2 needs to overcome kinetic barriers to lower overpotentials, increase faradaic efficiency and promote products selectivity. The development of new processes and efficient materials to obtain fuels from carbon dioxide using (photo)catalytic and (photo)electrocatalytic routes has become an important research field topic.

The project aims to design, formulate and characterize new metal-free electrocatalysts based on nanoporous carbons for a sustainable CO_2 conversion into fuels or feedstock. The goals are to explore the transformation of CO_2 and H_2O into sustainable fuels at a multiscale level, going from (i) the understanding of the nano-microscale phenomena that govern the (photo)electrocatalytic process; (ii) to the macroscopic level by designing photo(electro)catalytic reactors (e.g., bench scale) with electrodes operating in a continuous regime. By screening C-based catalysts with different chemical, structural and textural properties, we are able to establish relationships between their photo(electro)catalytic activity and their physicochemical properties. Firstly, we study their photo(electro)chemical response, and depending on the nature of the carbon, we observe different signs and amplitude of the transient photopotentials. We also observed that it is possible to modulate the anodic or cathodic photocurrent of the carbons with the applied potential. Likewise, carbon materials are capable of showing different affinity towards CO_2 uptake, which is important for the conversion yield.



MECHANISMS OF GLASS CRYSTALLIZATION ANALYSED BY ELECTRON BACKSCATTER DIFFRACTION (EBSD)

This project is aimed towards studying crystallization during or after the process of levitation melting. This includes the crystallization of melts during cooling but also the more controlled crystallization of glasses in a subsequent thermal treatment. In order to determine the occurring crystallization mechanism, it is necessary to analyze the crystallographic orientation relationships amongst the various components of a microstructure. While phase identification and characterization can be achieved using X-ray diffraction (XRD), determining local orientation relationships in the microstructure necessitates the use of electron backscatter diffraction (EBSD) which is performed in a scanning electron microscope (SEM). EBSD can also be used to locate and identify phases which occur in a quantity below the detection threshold of XRD.

It is essential to know and understand the possibilities and limits of the applied methods when performing high-level analysis. With this aspect in mind, a critical view on results obtained during the search for a phase of the composition ZnY₂O₄ in solid state ceramics was published in early 2020 [1]. Further fundamental work was addressed towards the significant information depth of XRD and showed it to range from at least 30 µm up to more than 100 µm in the analyzed material instead of the 10 µm sometimes assumed in the literature [3].

The EBSD-analyses of beads produced using levitation melting showed that various crystal growth mechanisms can occur during cooling. Figure 1 illustrates three possible types of crystal growth via the image quality maps of EBSD-scans. Figure 1 a) shows the entire cross section through a fully crystallized bead where many nucleation events occurred but it can be shown that each grain shows its own, independent crystal orientation. Figure 1 b) illustrates the microstructure in a different bead with a higher magnification to illustrate the tree-like (central trunk with branches to each side) morphology characteristic for dendritic growth. It can be shown that all the crystallites within the white frames show only one orientation per frame, confirming that they are connected outside of the current cross section and hence their formation via dendritic growth. Figure 1 c) presents the microstructure in a segment of a bead that fractured during cooling: apart from some polishing artifacts and two pores, it contains no grain boundaries and can be shown to have only a single crystal orientation. While it is only part of a bead and the scan only covers a cross section, the scanned area covers more than 7.2 mm², proving that macroscopically homogeneous crystals can be produced by levitation melting. The ability to produce spherical single crystals e.g. 5 mm in diameter would allow their use in as optical components that the production via levitation melting is much faster than the classical methods used for single crystal production [4].

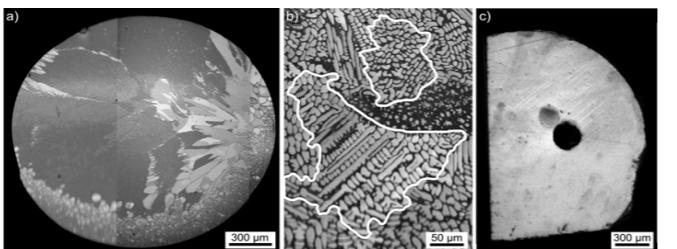
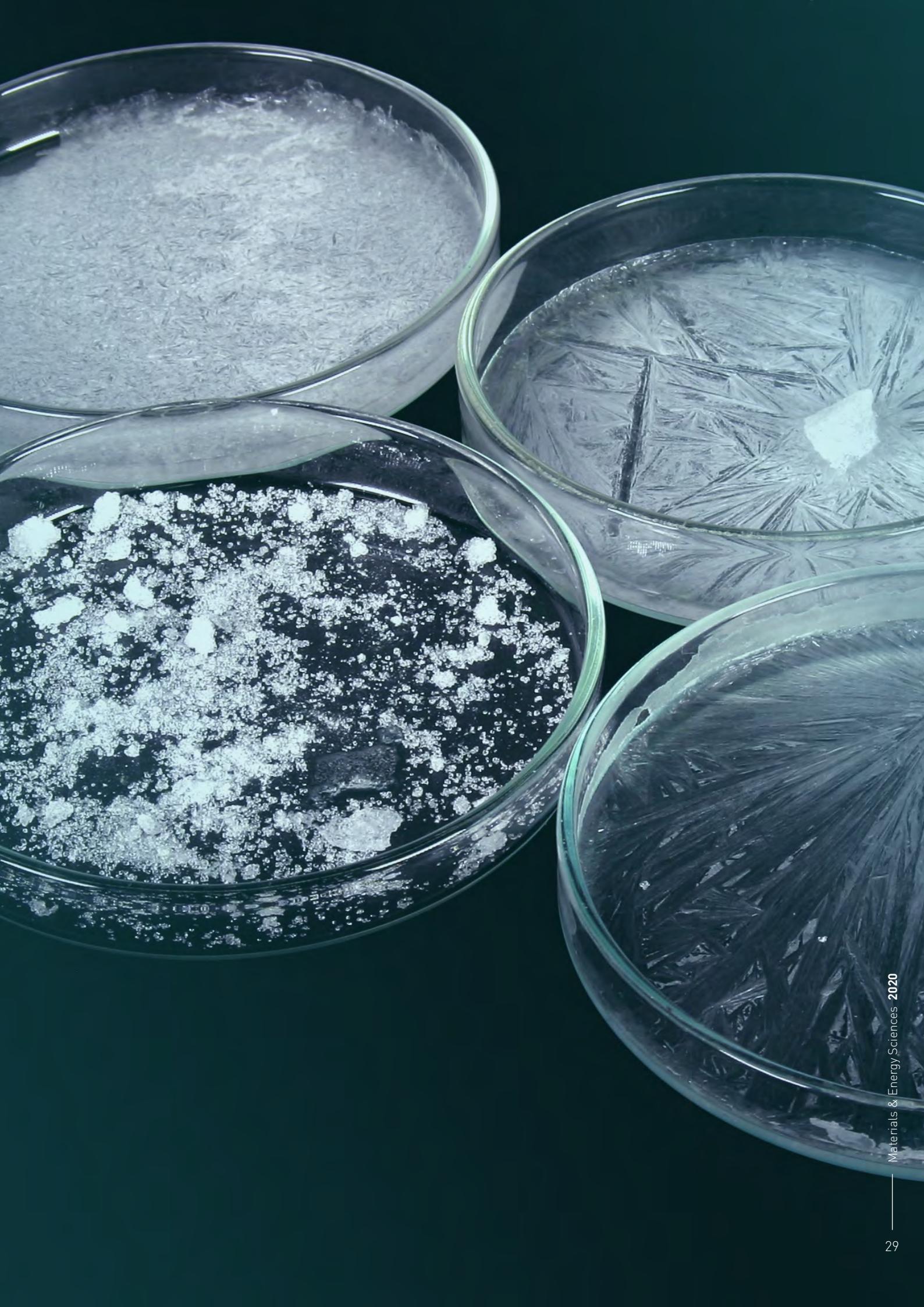


Figure 1: IQ-maps of microstructure cross sections through beads produced via levitation melting: a) polycrystalline b) dendritic and c) single crystalline.

While the Corona Pandemic of 2020 caused severe restrictions on the ability to access laboratory equipment, the extensive home office hours provided enough time to finalize a manuscript titled: "Oriented Surface Nucleation in Inorganic Glasses - A Review" [2] (summarizing 10 years of work in this field) and publish it in the high-ranking journal Progress in Materials Science (impact factor: 31).



Dr Wolfgang Wisniewski

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: Jena University - DE

In residence at: Extreme Conditions and Materials: High Temperature and Irradiation (CEMHTI) - Orléans

Nationality: German

Dates: September 2019 to August 2020

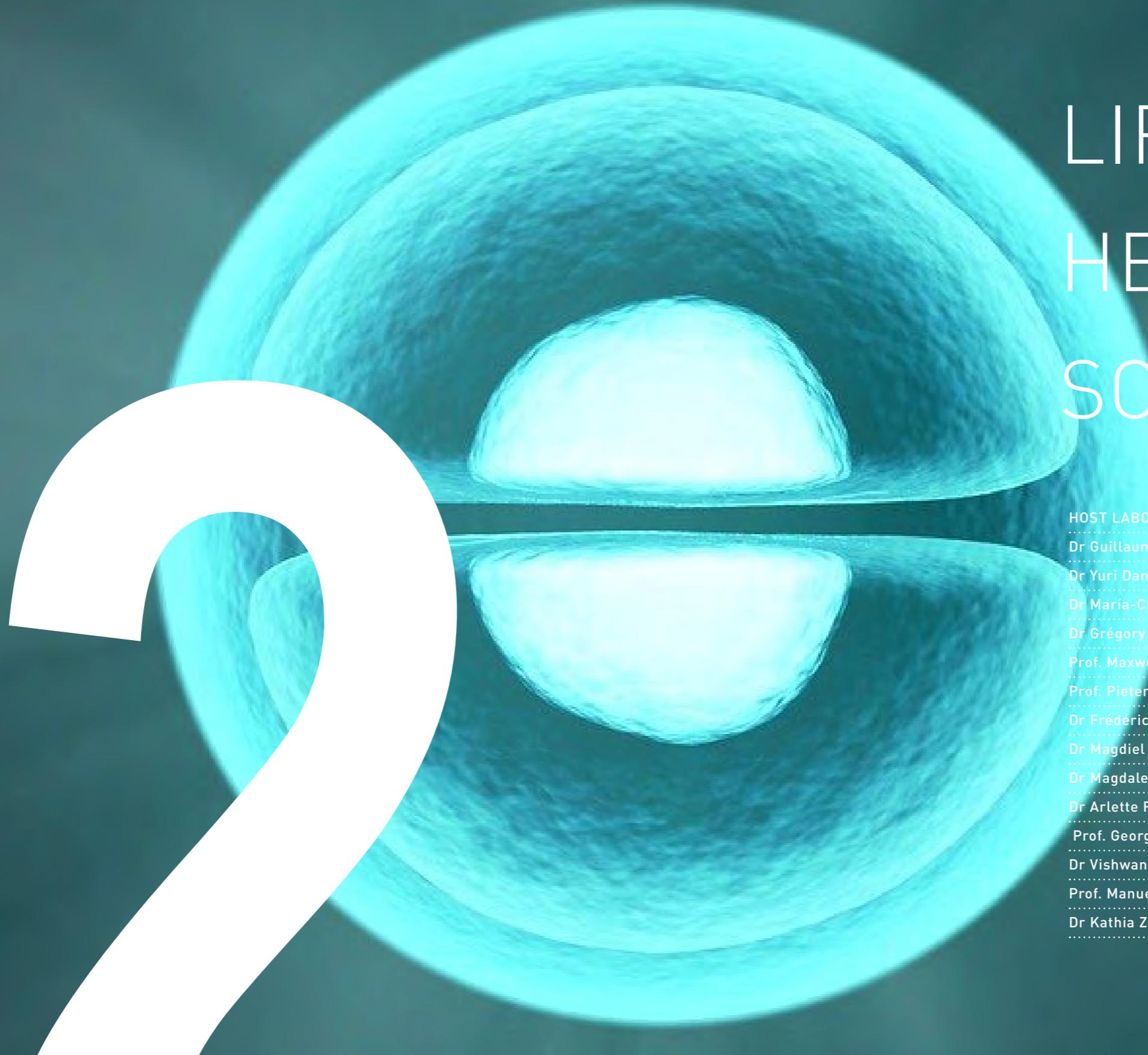
Wolfgang Wisniewski worked in Jena, Germany from 2010-2018 where he focused on applying the method of electron backscatter diffraction (EBSD) to glass-ceramics for which he received his Ph.D. in 2011. In early 2019 he became a Visiting Scientist in Trencin, Slovakia and is currently a Le Studium Research Fellow at the CEMHTI in Orléans, France. While his primary work has remained the EBSD-analysis of crystallized glasses, he has contributed to more than 67 articles published in peer reviewed journals concerning glass-ceramics, the information depth of EBSD, ceramics, dewetted metal nano particles, superconductors and solar cell materials.

In 2015 he received a Best Presentation Award at the 11th International Symposium on Crystallization in Glasses and Liquids in Nagaoka 2015. He also contributed to work concerning solar cell materials which became an ESRF Scientific Highlight in 2018 (Nano Energy, 2017, Vol. 42, 307-313).



Dr Mathieu Allix Host Scientist

Mathieu Allix, completed his PhD at the University of Caen in 2004. After three years at the University of Liverpool (U.K.), he joined the CNRS in Orléans at the CEMHTI laboratory. His research covers synthesis and characterization of inorganic materials with a special interest on new transparent ceramics. He has patented and published (i) the first transparent polycrystalline ceramics obtained by full crystallization from glass (http://www.cnrs.fr/ln/c/communication/direct_labos/allix.html) and (ii) new highly transparent glasses and glass-ceramics exhibiting controlled nanostructuration. He is author or co-author of more than 130 scientific publications (H-index = 30), he is also co-inventor of 5 recent international patents on transparent alkaline earth aluminate glass and nanostructured glass and glass-ceramics. He was awarded the CNRS bronze medal in 2013.



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HOST LABORATORIES IN LIFE & HEALTH SCIENCES

CENTRE DE BIOPHYSIQUE MOLÉCULAIRE (CBM) - UPR 4301 - CNRS

The "Centre de Biophysique Moléculaire" (CBM) is one of the largest research laboratories in the Region Centre-Val de Loire. It was founded in 1967 to set up interdisciplinary collaborations between chemists, biologists and physicists. Researchers at the CBM are investigating the structures, dynamics and interactions of biomacromolecules. This approach entails searching for the molecular causes of biological dysfunctions which trigger the development of diseases. The CBM is also recognized for its research in biomedical imaging. One key goal of CBM is to conceive new strategies in human therapy by combining innovative approaches in peptide/protein synthesis, biochemistry, bio-physics, molecular and computational biology. For this purpose, biomolecular interactions involving DNA, RNA, proteins and ligands are studied at the atomic and molecular level. Moreover, some research projects are dedicated to the identification of new therapeutic targets and the development of innovative delivery systems for therapeutic and imaging agents in various pathologies. Novel therapeutic strategies are developed using original nucleic acid delivery systems that combine chemical vectors and physical methods. One main area is the optimization of innovative vaccination based on messenger RNA coding for tumoral or viral antigens for cancer and viral infections, respectively.



BIOLOGIE DES OISEAUX ET AVICULTURE (BOA) UMR 0083 - UNIVERSITÉ DE TOURS, INRAE

UMR BOA In 2018, the INRA URA unit became the UMR BOA, Avian Biology & Poultry Research, in collaboration with the University of Tours. In the context of its mandate, UMR BOA conducts integrated research on the biology of birds, from the molecular level to that of the entire animal in its environment. The overall objective is to produce knowledge in the fields of physiology and genetics and to contribute to the development of sustainable livestock systems. Their research is based on three axes shared by the four teams of the unit: To characterise the physiological, molecular, and genetic mechanisms underlying the biological functions of birds (metabolism, growth and development, digestion, plasticity, egg formation and function); To propose evaluation tools, by developing indicators or biomarkers that can be used in selection programs and during rearing to improve bird adaptability and the quality of products (eggs and meat); To integrate knowledge and tools so as to contribute to the transition from animal husbandry systems to multi-performance and to the food and non-food valuation of poultry products.



UNITÉ DE PHYSIOLOGIE DE LA REPRODUCTION ET DES COMPORTEMENTS (PRC) - UMR 7247 - INRAE, CNRS, UNIVERSITÉ DE TOURS, INSTITUT FRANÇAISE DU CHEVAL ET DE L'ÉQUITATION

The Reproductive Physiology and Behaviours Laboratory is affiliated to INRAE, CNRS, University of Tours and IFCE. The biology and bioinformatic of signalling systems (BIOS) group has investigated the cellular mechanisms and signalling pathways downstream of G protein-coupled receptors (GPCRs). An emphasis has long been put on the receptors involved in the control of reproduction with a particular attention on the two key gonadal receptors, the follicle stimulating receptor (FSHR) and the luteinizing hormone receptor (LHR). The BIOS group uses systems biology approaches, including mathematical modelling and bioinformatics, to decipher GPCR-induced signalling to better understand how receptors control gonad functions. The BIOS group also develops new pharmacological strategies targeting these receptors. Capitalizing on the dynamics initiated in The Centre-Val de Loire region 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 for both in vitro and in vivo applications.



BIOMOLÉCULES ET BIOTECHNOLOGIES VÉGÉTALES (BBV) EA 2106 - UNIVERSITÉ DE TOURS



The Lab of Plant Biomolecules and Biotechnology, founded in 1987 and located at the Faculty of Pharmacy. This Lab is mainly dedicated to the characterization of plant specialized metabolisms and their use as pharmaceuticals, cosmeceuticals and biopesticides with the use of combinatory approaches in plant physiology, molecular biology, biochemistry, bioinformatic (identification of genes), genetic and metabolomics. The lab is also involved in the development of plant biotechnologies (in vitro technologies and GMOs) and in bio-engineering (production of plant metabolites in yeast). This laboratory also works on applied research programs to identify new natural preservatives or biologically active ingredients (BAIs) for cosmetics.



NANOMÉDICAMENTS ET NANOSONDÉS EA 6295 - UNIVERSITÉ DE TOURS



The NanoMédicaments et NanoSondes (NMNS) group is part of the Philippe Maupas Faculty of Pharmacy of the Université de Tours. It is lead by Professor Igor Chourpa. The group started in 2008 and became an independent "Equipe d'Accueil" in 2012. Its scientific research centers around the development of nanotechnologies for anticancer drugs and/or contrast agents for imaging with applications in cancer theranostics as well as dermatological and cosmetic sciences. The group's activities combine expertise in biology, chemistry (synthetic and analytical) and physics. This confluence of expertises is reflected in the pluridisciplinarity of its staff, consisting of pharmaceutical scientists, chemists and physicists. The group enjoys research collaborations within an extensive national and international network consisting of academic and industrial partners. Funding sources include the Région Centre, La Ligue contre le Cancer, the Institut National du Cancer, ERA.NET Plus and ARD 2020 Cosmétosciences / LE STUDIUM.



IMAGERIE ET CERVEAU (IBRAIN) UMR 1253 - UNIVERSITÉ DE TOURS, INSERM



The University of Tours Imaging and Brain Unit (iBrain, Inserm Unit 1253) was created in 1988 with the goal of generate a local network of specialists from different domains in neuroscience. The unit is located at the school of medicine and the University Hospital where medicine students, faculty professors and research scientists came together to exchange scientific ideas in neuroscience. The main objectives of the unit is to improve the comprehension of psychiatric and neurologic disorders and to develop new imaging technologies and innovative therapies for the diagnosis and treatment of neuropathology disorders. The host laboratory (Dr. Patrick Vourc'h), Team 2 "Neurogenomics and neuronal physiopathology" is member of the iBrain unit and his research is mainly focused on developing therapies for the treatment of Amyotrophic lateral sclerosis (ALS). The Team 2 is a multidisciplinary team of neurologists, geneticists, biochemists, and molecular biologists that are working together on taking research data from the laboratory into the clinic that can benefit patients in the long run.



HOST LABORATORIES IN LIFE & HEALTH SCIENCES

IMMUNOLOGIE ET NEUROGÉNÉTIQUE EXPÉRIMENTALES ET MOLÉCULAIRES (INEM) - UMR 7355 - UNIVERSITÉ D'ORLÉANS, CNRS



The research unit "Experimental and Molecular Immunology and Neurogenetics" (INEM), UMR 7355 affiliated to CNRS and University of Orleans, is located on Orleans CNRS campus. Created in 2001, INEM is presently composed of 2 Teams, "Immune responses to infection and injury" led by V. Quesniaux / I. Couillin, and "Neurogenetics" led by S. Briault / S. Mortaud, focusing on « Autism, mental deficiency and genetics » and « Developmental Neurotoxicity ». A spin-off company Artimmune SAS was created in 2010 based on our immunology team expertise and research. A joined laboratory is being created with INEM (Site: <http://www.artimmune.com/>). Upcoming public health challenges will have to integrate the constant increase of 1) asthma and lung pathologies, 2) neuropathologies such as autism due notably to pesticides neurotoxic effects, and 3) the emergence of drug resistant bacteria and parasites. Inflammatory responses, either exacerbated and pathogenic, or protecting and controlling infection, are central. Our strategy to contribute to these clinical challenges is multifold and transversal, by addressing novel regulatory mechanisms that are being unraveled and may concern these different pathologies. We aim at fostering the progress of the main research themes through common transversal approaches and research on mechanistic pathways, either in silico or in vitro when it is possible, but mainly through integrated in vivo approaches based on functional analysis of murine models.



CONDITIONS EXTRÊMES ET MATERIAUX : HAUTE TEMPÉRATURE ET IRRADIATION (CEMHTI) - UPR 3079 - CNRS

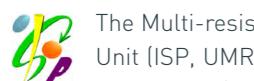


The lab was originally formed in 1969 and renamed the «Centre de Recherche sur les Materiaux à Hautes Températures» in 1998. In 2008, it merged with the Centre d'Etudes et de Recherches par Irradiation laboratory. Its goals are to analyze and understand the physical and chemical properties of materials 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 behavior 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.



INFECTIONIOLOGIE ET SANTÉ PUBLIQUE (ISP) UMR 1282 - UNIVERSITÉ DE TOURS, INRAE



The Multi-resistance and Pathogenicity of Nematodes team (MPN) belonging to Infectiology and Public Health Unit (ISP, UMR 1282). 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 investigated several different aspects of anthelmintic resistance, from field studies to molecular characterisation of parasite anthelmintic targets. 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 participated in numerous international projects dealing with anthelmintic resistance.

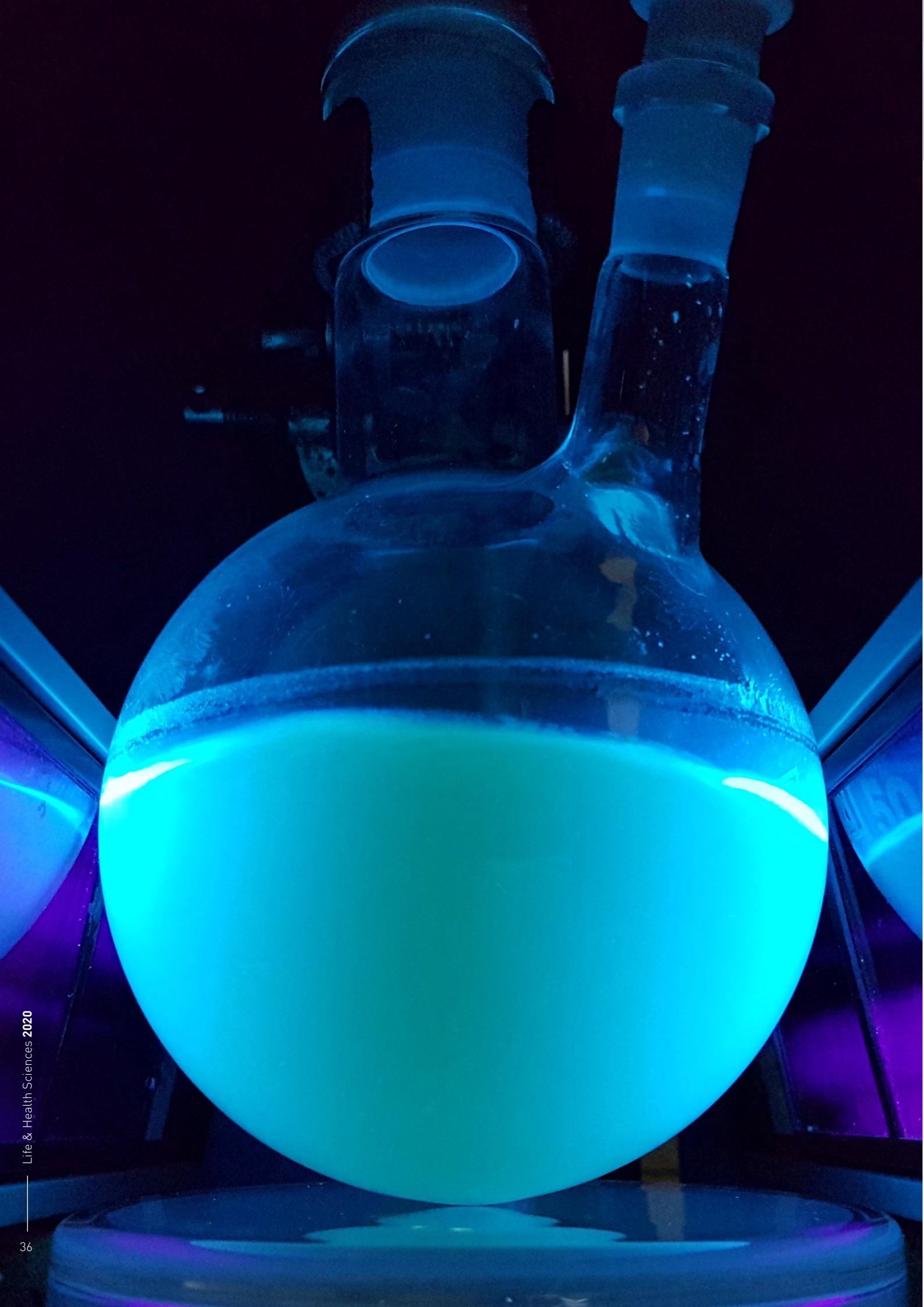


CENTRE D'ÉTUDE DES PATHOLOGIES RESPIRATOIRES (CEPR) UMR 1100 - INSERM, UNIVERSITÉ DE TOURS



Respiratory diseases have a major impact in medical and socio-economic terms. It is against this backdrop that the CEPR is aimed to develop innovative research that gives a better understanding of the pathophysiology of these diseases and improves inhalation therapy devices. These activities therefore fall in line with Inserm's scientific priorities which are: - To identify the mechanisms at work in respiratory mucosal cell alterations and characterise their regulation during inflammatory and infectious processes; - To identify the cellular and molecular mechanisms that regulate tissue remodelling in the various structures of the respiratory system; - To develop better targeted treatment strategies. This translational research has yielded an abundance of results that are complementary. Also, knowledge transfer from CEPR's scientific programmes was achieved both at the academic level (e.g. publications, oral presentations, student training, conferences organisation, etc), at the socio-economic level (e.g. acquisition of licences, patents deposits, development of public-private partnerships, etc) and at the clinical level (e.g. coordination of three national "PHRC" programs by clinicians affiliated with the CEPR's three teams, etc).





EARLIER TUMOR DIAGNOSTIC COMBINED WITH RADIO-PRECONDITIONING IN CANCER THERAPY: A NOVEL NEAR-INFRARED EMITTING NANOMOFS FOR OXYGEN DELIVERY



Dr Guillaume Collet

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: University of Geneva - CH

In residence at: Center for Molecular Biophysics (CBM) - Orléans

Nationality: French

Dates: September 2019 to August 2020

Guillaume Collet obtained his PhD in molecular and cell biology in 2009 on the development of cell-gene based therapy applied to cancer. He then did a first postdoctoral internship at the GREMI in 2013 on the effects of cold plasma on vascular parameters. A second postdoctoral fellowship at the University of California, San Diego in the United States between 2014 and 2016. He designed and studied «intelligent» nanoparticles for the controlled delivery of therapeutic agents. In 2016, he completed his third post-doctorate at the University of Geneva in Switzerland on the design of “on-demand” degradable MOFs. He continued this project at the CBM in Orléans where he moved in 2018, joining Stéphane Petoud’s group with the goal of designing new metal-organic frameworks (MOFs) based on lanthanides for bio-applications in optical imaging and therapy. In 2019, he received the Horizon 2020 Marie-Curie Seal of Excellence.



Prof. Stéphane Petoud
Host Scientist

Prof. S. Petoud is an INSERM Research Director. A LE STUDIUM Fellowship in 2009 allowed him to move from the University Pittsburgh in the United States to the CBM in Orléans. He has an extensive experience in the creation of lanthanide-based molecules designed for applications in optical biological imaging. He is especially interested in near-infrared emitting lanthanides. He received three scientific research awards for his stay at the University of California, Berkeley, USA (Swiss National Science Foundation - Novartis Stiftung and Leenaards Foundation). His current research has been recognized by several “Prime d’Excellence Scientifique” from INSERM from 2010 to 2020. Since 2018, he holds the title of Fellow of the Royal Society of Chemistry (FRSCL) upon nomination. Prof. Petoud has been the coordinator of one NSF grant (USA), three NIH (USA), eleven grants from “La Ligue Nationale contre le Cancer” and six projects of the Centre-Val de Loire region.

Diagnostic and therapy are closely related to each other since an early detection of a pathology offers a better chance to set a treatment at the time when it is the most efficient. The concept of theranostic agents introduced to address this need by combining both diagnostic and therapy on the same entity suffers from limitations that are mainly due to the off-targeting induced toxicity.

To revisit this concept, we propose to create a tumor-targeted metal-organic frameworks (MOF) as a new generation of theranostic agents.

A remarkable property of MOFs is their crystalline rigid organization including pores that can be loaded with biologically relevant gases such as O_2 . Relatively harmless by itself, once delivered to a hypoxic tumor, this original payload will reinforce radiotherapies that require O_2 to generate the reactive species that will promote the eradication of tumor cells. Alternatively to commonly described theranostic agents carrying an active drug, this innovative nanomaterial will be able to precondition specifically the tumor microenvironment to reinforce radiotherapies.

Moreover, as intrinsic property, the proposed nanoMOFs will operate as near-infrared (NIR) emitting imaging agent, providing a detection combined with a tracking modality of the targeted compounds. These luminescent nanoMOFs have been created from the tridimensional assembly of NIR luminescent lanthanides (light emitting elements) coordinated and sensitized with antennae building block (light absorbing elements). NanoMOFs structures provide a high density of absorbing and emitting moieties per unit volume resulting in a strong signal enhancement.

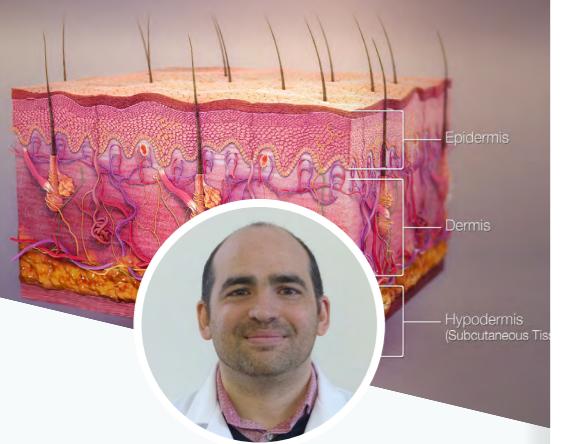
The full completion of this project will result in the creation of novel families of NIR emitting lanthanide-based nanoMOF offering unprecedented sensitivity for tumor detection combined with tumor radiotherapy.

Inspired by the MOF published recently in JACS (Collet et. al., J Am Chem Soc, 2018), I created a new MOF system that has the ability to emit NIR light at 980nm (ytterbium emission) under biologically compatible excitation wavelength. To obtain the Yb^{3+} ions sensitization, I used an innovative approach in which I entrap a chromophoric lanthanide sensitizer inside of the pores during the synthesis, allowing their homogeneous and complete loading. Such type of MOF, possessing such excitation and emission wavelengths is unprecedented to date. We have submitted this works for publication (manuscript available upon request).

A complementary part of the work consists in the design of new MOFs formed by the reaction of the Di-9AC ligand lanthanide cations of different natures in order to generate new optical properties. I obtained different type of MOFs through this work, some of them possessing different structures. In this respect, I designed and successfully synthesized a promising down-converter system possessing both excitation and emission in the NIR domain (excitation 980 nm, emission 1530 nm). I obtained these optical properties by introducing both Yb^{3+} and Er^{3+} lanthanide ions in an appropriate ratio in the framework of the MOF. I anticipate two publications from these new materials that are in preparation. This new down-converting MOF is an excellent candidate to move the project to the next step with gas loading since its NIR optical properties are associated to the MOF framework maintaining consequently pores empty and available for gas.

Another type of MOF obtained with Er^{3+} lanthanide ions is currently under investigation for its sensitization mediated by a pore entrapped organic chromophores. A particular attention is paid on the erbium emission signal at 1530 nm, which could offer impressive performance for biological imaging due to its high wavelength value, far away from residual biological emissions. I am also driving the biological applications of MOFs created in collaboration with the worldwide MOF expert, Prof. Nathaniel Rosi at the University of Pittsburgh. A new approach consisting to grow a polymer inside of MOF pores has shown, in addition to enhanced water stability, unprecedented ability to sensitize lanthanide NIR emission in a controlled way. A manuscript has been recently published in JACS (manuscript available upon request).

I am exploring innovative approaches to control MOFs sizes. The light-degradable MOFs present the advantage to be miniaturized by a top-down approach with a highly controlled dynamic light-erosion fluidic strategy. With such approach, light-degradable MOFs melt down to the desired size. Preliminary data indicate a successful miniaturization at the targeted size of 200 nm with an excellent level of monodispersity, considering that other sizes could be similarly obtained.



Dr Yuri Dancik

LE STUDIUM Research Fellow
ARD 2020 COSMETOSCIENCES Programme

From: Agency for Science, Technology and Research - SG

In residence at: Nanomedicines and Nanoprobes (MNMS) - Tours

Nationality: American

Dates: October 2018 to June 2020

Yuri Dancik obtained his PhD in Chemical and Biological Engineering from the State University of New York at Buffalo in 2007. His main research interests are understanding the physico-chemical basis of chemical transport through skin and applications in cosmetic, pharmaceutical and toxicological science. In Buffalo, he developed mathematical models of drug transport through skin appendages. He worked at Procter & Gamble [Brussels], developing *in silico* pharmacokinetic methods for the prediction of skin sensitization and systemic toxicity following cutaneous exposure. From 2014 to 2018 Yuri was Senior Research Fellow at the Institute of Medical Biology and the Singapore Skin Research Institute. His colleagues' and his efforts into the development and validation of a novel microfluidic skin-on-chip platform were recognized with a Global 3Rs Award.



Dr Franck Bonnier Host Scientist

Franck Bonnier obtained his PhD from the Department of bio-spectroscopy for life sciences as a member of the Médian CNRS group, Université de Reims, France. Following his PhD, he joined the FOCAS Research Institute, DIT in 2008 as a postdoctoral research engineer under the National BioPhotonics and Imaging Platform, Ireland, and as a member of the Biophotonics and Imaging group specialised in the application of biophotonics, especially Raman and Infrared spectroscopy, in the biomedical field. In September 2014, Franck Bonnier joined the NMNS research group at University of Tours (France) as associate professor. The main field of expertise remains the development of methodologies towards implementation of spectroscopic techniques as clinical screening tools for diagnostic or with a particular focus on pharmaceutical and cosmetic applications.

MOLECULAR IMAGING USING RAMAN SPECTROSCOPY: FROM FUNDAMENTAL RESEARCH TO INDUSTRIAL APPLICATIONS

We are using Raman spectroscopy to demonstrate the impact of storage conditions on the biophysical quality of lab-grown human skin equivalent tissues. These skin equivalents are known as reconstructed human epidermis or RHE, as they mimic the uppermost epidermal layer of human skin.

The development, characterization and use of RHE is an active area of cosmetic and pharmaceutical R&D. Designed to replace animal tissues, RHE are particularly useful for testing or screening new cosmetic formulations and pharmaceutical topicals. To date, little is known on the effects of common tissue storage conditions on the quality and in particular, the barrier function, of RHE. Commercial RHEs are frequently cultured and shipped in batches of 6 or 12 replicates. With testing and screening applications often requiring large numbers of replicates, practical knowledge on the effects of storage conditions is of significant value to academic and industrial users. The specific scientific goals are thus:

1. To investigate the impact of different storage conditions on the barrier function of RHE. To this end, the penetration of resorcinol, a well-known cosmetic ingredient, in RHEs stored under different conditions is tracked via confocal Raman spectroscopy.
 2. To compare the spectroscopic results to resorcinol penetration data obtained from a conventional, but more labor-intensive, diffusion protocol performed in the RHE culture plates.
 3. To assess how the information obtained by confocal Raman spectroscopy complements that attained from the conventional diffusion experiment.
- In addition to answering a practical scientific question, the project is novel in that it highlights confocal Raman spectroscopy as a method to assess the barrier integrity of RHE.
- The achievements to date are:
1. Optimisation of the conventional diffusion and Raman spectroscopy experimental protocols of the spectroscopic data analysis (data pre- and post-processing).
 2. Acquisition of conventional diffusion and spectroscopic data for 6 different RHE storage methods and 3 different resorcinol formulations.
 3. Analysis and interpretation of all conventional diffusion data. Raman data analysis and drafting of a manuscript are ongoing.



Dr Maria-Cristina Del Rincon-Castro

LE STUDIUM / Marie Skłodowska-Curie Research Fellow
Smart Loire Valley General Programme

From: University of Guanajuato - MX

In residence at: Insect Biology Research Institute (IRBI) - Tours

Nationality: Mexican

Dates: October 2020 to October 2021

Maria Cristina Del Rincón is currently a Professor and was head of Doctoral School in Biosciences in the Department of Food at the University of Guanajuato in México. She obtained her Ph.D. in Plant Biotechnology at CINVESTAV-IPN Irapuato, in México. She is a member of the National System of Researchers Level 2 and Member of the National Academy of Sciences; was President of the Mexican Society of Biological Control. She is focused on the characterization, identification, molecular biology, and evaluation of entomopathogenic viruses as biological control agents of pests and as expression vectors of eukaryotic genes for 30 years. She has published more than 50 research articles in international journals, 10 book chapters, and made 115 presentations to experts in biological control at national and international meetings. She has been responsible for 15 research grants related to biological control agents for pests of economically important insects in México.



Dr Elisabeth Herniou Host Scientist

Elisabeth Herniou is a CNRS Research Director at the Insect Biology Research Institute UMR 7261 CNRS – University of Tours. She obtained her PhD from Imperial College London in the UK and was among the first ERC awardee to settle in Region Centre-Val de Loire. She has published over 60 publications, and serves as editor for Journal of General Virology and Virus Evolution. She was awarded the founder's lecture prize for her scientific contribution to the Society for Invertebrate Pathology. Anchored in evolutionary biology, her research focuses on the interactions between genomes and ecology in the context of hosts - pathogens interactions, in particular between insect and viruses. Her multidisciplinary approach integrates different levels of complexity to understand how ecology shapes genomes and can thus lead to speciation. Her concern for societal issues has recently led her to undertake forest biodiversity studies in the context of global change and to study pathogens in connections with the developing field of Insect for Food and Feed with the European project Insect Doctors.

GENOMIC CHARACTERISATION OF SIX MEXICAN BACULOVIRUS STRAINS WITH ACTIVITY AGAINST SPODOPTERA FRUGIPERDA (LEPIDOPTERA: NOCTUIDAE)

Mexico is the seventh-largest producer of corn in the world. Corn in Mexico is split into two seasons, the spring/summer crop, accounting for approximately 75 percent of total production, followed by the fall/winter crop. The main crop is planted from April through August and relies predominantly on monsoon rainfall, as approximately 85 percent of the main crop is rainfed. Mexico and France are among the top 10 corn producers, and 1.5 million tons of corn are produced annually in the Region Centre-Val-de-Loire. This crop is affected by various lepidopteran pests, among which is the fall armyworm, *Spodoptera frugiperda*. The Laboratory of Food and Agricultural Biotechnology of the University of Guanajuato, in México, has worked with 6 SfNPV baculovirus strains with activity towards *Spodoptera frugiperda*, which have been characterized at a biological and molecular level, and these strains have presented a high bioinsecticide potential when presenting high levels of virulence against this pest. However, these strains have not been studied in greater depth, and no phylogenetic studies have been carried out. In Mexico, baculoviruses are not used as biological control agents in any proportion. They are not produced, are not commercialized, and have not been developed as an alternative to chemical control in crops' importance. The results obtained from this research will allow the development of biological insecticides against corn fall armyworm, which can be used in all regions of the world where this insect has already shown its harmful effect on corn crops, and will also contribute to a decrease in the use of chemical insecticides to control this pest.

The objective of this project is to perform the genetic characterization of 6 baculovirus isolates (3 exotic and 3 natives from México) to determine which genetic factors might be involved with increased pathogenicity against *S. frugiperda* through (1) genetic characterization of the 6 SfNPV isolates, first to determine if phylogenetic relatedness explain phenotypic similarity (3 genes); (2) to determine if particular genomic features could explain phenotypic differences (genome sequencing) and (3) host specificity assays (useful in case of product licensing in Europe). The development of biological insecticides for use in the field, in the control of insect pests of agricultural importance, is undoubtedly a multidisciplinary aspect, since scientists, producers, farmers, and final consumers of the innocuous food product are involved, since this, it will be produced free of chemical inactivate, and this will strengthen human health and the protection of the environment. To carry out this type of project, it is necessary that experts in agronomy, biology, biochemistry, molecular biology, marketing, and others involved in the development of viral bioinsecticides at a commercial level. Even though in France, there is still no problem with *S. frugiperda*, this has already been detected in continents such as Africa and Asia, so this research could be very relevant to prevent the introduction of this pest to France. It is important to train producers to measure the impact of the presence of this pest if required and know the biological measures that exist for their control.





Dr Grégory Guirimand Tanaka

LE STUDIUM Research Fellow
ARD 2020 BIOPHARMACEUTICALS Programme

From: Kobe University - JP

In residence at: Biomolecule and Plant Biotechnology (BBV) - Tours

Nationality: French

Dates: June 2019 to March 2021

Living in Japan since 2011, I became an Assistant Professor at Kobe University in 2016, intensively working on metabolic and cell surface engineering of baker's yeast (*Saccharomyces cerevisiae*). My research interests are widely broad from plant and yeast biotechnologies, to synthetic biology, for the bio-production of high value-added therapeutic bio-molecules in microbial cell factories. My main achievements include but are not limited to the publication of 24 research articles (13 h-index), 9 oral presentations (4 as invited speaker) at international conferences, as well as the co-invention (10%) of a biotechnological process for xylitol bio-production from Kraft Pulp. Working now in BBV Lab as a Le Studium Research Fellow, is a unique opportunity to combine my knowledge of specialized metabolic pathways of *Catharanthus roseus* with my skills of bio-engineering of yeast cells, in order to sustainably produce such valuable anticancer molecules



Dr Vincent Courdavault Host Scientist

Vincent Courdavault is Associate Professor at the University of Tours in the EA2106 BBV laboratory. He is working on the elucidation of the biosynthetic pathways of plant natural products with a particular focus on the anticancer alkaloids and to the production of these compounds through metabolic engineering strategies in microbiological cells. He recently contributed to the elucidation of the last steps of the biosynthesis of Vinca alkaloids in the Madagascar periwinkle and to elaboration of the first yeast strain producing monoterpene indole alkaloids. He published 104 research articles/12 book chapters and has 32 h-index. He is reviewing editor for Frontiers in Plant Science and editor for the "MDPI plants" journal. He is currently leading research programs aiming at securing the supply of anticancer compounds and is the scientific coordinator of the European H2020 project MIAMI in Tours.

BIO-PRODUCTION OF VINDOLINE AND CATHARANTHINE BY RECOMBINANT YEAST CELL FACTORIES

The tropical plant Madagascar periwinkle (*Catharanthus roseus*) is a natural source of anticancer monoterpene indole alkaloids (MIA), such as vinblastine and vincristine, two molecules of major interest and therapeutic values (Fig.1). In planta, the MIA biosynthetic pathway in *C. roseus*, described in the literature as the most complex pathway in all living organisms, shows an outstanding compartmentation at both cellular and subcellular levels. This drastic compartmentation is potentially responsible for the extremely low level of production of these MIA in planta. In order to overcome this issue our approach consists in producing these molecules in a heterologous system such as yeast cell factories. The present research project supported by the ARD2020 Biopharmaceuticals Programme is a very ambitious project aiming to produce vindoline and catharanthine, [the monomeric precursors of vinblastine and vincristine] in yeast cell factories by using cutting-edge techniques of synthetic biology and metabolic engineering of *S. cerevisiae*. In total, the biosynthetic pathway leading to vindoline from tabersonine encounters 7 enzymatic steps, while the catharanthine biosynthesis from tryptamine and secologanine encounters not less than 12 steps.

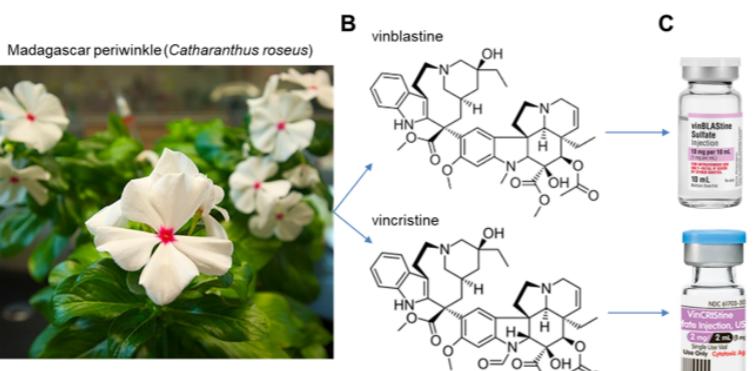


Figure 1. Natural origin of two different monoterpene indole alkaloids molecules with anticancer properties. *Catharanthus roseus* (A) is a tropical plant naturally able to synthesize the anticancer molecules vinblastine and vincristine (B), both used in chemotherapy treatments in human medicine (C).

The construction of such kind of yeast cell factories, able to produce vindoline and catharanthine respectively, requires the beforehand transfer of each gene (cDNA) coding for each corresponding enzyme from the plant cells to the yeast cells. Once all the target genes are correctly integrated into the genome of *S. cerevisiae*, another important challenge consists in the rational coordination of them altogether, in order to ensure a proper metabolic flux in the yeast cells, for an optimal bio-production ability of the system.

In this context, an intensive preliminary work of molecular biology has been conducted. This work has allowed us to obtain a full set of more than 12 different vectors containing bidirectional strong promoters. Each vector allows to stably integrating into the genome of yeast cells two different enzyme genes simultaneously. To achieve this goal, we used the cutting edge molecular tool CRISPR-Cas9 to ensure a strong stability and expression levels of the transgenes. This powerful approach enabled us to generate the recombinant yeast cell factories *S. cerevisiae* CENPK "Vindoline I3.0" and *S. cerevisiae* CENPK "Catharanthine I3.0", which will be used for the industrial bio-production of vindoline and catharanthine, respectively.

At this point of the project, the strain *S. cerevisiae* CENPK "Vindoline I3.0" has been fully established and scale-up experiments conducted with this strain show promising results. In particular, this strain shows a very high fidelity, and a very high efficiency of tabersonine bio-conversion. These results prove the robustness of our approach, and make this strain an excellent candidate for technology transfer to our industrial partner. While the strain *S. cerevisiae* CENPK "Catharanthine I3.0", containing a more complex biosynthetic pathway, is still under construction.



Prof. Maxwell Hincke

LE STUDIUM Research Professor
Smart Loire Valley General Programme

From: University of Ottawa - CA

In residence at: Avian Biology & Poultry Research (BOA) - Tours

Nationality: Canadian

Dates: March 2018 to May 2018
March 2019 to May 2019
March 2020

Maxwell HINCKE (PhD, Univ. Alberta, 1981) is a senior scientist and tenured Full Professor in the Faculty of Medicine at the University of Ottawa. He is former Head of the Division of Clinical and Functional Anatomy, and has been a member of the Senate of the University of Ottawa. He investigates integrated defense strategies that operate at biomimetic barriers to understand molecular control of calcific biomimetication and antimicrobial strategies. His vision is that the insight gained can be reverse-engineered for application to human health and therapeutics. His CV includes: >110 refereed journal publications; mentorship: >15 undergraduate & graduate students, postdoctoral fellows and clinical trainees; awards: Excellence in Mentorship; international research collaborations with extended sojourns in France, Spain and China. (https://www.researchgate.net/profile/Maxwell_Hincke).



Dr Sophie Rehault-Godbert Host Scientist

Sophie Réhault-Godbert (PhD, Univ. of Tours, 2001) is currently the co-director of the unit Défenses de l'Œuf, Valorisation, Evolution (DOVE). She has expertise in the physiology of chicken egg formation, egg defenses, functional and structural characterisation of egg proteins including proteases, antiproteases and antimicrobials, and has coordinated a project aiming at evaluating the therapeutic potential of egg derived molecules against microbial infections, inflammation and cancer. Her research addresses the role of egg proteins and the regulation of egg defenses during chicken embryonic development. She has authored >45 peer-reviewed articles, 8 book chapters, and holds one patent. She was a partner in various DOVE-coordinated projects. (https://www.researchgate.net/profile/Sophie_Rehault-Godbert).

EVOLUTION OF INNATE IMMUNITY AT BIOMINERALIZED BARRIERS

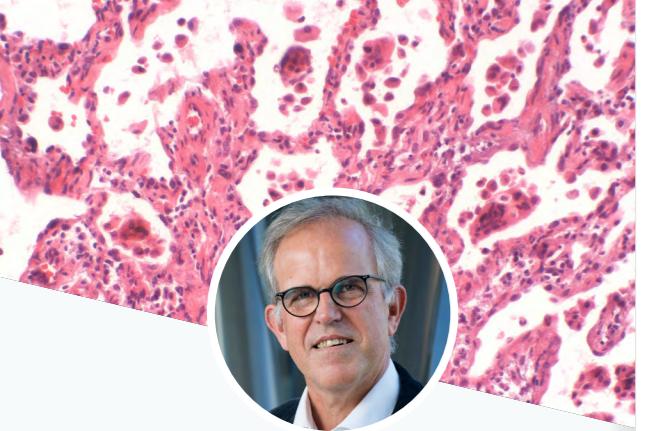
Hypotheses: The antimicrobial environment in the critical zone between the eggshell and CAM are upregulated during embryonic development and during pathogen challenge: i. Genes coding for defense molecules are expressed within the growing chorioallantoic membrane during embryonic development; ii. Secreted antimicrobial proteins enhance protection against pathogens in the chorioallantoic membranes and in the extra-embryonic fluids; iii. Weakening of the eggshell during CAM-mediated decalcification is compensated by upregulation of innate immune mechanisms.

To explore these hypotheses, the aims are:

1. To identify the full inventory of peptides / proteins that intervene between the eggshell and developing embryo and characterise their role in pathogen defense.
2. To determine the plasticity of protection against pathogens in embryonic placental-like structures during development.
3. To further characterise the role of the CAM in eggshell calcium solubilisation / decalcification during embryonic development, using functional bioassays, transcriptomics, proteomics and bioinformatics.

Due to the Covid-19 sanitary crises, Prof. Hincke's annual visit was drastically shortened and activities slowed down. The LE STUDIUM conference "Innate Immunity in a Biomimetic Context: Trade-offs or Synergies?" initially scheduled for March 31-April 2, 2020 was postponed to March 2021.

1. Hincke collaborated with Joel Gautron and Yves Nys (DOVE, INRAE) to finalize one manuscript investigating a novel mechanism of eggshell mineralization, one review of eggshell mineralization, and a book chapter for "Sturkie's Avian Physiology, 7th edition".
2. S. Réhault-Godbert and M. Hincke collaborated to finalize a chapter for the new edition of a book "Avian Immunology", edited by Thomas Göbel, Lonneke Vervelde, Ton Schat and Bernd Kaspers.
3. Although the activities of our PhD student (Maeva Halgrain, université de Tours) were seriously affected by the Covid-19 restrictions, we continued to supervise her ongoing activities with respect to CAM morphology and transcriptomics. (title of project: Role of the chorioallantoic membrane during chicken embryonic development and impact of genetic selection on its functionality, with a focus on innate immunity and mineral transport).
4. Hincke was external examiner for the PhD defense of Alix Barbe "Grape seed extract supplementation for growth and laying performance, egg quality and fertility parameters in chickens and in pig". PhD. Université de Tours, France. (Supervisor: Joelle Dupont, INRAE). Successfully defended on October 13, 2020.
5. Hincke attended: Le Studium and University of Tours, France; Community of international researchers. (université de Tours, France, March 12, 2020).



Prof. Pieter Hiemstra

LE STUDIUM Research Professor
ARD 2020 BIOPHARMACEUTICALS Programme

From: Leiden University Medical Center - NL

In residence at: Centre for the Study of Respiratory Pathologies (CEPR) - Tours

Nationality: Dutch

Dates: September 2018 to December 2018
September 2019 to October 2019

Pieter S. Hiemstra is Professor of Respiratory Cell Biology and Immunology at the Department of Pulmonology of the Leiden University Medical Center (LUMC) in The Netherlands. He is currently head of the Laboratory for Respiratory Cell Biology and Immunology of the Department of Pulmonology. His research is focused on basic and translational research in chronic obstructive pulmonary disease (COPD), asthma and lung cancer. He has a specific interest in the role of the epithelium of the airways and alveoli in these diseases. His other activities include teaching and curriculum development for Biomedical Sciences and Medical students. Until October 2019, he was head of Assembly 3 (Basic and translational science) of the European Respiratory Society, and he is currently the Section Editor of the European Respiratory Journal. Pieter Hiemstra was elected to a fellowship of the European Respiratory Society in 2014.



Dr Mustapha Si-Tahar
Host Scientist

He is an INSERM research director who worked for 10 years at the Pasteur Institute in Paris before moving in 2012 to Tours to be the Head of Research Center for Respiratory Diseases (french acronym: "CEPR"). He also supervises one out of the three research teams of this laboratory. M. Si-Tahar has expertise in innate immunity and antimicrobial responses in the lung mucosa as well as strong competence with *in vitro* and *in vivo* models. Thus, he demonstrated the role for specific pattern-recognition receptors and cell signalling pathways in the immune response to major respiratory bacteria and viruses, in the context of cystic fibrosis or COPD. Besides, he contributes to several scientific expert committees (including ANR, VLM) and is the co-founder of Cynbiose Respiratory, a contract research organization providing a set preclinical services in the area of respiratory diseases.

DEVELOPMENT AND APPLICATION OF WELL-DIFFERENTIATED CULTURE MODELS OF PRIMARY AIRWAY EPITHELIUM FROM VARIOUS SOURCES

This project is directly in link with the ARD2020 research programme entitled «PRIMine - « Modèle préclinique de PRIMates non humains (PNH) pour traiter les épisodes infectieux d'exacerbations de la Broncho-Pneumopathie chronique obstructive (BPCO)». The specific aim of this part of the project is to develop a state-of-the-art airway epithelial cell (AEC) culture model from non-human primate tissue to study the effect of cigarette smoke exposure and respiratory tract infections. This project is supported by the ARD2020 Biopharmaceuticals Programme and this report covers the work carried out in the second visit of my Professorship in 2019: The set objectives were to:

1. Introduce the methods for culture of **airway epithelial organoids** at CEPR with the aim to establish cultures of nasal epithelial cells from nasal scrapings of non-human primates.
2. Further establish **isolation and culture of primary airway human epithelial cells** at CEPR in collaboration with Thoracic Surgery (Dr Antoine Legras) and Pathology clinical departments.

During the 2019 stay in Tours, to address aim 1 a nasal organoid method was introduced in the laboratory that was developed in the laboratory of the researcher in residence at LUMC. Using this method, nasal epithelial cell cultures were established from nasal scrapings derived from healthy volunteers and from non-human primates. These 3D organoids cultures were next used to establish 2D air-liquid interface (ALI) cultures that are required to perform exposures to airborne substances, such as respiratory viruses and cigarette smoke. Organoid and ALI cultures were characterized using immunofluorescence analysis of markers of epithelial differentiation. To address aim 2, before and during the 2019 stay in Tours, methods were provided and established at CEPR to begin setting up a biobank of cultures of primary airway epithelial cells derived from resected lung tissue. This proved to be successful, and a large number of vials from several donors have now been stored in liquid nitrogen for the establishment of the Tours biobank. Characterization for epithelial cell markers and functional assays using influenza virus infections were performed to confirm that such cultures established at the CEPR behaved in a similar manner as those established at the home institute of the researcher in residence (LUMC). The established collaboration has resulted in a one-week training visit of one of the researchers from CEPR (Virginie Vasseur) to the LUMC in Leiden in June 2019. This visit was aimed at learning techniques required to set up the above-mentioned biobank in of cultured human airway epithelial cells in Tours.

LE STUDIUM CONFERENCES

NOVEL HOST- AND MICROBIOTA-DIRECTED STRATEGIES FOR TREATING RESPIRATORY INFECTIONS

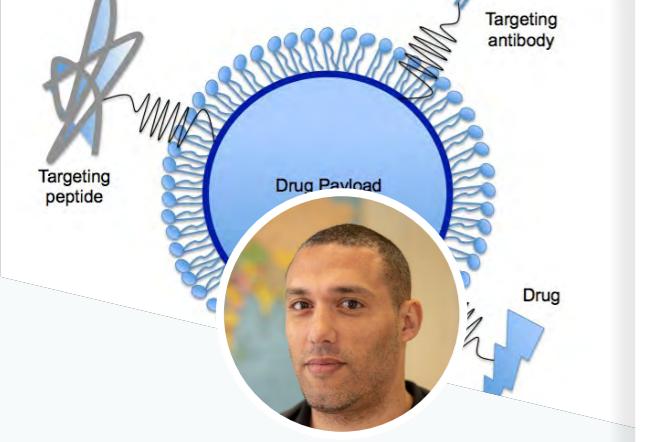
Respiratory infections ranked 4 in the WHO 2016 list of "Top 10 causes of death worldwide". There is an urgent need for improved treatment of respiratory infections, in view of the absence of affordable treatment, but also because of the absence of effective drugs for selected respiratory pathogens and the increase in microbial resistance to conventional antibiotic treatment.

Recent insight into host defense mechanisms against respiratory infections and the respiratory microbiota have opened up new avenues for novel treatment strategies.

The poster for the conference is titled "LE STUDIUM CONFERENCES VIRTUAL MEETING | 2020" and "24-25 September 2020 Novel host- and microbiota-directed strategies for treating respiratory infections". It features a green and yellow color scheme. At the top right is a small image of a green plant. Below the title, there is a large image of several cells, some stained green and some red. The text on the poster includes "LOCATION VIRTUAL MEETING", "CONVENORS Prof. Pieter Hiemstra, Dr. Mustapha Si-Tahar, Dr. Antoine Guillot", and "PROGRAMME - REGISTRATION". There is also a small logo for "Le Studium".

The aim of this Le Studium Conference was to bring together experts from a variety of European countries to discuss the latest developments in the field, and to explore future opportunities for collaboration with the European Horizon 2020 programme or related EU programmes. This international conference was organised in the framework of the BIOPHARMACEUTICALS ARD 2020 Programme.

This international conference was organised online in the framework of the BIOPHARMACEUTICALS ARD 2020 Programme.



Dr Frédéric Jean-Alphonse

LE STUDIUM Research Fellow
ARD 2020 BIOPHARMACEUTICALS Programme

From: University of Pittsburgh - USA

In residence at: Physiology of Reproduction and Behaviour (PRC) - Tours

Nationality: French

Dates: November 2018 to September 2020

During my PhD obtained in 2008, and my two postdoctoral experiences, I've been studying GPCRs. I characterised small molecules as pharmacological chaperones to restore cell surface expression and function of several mutants of the vasopressin type 2 receptor involved in the Nephrogenic Diabète Insipidus. For my first post doc at the Imperial College London 2009, I studied the endocytic trafficking and signalling of the Gonadotrophins receptors. I further studied endosomal signalling generated by GPCRs by joining in 2013, the laboratory of Prof. Vilardaga in Pittsburgh, USA, and I was promoted in 2017 as research Instructor. In 2020, during my "Le Studium fellowship", I applied for and obtained a permanent position as researcher at the CNRS which started in October 2020. I am now part of the BIOS team.



Dr Eric Reiter Host Scientist

Eric Reiter is research director at INRAE 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 INRAE, 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 cofounded ReproPharm, and in 2017, MAbSilico, two spin-offs from INRAE. He has published more than 100 peer-reviewed papers that have been cited more than 5825 times. He has acted as an expert for national and international agencies. He organised 1 international congress and 3 workshops and maintains sustained editorial responsibilities for a number of journals. He is a Key Question leader in MabImprove LabEx and coordinates the GPCRAb project in the framework of ARD 2020 Biopharmaceuticals Programme.

LUTEINIZING HORMONE RECEPTOR (LHR) SPECIFIC NANOBODIES DEVELOPMENT FOR THERAPEUTIC USE

LHR belongs to the GPCR family and is expressed by the gonads in both males and females. LHR is crucial to control gametogenesis and steroidogenesis. While GPCRs are the main target of most of pharmaceutical drugs on the market (>30%), with the exception of recombinant or extractive hormones, there is no available compound targeting and modulating specifically the LHR. One reason arises from the structural complexity of this receptor and its hormones and the lack of knowledge in its structure function. Moreover, classical approaches for drug discovery are traditionally tedious and costly. To tackle down these limitations, with the support of the BIOS team, my goal is to modulate LHR function using LHR specific antibody fragments, more specifically nanobodies or VHH. Nanobodies present several advantages including high affinity, selectivity for the antigen, reduced cost of development and production compare to other methods. The objective is to find and characterize VHH binding the LHR, possibly at various epitopes (extracellular or intracellular). For this purpose, an immune bank was generated from a llama immunized with cell membranes expressing the LHR. Additionally, we recently developed and acquired a synthetic bank of VHH that should help to further select anti-LHR VHH. Following isolation of these VHH, their pharmacological properties (antagonists, agonists, biased ligands, allosteric modulators, etc.) will be determined. Ultimately, the goal is to develop new and original therapeutic tools targeting LHR to positively or negatively regulate its functions *in vivo*. To date, I am still developing tools for the selection of these VHH, including the production of several fragments of the receptor corresponding to the full extracellular LHR ectodomain, the hinge region, but also the intracellular domains. The *in vitro* production is currently being optimized for both a mammalian suspension cell system (ExpiCHO) and bacterial system to produce material for the selection by phage display. For this LHR antibody's project, the BIOS team has this October recruited a PhD student that I am now supervising. As part of the LabEx MabImprove programme with the BIOS team, I participated to the MabImprove retreat meeting (Mont Dore 2019) allowing me to meet other scientists developing therapeutic antibodies. I am now involved in and leading for my team, a key question in the framework of this LabEx, consisting in developing strategies to optimize a lead antibody in order to better control receptor target activity.

I am also working in deciphering the molecular mechanisms of FSHR and LHR function in signalling and trafficking. This work should allow to decode the spatial and temporal signalling information that lead to the various regulation cell responses in order to develop and select tools to fine-tuned receptor function.

Additionally, with Prof. Manuela Simoni leadership, another Le Studium Fellow, and the team BIOS, I was also involved in the FET-OPEN European programme submitted in June 2020. This project aimed at developing and using nanobodies targeting LHR and FSHR to improve and/or replace current strategies to manipulate reproduction in humans but also in farm animals. Unfortunately, despite a good score, this ambitious and interdisciplinary programme entitled "DEMETER" failed to obtain the funding.



Dr Magdiel Pérez-Cruz

LE STUDIUM Research Fellow
ARD 2020 BIOPHARMACEUTICALS Programme

From: Stanford University - USA

In residence at: Experimental and Molecular Immunology and Neurogenetics (INEM) - Orléans

Nationality: Spanish

Dates: October 2019 to September 2020

Magdiel Pérez-Cruz was educated at University of Havana. He received his PhD degree in Biomedicine from the University of Barcelona in 2012. He spent two postdoctoral years in Pasteur Institute from Lille in France, 3 years in blood and marrow transplantation division from Stanford University in the United States. He has been interested in biomedical research to study infection diseases and immunity. He is the author of several publications in the field of immunology and immunotherapy. He has been awarded different international grants from Carolina and IDIBELL Foundations, among others. In addition, he has worked on the development of novel immunology-based therapies using antibodies and T cells therapy to prevent or treat exacerbation of inflammatory diseases and cancer, as well as to induce immune tolerance in transplantation. Several international patents protect these innovations; some of them have been licensed to RemAb Therapeutics and Triurus Therapeutics.



Dr Bernhard Ryffel Host Scientist

Bernhard Ryffel's research interests primarily relies in understanding the mechanisms of pulmonary inflammation and repair of resulting from lung injury. He has published over 480 papers and has an H factor of 85. In addition to his position at CNRS, he has honorary positions in Guangzhou and Cape Town. He currently holds a number of major international grants supporting this work. In addition to his academic achievements, Bernhard has excellent links with the pharmaceutical industry and founded IBR Inc. and ArtImmune SAS, and is editor of and serves as a reviewer for several journals and consultant of several private and academic institutions.

THERAPEUTIC USE OF ANTI-PERIOSTIN ANTIBODY IN INFLAMMATORY LUNG DISEASES

According to the World Health Organization, asthma prevalence has significantly increased in the last 30 years, resulting in a severe human health and economic burden for the society affecting around 235 million people worldwide. In 2016, it was estimated that 383,000 people in the world died from asthma in 2015, more than 1000 per day. Risk factors associated with asthma are exposure to allergens as an infant and exposure to environmental factors, such as pollutants.

Several mechanisms are invoked in driving the allergic lung inflammation. Recently, an increase of the matricellular protein periostin (POSTN) was reported in serum of patients with asthma and chronic obstructive pulmonary disease (COPD) which is considered also as a biomarker of severity. Several studies suggest also that POSTN may be part of a negative-feedback loop regulating allergic inflammation that could serve as a therapeutic target in the treatment of lung diseases.

This research project aims to develop novel immunology-based therapy using monoclonal antibodies targeting POSTN to prevent or treat asthma, fibrosis and exacerbation in inflammatory lung diseases. It is supported by the ARD2020 Biopharmaceuticals Programme.

In this year 2020 as Le Studium fellowship, preclinical models to evaluate the anti-inflammatory capacity of therapy, as well as fibrosis and exacerbation has been successfully established. Details about the three principal topics of research are listed below:

1. Inflammation: POSTN is expressed upon lung inflammation and upregulated in the lung epithelium in mouse models. The development of the therapy is based on the use of monoclonal antibodies targeting POSTN to reduce respiratory barrier injury and lung inflammation in preclinical asthma models using papain. We demonstrate that anti-POSTN antibody can prevent or treat respiratory barrier injury, inflammation and disruption of tight junction in preclinical models.

2. Fibrosis: POSTN plays an important role in chemokines production to recruit neutrophils and macrophages important for the process of lung fibrosis. We demonstrate that anti-POSTN antibody can prevent or attenuate respiratory barrier injury, disruption of tight junction and fibrosis in a preclinical model. Bleomycin (BLM)-administered in mice is widely used as a model of idiopathic pulmonary fibrosis (IPF).

3. Exacerbation of inflammation: Another important aspect in inflammatory lung diseases is the frequent acute exacerbation due to infections. We demonstrate that anti-POSTN antibody can promote bacteria clearance in lung.

A grant has been submitted to C-VaLo program to provide more resources and support to continue the biological evaluation of monoclonal antibodies in preclinical animal models and in vitro models to explore the mechanisms of action and the affected pathway.

Data have been filed for intellectual property protection to facilitate the generation of spin-off company. In particular, the aim of the spin-off is to develop to prepare a solid preclinical dossier to license for clinical trials in severe asthma and other lung diseases. The results will be published in peer-reviewed journals.



GRAPE METABOLOMICS & CELL COSMETICS



Dr Magdalena Malinowska

LE STUDIUM Guest Research Fellow
ARD 2020 COSMETOSCIENCES Programme

From: Cracow University of Technology - PL

In residence at: Biomolecule and Plant Biotechnology (BBV) - Tours

Nationality: Polish

Dates: October 2019 to October 2020

Doctor Magdalena Malinowska works as an Assistant Professor at Cracow University of Technology, the Faculty of Chemical Engineering and Technology. Her PhD thesis was based on the synthesis of novel triterpenes as potential active substances for skin regeneration. She has the experience in organic synthesis, modern extraction techniques, compounds isolation and purification and their analysis. Her research is focused on the determination of biological activity, bioavailability, evaluation of skin permeability and the safety of use for chemical substances. Her professional experience covers also the technology of modern cosmetic formulations, the evaluation of their physicochemical and rheological properties as well as development of novel cosmetic recipes allowing for encapsulation of natural active substances.



Dr Arnaud Lanoue Host Scientist

Doctor Arnaud Lanoue is Assistant Professor at University of Tours, BBV Laboratory [Laboratoire Biomolécules et Biotechnologies Végétales EA2106]. He is the author of numerous publications concerning plant metabolomics analysis and screening of natural products with biological activities. His professional experience covers the development of bio-based active ingredients for various applications using methods derived from green chemistry. His research is currently focused on the molecular diversity in grapevine in relation to different genetic and environmental factors. Carrying out a metabolic mapping of various grape varieties, including rare species, will allow to multiply rare or ancient grape varieties to their future exploitation. Doctor Arnaud Lanoue applies high-throughput biochemical analysis techniques such as metabolomics which allow to grasp remarkable complexity of natural vine products. His scientific studies have shown that European vines have a specific biomolecule composition which is linked to their genetic background.

The research project "Grape Metabolomics & Cell Cosmetics" focuses on the metabolomics screening of ancient, rare grape varieties from Loire Valley for the development of plant cell lines producing active cosmetics. Various grape cultivars present a remarkable diversity of original natural substances capable of being valued by the cosmetic and dermatological sectors. Grape extracts enriched with natural antioxidant substances can be used as cosmetic active ingredients, especially with anti-aging potential. Today, high-throughput biochemical analysis techniques, such as metabolomics, make it possible to understand this remarkable complexity of natural vine products.

A first step in this project was to carry out a metabolic mapping of ancient regional grape varieties in order to assess their potential in cosmetic active ingredients.

Samples of 107 grape cultivars, including six rare cultivars from Loire Valley region, were collected in the grape collection maintained by URGC (Union pour les Ressources Génétiques du Centre).

In October 2019 berries and leaves were harvested and in January, grape canes, representing the winter by-products of viticulture, have also been picked. All three organs were freezed, lyophilized, and extracted using ultrasound assisted extraction method. The UPLC-MS analysis ensured the identification and quantification of 104 grape metabolites, including stilbenoids, flavonols, flavan-3-ols, aminoacids, phenolic acids and anthocyanidins. Biological activity of the dry extracts was determined by the evaluation of antioxidant activity by four different methods (DPPH, FRAP, CUPRAC, ABTS) and by the measurement of the extracts influence on tyrosinase inhibition and sirtuin activity. The results of the composition and biological effect of berries, leaves and canes (rare cultivars compared to the selected common ones) allowed for the determination of metabolomics profiles of all three grape organs and for the determination of the most valuable composition that can be useful for cosmetic purposes.

The second phase covered the initiation of in vitro culture processes applied to rare or extinct Loire Valley grape varieties. This exploratory work will provide access to rare or ancient plant material that has the potential to produce natural substances of original cosmetic interest compared to the grape varieties conventionally used.



LE STUDIUM WORKSHOP

EXPLORING THE MOLECULAR DIVERSITY OF GRAPE, A SOURCE OF NATURAL INGREDIENTS

The workshop entitled "Exploring the molecular diversity of grape, a source of natural ingredients" took place virtually on December 3, 2020.

Grapevines and their byproducts produce a broad range of specialized metabolites, including flavonoid- and stilbenoid-type compounds, that exhibit diverse biological activities highly sought by biomass-based industries. Among the large molecular diversity present in grape, only few lead molecules are exploited. This is the case for resveratrol; currently exploited as food supplements and cosmetics ingredient for its anti-aging properties and for oligomeric pro-anthocyanidins (OPCs) that are used for several health purposes including the prevention of cardiac and Alzheimer diseases. Beyond these two well-known lead molecules, grapevine is a natural source for a myriad of other biomass-derived molecules that remains underexplored. The objective of the present workshop is to build-up a transversal platform for the development of novel grape biomass-derived chemicals with outputs in pharmacy, cosmetics and sustainable agriculture. Several aspects will be covered in a top-down approach such as impact of climate change on phytochemicals, green extraction technologies, comprehensive analytical tools and biological activities.

This international workshop was organised online in the framework of the COSMETOSCIENCES ARD 2020 Programme.



AROUND THE PROJECTS

Scientific Publications

- Magdalena Anna Malinowska, Kevin Billet, Samantha Drouet, Thibaut Munsch, Marianne Unlubayir, Nathalie Giglioli-Guivarc'h, Christophe Hano, Arnaud Lanoue, Grape cane extracts as multifunctional rejuvenating cosmetic ingredient: Evaluation of sirtuin activity, tyrosinase inhibition and bioavailability potential, *Molecules* 2020, 25(9), 2203. <https://doi.org/10.3390/molecules25092203>

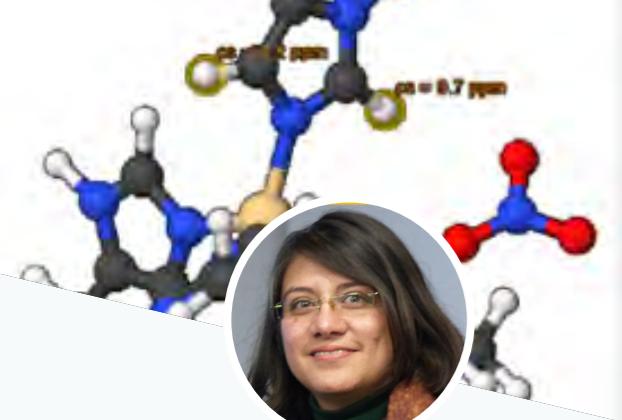
- Kévin Billet, Magdalena Anna Malinowska, Thibaut Munsch, Marianne Unlubayir, Sophie Adler, Guillaume Delanoue, Arnaud Lanoue, Semi-Targeted Metabolomics to Validate Biomarkers of Grape Downy Mildew Infection Under Field Conditions, *Plants* (Basel). 2020, 9(8), 1008. <https://doi.org/10.3390/plants9081008>

Book chapters

- Kevin Billet, Malinowska Anna, Malinowska, Thibaut Munsch, Marianne Unlubayir, Thomas Dugé de Bernonville, Sébastien Besseau, Vincent Courdavault, Audrey Oudin, Olivier Pichon, Marc Clastre, Nathalie Giglioli-Guivarc'h, Arnaud Lanoue, Stilbenoid-Enriched Grape Cane Extracts for the Biocontrol of Grapevine Diseases. In: Mérillon JM., Ramawat K.G. (eds) Plant Defence: Biological Control. Progress in Biological Control, vol 22. Springer, Cham. https://doi.org/10.1007/978-3-030-51034-3_9

Oral communications

- Magdalena Malinowska, Grape metabolomics and cell cosmetics, LeStudium Thursday meeting, University of Tours, 1.10.2020
- Magdalena Malinowska, Grape metabolomics and cell cosmetics, French network on Plant Specialized Metabolism: Meta SP, University of Tours, 15.10.2020 (online conference)



COORDINATION COMPOUNDS AS ANTIOXIDANTS: ACTIVITY EVALUATION BY COMBINING FIRST- PRINCIPLE CALCULATIONS AND SOLID-STATE NMR

To develop extra thermodynamic relationships between chemical reactivity parameters and structural data obtained by solid state NMR of coordination compounds to follow their antioxidant ability.

Twenty coordination compounds were obtained by the use of different inorganic salts of divalent transition metal cations with the 4(5)-methyl imidazole ligand. The compounds were characterized by analytical and spectroscopic methods. The experimental ^1H , ^{13}C and ^{15}N Solid State NMR spectra for each compound were also determined. Some calculus at first principles were based in the structural data obtained by single crystal X-ray diffraction and some others by the structural interpretation of the spectroscopic NMR studies. The structural information obtained was used to calculate the chemical reactivity parameters based in the Hard and Soft Acids and Basis Principle (HSAB) supported by the Density Functional Theory (DFT) theory. The isotropic chemical displacement observed in the experimental ^1H , ^{13}C and ^{15}N solid state NMR spectra were in agreement with the electronic density characteristics revealed by the reactivity parameters obtained for each site in the testing molecules.

The results of the first principle calculations of NMR parameters were also in agreement with their respective experimental NMR spectra. The analysis of the theoretical and experimental results allow us to identify the influence of the substituent in the ligands as well as in the formation of the coordination compounds and their influence in the antioxidant behavior of the nickel, cobalt and copper compounds. The influence of the counteranion was evidenced and the correlation of the antioxidant ability of each compound was correlated with the ^1H and ^{13}C isotropic values.

We have obtained different correlations between the HSAB-DFT reactivity parameters of the designed and synthetized coordination compounds related to its antioxidant behavior and its solid state NMR parameters. The relationships between the electrophilicity and the proton and carbon ss-NMR isotropic values presented better correlation in comparison to the data for ^{15}N .

Dr Arlette Richard-Torres

LE STUDIUM / Marie Skłodowska-Curie Research Fellow
Smart Loire Valley General Programme

From: Autonomous Metropolitan University Unidad Iztapalapa - MX

In residence at: Extreme Conditions and Materials: High Temperature and Irradiation (CEMHTI) - Orléans

Nationality: Mexican

Dates: June 2019 to May, 2020

I am Chemist by UNAM (Mexico) and obtained a PhD in Sciences (Chemistry) by UAM (Mexico). I have expertise on synthetic strategies of coordination and organic compounds for biological applications as well as in analytical and spectroscopic methodologies for structural characterisation of those compounds and theoretical reactivity studies of different chemical systems, specially in heterocyclic compounds in the design of biological active compounds. I have been referee of international journals, professor chemistry and environmental legacy at UAM (Mexico). I worked as invited professor at Donostia International Physics Center (Spain), Euskal Herriko Unibertsitatea (Spain), Valladolid University (Spain), Marie Skłodowska-Curie Research Fellow by Le Studium. I am CONACyT-Mexico National Researcher (SNI level I) and funder and organiser of the NMR symposia in Mexico and actually, researcher at CNRS- CEMHTI.



Dr Pierre Florian
Host Scientist

He is an expert and international reference on Solid-State Nuclear Magnetic Resonance, specifically on about spectroscopy of crystalline and amorphous phases, structure of oxide glasses, structure and dynamics of very high-temperature molten oxides. He has performed in joint with Dr Massiot the network Research infrastructure Magnetic Nuclear Resonance, Very High Fields in France. Actually, he has more than 104 peer-reviewed publications, with an average citation per article of 28.5 and his h-index is 31. He has co-organized and participated as lecturer in more than 20 international conferences where the high quality of his research has been shown. Honored in 2019 with the crystal prize by CNRS due to his relevant role in the IR-NMR infrastructure research group. He is part of the organizing committee of the Rocky Mountain Conference on Magnetic Resonance (July, 2020 Colorado USA) and the NMR Symposia in Mexico.



THE ROLE OF PARASITE DERIVED P-GLYCOPROTEINS AS MEDIATORS FOR ANTHELMINTIC RESISTANCE

The main objectives of the Host laboratory at INRAE Centre Val de Loire (Multi-resistance and pathogeny factors from parasitic nematodes headed by Cedric Neveu) and the Institute for Parasitology and Tropical Veterinary Medicine (IPTVM) at Freie Universität Berlin (headed by Prof. Georg von Samson-Himmelstjerna) are innovative contributions to the sustainable control of gastro-intestinal parasitic nematodes (GIN) in livestock industry. Currently, the control of GIN infections remains largely based on anthelmintic treatments, but increasing anthelmintic resistance has reduced their efficacy. In that respect, during the past decade, both groups have investigated anthelmintic resistance (AR) on several different aspects from field studies to molecular characterization of parasite anthelmintic targets.

The current project focusses on the investigation of metabolic pathways of anthelmintics, in particular the P-glycoproteins (Pgp) and their mutations in the context of drug transport, specifically concerning macrocyclic lactones (ML). As it is to date not feasible to perform forward or reverse genetic studies in parasitic nematodes and thus also not possible to study the effects of gene modifications directly in these organisms, scientists employ model organisms such as the earth nematode *Caenorhabditis elegans* in which the respective parasite derived genes are being functionally expressed. Specifically the Pgp11 gene of the equine GIN *Parascaris univalens* was cloned into wild-type as well as Pgp11 knock-out lines of *C. elegans*. This was performed using the CRISPR/Cas9 technology which is well established in the host institution. Based on previous findings in the laboratory of the Le Studium fellow there is circumstantial evidence showing that specific single nucleotide polymorphisms in the *Parascaris* Pgp11 coding sequence are associated with reduced ML efficacy. To investigate the functional relevance of these polymorphisms recombinant *C. elegans* lines expressing *Parascaris* Pgp11 with and without these polymorphisms were generated. A total of five different CRISPR/Cas9 experiments was performed employing two *Parascaris* Pgp11.1 constructs without the ML-resistance associated SNPs and two with these. Furthermore, one transformation with the plasmid encoding for mCherry was conducted. All experiments resulted in worms exhibiting the roller phenotype and showing the expected antibiotic resistance. Offspring of worms transformed using the mCherry-containing construct driving the expected intestinal expression was confirmed using fluorescence microscopy (Fig. 1). For the confirmation of successful integration in the correct genetic locus a range of PCR primer pairs was designed and tested in several of the obtained *C. elegans* lines. Finally, one of the primer pairs resulted in the generation of fragments which were confirmed by Sanger sequencing to represent the inserted mCherry encoding construct.

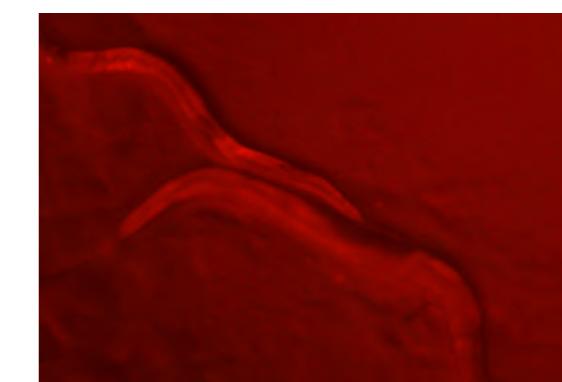
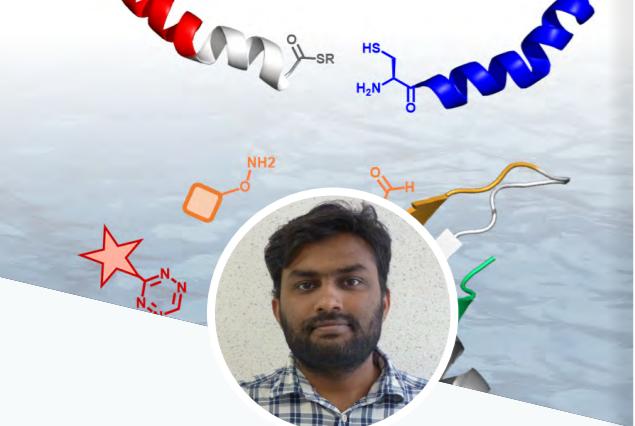


Figure 1. Two tm0333 worms showing intestinal red fluorescence based on expression of mCherry and exhibiting the roller phenotype.



Dr Cédric Neveu
Host Scientist

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



DEVELOPMENT OF NOVEL CHEMOSELECTIVE LIGATION TECHNIQUES FOR PROTEIN SYNTHESIS



**Dr Vishwanatha
Thimmalapura Marulappa**

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: University Medical College Groningen - NL

In residence at: Center for Molecular Biophysics (CBM) - Orléans

Nationality: Indian

Dates: February 2019 to May 2020

I have joined the Prof. Sureshbabu's laboratory [Bangalore University, India] in July 2009 for a PhD programme. The main objectives of my research work were the design and synthesis of a novel class of peptidomimetics. After finished my PhD in 2014, Alexander Dömling [University of Groningen, The Netherlands] offered a postdoc position to work on multicomponent reactions. I am very fortunate to have had an additional experience to work on radiochemistry laboratory at the medical college under the guidance of Prof. Elsinga. I have committed for the opportunity to expand my ideas and past research activities for the synthesis of complex structures such as peptides and proteins. I worked as a postdoc in Dr Aucagne's group on drug discovery and organosulfur-based peptidomimetic synthesis. I received several award grants such as CSIR senior research fellowship, travel grants to attend the 2018 International Symposium on Chemical Biology in Switzerland and 2019 American Peptide symposium in the USA. With the help of Studium fellowship, I could success in getting an exiting project at Ledien University Medical Center.



Dr Vincent Aucagne
Host Scientist

Vincent Aucagne received his PhD from the University of Orléans [2002], working with Patrick Rollin on the development of synthetic methodologies to elaborate carbohydrate mimics. Following post-doctoral research with Prof. David Leigh at the University of Edinburgh [2003-2006] in the field of mechanically-interlocked architectures and molecular machines, he returned to Orléans to join the CNRS Center for Molecular Biophysics (CBM), as a CNRS Chargé de Recherche [2006] in the group of Dr Agnès Delmas. He currently holds a Directeur de Recherche position, leads the "Synthetic Proteins and Biorthogonal Chemistry" research group, and is the coordinator of the "Molecular, Structural and Chemical Biology" team. His current research interests focus on the development of synthetic methodologies for the chemical synthesis of proteins for application to the deciphering of biological processes at the molecular level.

The production of proteins by chemical synthesis is a very promising alternative to biotechnological techniques for applications to the deciphering of biological mechanisms at the molecular level, drug discovery and synthetic biology. It is particularly useful for accessing site-specifically modified proteins. Current technologies focus on the modular assembly of unprotected peptide fragments through highly chemoselective reactions called "chemical ligations".

This approach revolutionised the field about thirty years ago, but there is still only a very few reactions compatible with this purpose available to date. The overall goal of the project is to develop novel ligation reactions for chemical protein synthesis. In particular, the chemical ligation of peptide thioacids with N-activated peptides (imidazolyl ureas) has been investigated, with the goal to transform a known non-chemoselective reaction (carboxylic acid/imidazoylurea coupling developed by Campagnel) into a chemo and regio-selective reaction compatible with aqueous environments typically used for the ligation of unprotected peptides.

The rational behind the idea to replace carboxylic acids by thioacids is that, under acidic conditions, thioacids are reactive whereas side chain functional groups in the peptides such as amines and carboxylic acids are expected to be unreactives.

The ligation reaction between peptide thioacids and imidazolyl urea peptides involves three key challenges:

1. synthesis of unprotected peptide thioacids
2. synthesis of imidazolyl urea peptides and
3. ligation under aqueous conditions.

First, I investigated the synthesis of unprotected peptide thioacids which are notably difficult to prepare, and rather unstable. A model peptide was synthesized having a C-terminal hydroxy-benzyl cysteine group at the C-terminus (so called crypto-thioester) as described previously in the host laboratory. After the elongation on solid support, the peptide was released in solution and purified through HPLC. This crypto-thioester peptide was treated with trimethoxy benzyl thiol (Tmob-SH) leading to the formation of trimethoxy benzyl thioester peptide which was purified by HPLC. Very conveniently, trimethoxy benzyl thioester peptide is efficiently converted into peptide thioacid by a simple acidic treatment prior to use in ligation reactions. The second challenge was the synthesis of imidazolyl urea peptides. For this, activation of amine was carried out on solid support by the treatment with carbonyl diimidazole.

The imidazolyl urea activated peptide was then released from resin. I systematically studied the stability of model imidazolyl urea peptide in aqueous conditions. It was found that, the imidazolyl urea activated peptides are reasonably stable in water at acidic pH, thus compatible with the reaction with peptide thioacids.

Next we have carried out typical ligation reaction between unprotected peptide thioacid derived from LYRG and unprotected Imidazolyl urea peptide was taken as simple alanine methyl ester under acidic pH based on a previously synthesized dipeptide Boc-Phe-Ala-OMe as a solid proof of concept.

LE STUDIUM CONFERENCES

CHALLENGES AND PROSPECTS IN CHEMOSELECTIVE LIGATIONS: FROM PROTEIN SYNTHESIS TO SITE-SPECIFIC CONJUGATION

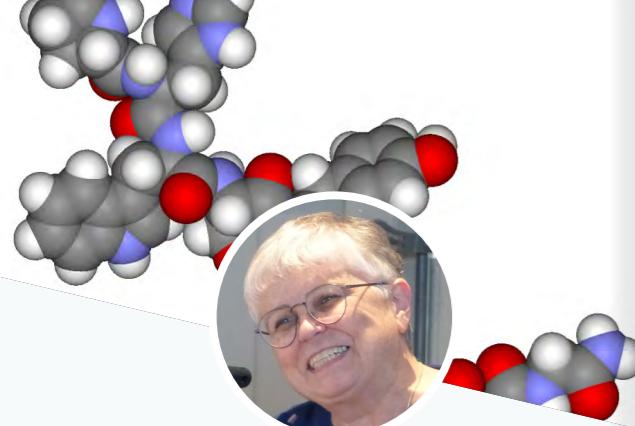
The main objectives are the interface between chemistry and biology, especially methods to synthesize proteins by chemical way and recombinant fashion. Additionally, by using organic chemistry reactions, how proteins will be modified and used them as biological tools to study the protein function.

The conference was really exiting and many world-renowned professors presented their ongoing discoveries and future prospects. Many oral and poster presentations have been selected from the Ph.D. and postdocs across Europe. We acknowledge

Studium and many pharma companies including European peptide symposia for their generous financial assistance. During the conference, many new techniques have been learnt for the protein chemical synthesis and new chemistries for the bioconjugation of proteins and their applications to solve the biological complexity.

Many world-renowned scientists are attended and presented their discoveries which are relevant to chemistry and biology. Key scientists are Prof. Lutz Ackermann, Dr Didier Boturyn, Dr Fabienne Burlina, Prof. Alexander Dömling, Prof. Beat Fierz, Prof. Matthew B. Francis, Dr Sébastien Gouin, Prof. Wenshe Liu, Dr Oleg Melnyk, Dr Cyrille Sabot, Dr Olivier Sénèque, Dr Denis Servent, Dr Frédéric Taran, Prof. Alesia Tietze, Dr Vladimir Torbeev, Prof. Carlo Unverzagt, Dr Birgit Wiltschi,





PLEOTROPISM OF GONADOTROPIN ACTION



Prof. Manuela Simoni

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: University of Modena and Reggio Emilia - IT

In residence at: Physiology of Reproduction and Behaviour (PRC) - Tours

Nationality: Italian

Dates: April, 2019 to April, 2020

Manuela Simoni, MD, PhD, trained as clinical endocrinologist at the Unit of Endocrinology of the University of Modena, Italy between 1982 and 1990 and, thereafter, as molecular endocrinologist at the Institute of Reproductive Medicine of the University of Münster, Germany, where she was Professor for Endocrinology and Molecular Biology of Reproduction from 1998 to 2008. Since 2008 she is full professor of Endocrinology at the University of Modena & Reggio Emilia, Italy.

Her research interests are gonadotropin and androgen action, testicular function, male infertility, endocrinology and pathophysiology of reproduction. She is Editor-in-Chief of ANDROLOGY, the official journal of the European Academy of Andrology and the American Society of Andrology. Bibliometry (Scopus): 257 articles, 11319 citations, 58 H-index.



Dr Pascale Crépieux

Host Scientist

Pascale Crépieux is a CNRS Research Director at the Laboratory of Physiology of Reproduction and Behaviors in Nouzilly. Her main research area is on the mechanisms whereby extracellular signals are integrated into an adapted cell response, from gonadotropin receptors membrane receptors to gene expression. She acquired a strong background in molecular biology during her PhD at the Pasteur Institute in Lille, then in cell signaling during a 3-year post-doctoral training at McGill University, Montreal. Since 2012, she has been co-leading the Biology and Bioinformatics of Signaling Systems (BIOS) group, a pluridisciplinary group that gathers 8 research scientists. Among other management activities, she has been participating to the Specialized Scientific Commission of Animal Physiology at INRA since 2011, and has been recently reviewer for the Biomedecine Agency, for the « SYSBios» of the Cancer ITMO, for the MRC and for the ESF. She also teaches in Masters of « Biology of Reproduction », « Biology, Health », « Antibodies », at the University of Tours.



PROTEIN TRANSLATION ENHANCEMENT FOR THE TREATMENT OF NEURODEGENERATIVE DISEASES



Dr Kathia Zaleta

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: University of California San Diego - USA

In residence at: Imaging and Brain laboratory (iBrain) - Tours

Nationality: Mexican

Dates: November, 2020 to October, 2021

Dr. Kathia Zaleta completed her PhD at the University of Nebraska-Lincoln in the US in collaboration with CINVESTAV-IPN in Mexico city. During her PhD studies, she investigated the catalytic mechanisms of modular megasynthases; such as polyketide synthases (PKS) and the Non-ribosomal peptide synthetases (NRPS), with the goal of reprogramming their chemistry for preparing novel natural products with potential drug activity. This work set the basis for the development of novel custom molecules by genetic manipulations of the gene clusters involved in their biosynthetic mechanisms. She completed her postdoctoral training at Stanford University where she designed a therapy to treat patients with the cardiovascular disease Hypertrophic Cardiomyopathy (HCM) using small interference RNAs (siRNAs) and antisense oligonucleotides (ASOs) to allele specific silencing single nucleotide variants causative of the disease. This research work was published in Circulation, a high impact factor journal ranked 1st among journals in the cardiovascular category and a patent that was filed in 2015. Before coming to France, she was a full-time R&D scientist at Crossignal therapeutics, an immunotherapy company located in La Jolla California.



Prof. Patrick Vourc'h

Host Scientist

Prof. Patrick Vourc'h is the head of the Department of Genetics at the CHRU of Tours, professor in biochemistry at the faculty of medicine at the University of Tours, assessor (research) of the Dean of the Faculty of Medicine and President of the Biomedical Research and Public Health Committee (CRBSP) of the Region Centre-Val de Loire. As the head of the platform of genomics of the University of Tours and of the platform of molecular biology of the CHRU of Tours, he has access to high throughput sequencing, transcriptomics. He maintains regional, national and international collaborations (ie. Montpellier Neuroscience Institute, Polytechnic Institute of Mexico City, Utrecht University, European Consortium Strength and Mine on ALS). He is a member of the team "Neurogenomics and neuronal physiopathology" of the iBRAIN research unit (University of Tours, INSERM). The team is part of the reference centre for ALS (CHRU of Tours) where Prof. Vourc'h is particularly involved in molecular diagnosis for patients with ALS and ALS-FTD (dementia). The team is member of the Labex MabImprove (Laboratory of Excellence, monoclonal antibodies).



EARTH ECOLOGY & ENVIRONMENT SCIENCES

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HOST LABORATORIES IN EARTH ECOLOGY & ENVIRONMENT SCIENCES

CENTRE DE BIOPHYSIQUE MOLECULAIRE (CBM) UPR 4301 - CNRS



The Center for Molecular Biophysics (CBM) is a research unit of the French National Center for Scientific Research (CNRS). The CBM develops research at the interface of chemistry, biology and physics to study the molecular mechanisms that sustain life or dysfunctions leading to diseases. The CBM was founded in 1967 and from here the biophysics first developed in France (the Biophysics French Society born in Orléans). At the CBM, I join the Chemistry, Imaging and Exobiology (CEI) team leaded by Dr. Frances Westall. The CEI research interests focus on the understanding of the origin and early evolution of life on Earth, and the search for life elsewhere throughout the study of the 1) origins of prebiotic molecules, 2) oldest traces of life, 3) Biosignatures and artificial fossilisation, and 4) Space exploration and the search for life on Mars and elsewhere in the solar system. The CEI group is strongly involved in the scientific and instrumental aspects of the European/Russian ExoMars 2020 rover mission.



INSTITUT DES SCIENCES DE LA TERRE D'ORLÉANS (ISTO) UMR 7327 - UNIVERSITÉ D'ORLÉANS, CNRS, BRGM



The ISTITO (Institut des Sciences de la Terre d'Orléans) is a research laboratory in earth sciences, studying the external envelopes of the Earth (upper mantle, continental crust, atmosphere) and the exchange processes between interfaces. The research subjects in the institute include primary mineral, energy and water resources, volcanic hazard, as well as the environmental impacts of anthropogenic activity affecting the critical zone and aquifers. The ISTITO was born in January 2000 from the regrouping of three specific units with some subsequent additions that conformed a joint research unit (UMR), with three bodies to date: University of Orleans (UO), Centre National de Recherches Scientifiques (CNRS) and Bureau de Recherches Géologiques et Minières (BRGM); and it is attached to the Observatory of Sciences of the Universe in the Centre-Val de Loire region (OSUC). The Peatlands Group is part of the Biogeosystems Team, one of the research teams at the institute, that is aimed to understand the physical, chemical and biological processes that govern the functioning and evolution of continental bio-geosystems, in order to modelling the interactions between climate, people, environment, past, present and future.



LABORATOIRE DE PHYSIQUE ET CHIMIE DE L'ENVIRONNEMENT ET DE L'ESPACE (LPC2E) UMR 7328 - UNIVERSITÉ D'ORLÉANS, CNRS, CNES



The LPC2E (Laboratoire de Physique et Chimie de l'Environnement et de l'Espace) is a joint research unit of the CNRS, the University of Orleans and the CNES (Centre National des Etudes Spatiales). In common with the ISTITO (Institut des Sciences de la Terre d'Orléans) and the Station of Radioastronomy of Nançay, it is one of the founding laboratories of the OSUC (Observatoire des Sciences de l'Univers de la région Centre-Val de Loire). The fields of activity of its three scientific teams range from the atmosphere to the most distant space: physico-chemistry of the atmosphere, physics of space plasmas, planetology to study environment of planets and small bodies (e.g. comets) of the Solar System, pulsars and gravitation. This research relies mainly on the scientific exploitation of instruments on board balloons, satellites or space probes. The LPC2E is one of the CNRS-INSU (Institut National des Sciences de l'Univers) space laboratories, working in close partnership with the CNES to propose, design, build and operate these instruments, then make their data and observations available to the scientist community.



INSTITUT DE COMBUSTION AÉROTHERMIQUE RÉACTIVITÉ ET ENVIRONNEMENT (ICARE) UPR 3021 - CNRS



ICARE was founded on January 1st, 2007. It is a laboratory fully funded and managed by CNRS. It depends on the Institute for Engineering and Systems Sciences (INSIS). It is the result of the merger of two laboratories: the "Laboratoire d'AérotHERMIQUE" and the "Laboratoire de Combustion et Systèmes Réactifs". Today, ICARE is a major player in the field of reactive systems, with leading experimental facilities, at national and even global level. The main areas of research concern the chemical transformation of energy, the environment, propulsion and space. The laboratory develops four main research themes: - Chemical kinetics of combustion and reactive systems - Dynamics of combustion and reactive systems - Atmospheric reactivity - Space propulsion and high speed flows.





ANALOGUES IN THE SEARCH FOR LIFE ON MARS

This project focuses on the search for traces of fossil life on Mars and related habitats, and is directly relevant for the forthcoming astrobiological missions to Mars.

Martian life is most likely to have been (and may still be) very primitive, leaving, at most, the fossil traces of organisms similar to terrestrial anaerobic microbes. Their biosignatures will be subtle, diluted by a mineral matrix, and easily confused by abiotic bacteriomorphs. Thus, criteria that can aid distinction bacteriomorphs from bona fide microbial fossils is of prime importance in the run-up to the missions for scientific testing of the payload instruments. As well, to be able to reconstruct field geological analogues for Mars will help in detecting rocks with a high fossilization potential.

The main target of this project is to compile a comprehensive catalogue or book including Mars-analogue environments and a broad range of biosignatures of relevance to Mars. There are many studies concerning different types of Mars analogue organisms and there have been some previous generalisations regarding biosignatures on Mars, but that's what is lacking, at this very critical stage in the lead-up to the Mars missions. Such work will be particularly useful especially to those directly involved in the search for Martian life, from students (who will be the next generation of astrobiologists and planetary scientists) to established scientists.

Within this timely space mission context, the objectives of this project are: 1) to study biosignatures from carbonates cropping out at the Djiboutian area of the Afar depression, an analogue for the surface of Mars during the Noachian/Hesperion eras (~4-3.5 Ga); 2) To create a catalogue of Mars-relevant terrestrial analogues and biosignatures in the form of a review article and a photographic textbook, for which there is an urgent and timely need to help prepare the scientists involved in the Mars 2020 and ExoMars 2020 missions.

To date in collaboration with Dr Westall, I have prepared for analyses the samples from Djiboutia area, discussed with the Springer Ed. the project for the book Planetary Filed Analogues, I am defining the table of content with Dr. Westall and the Publisher.

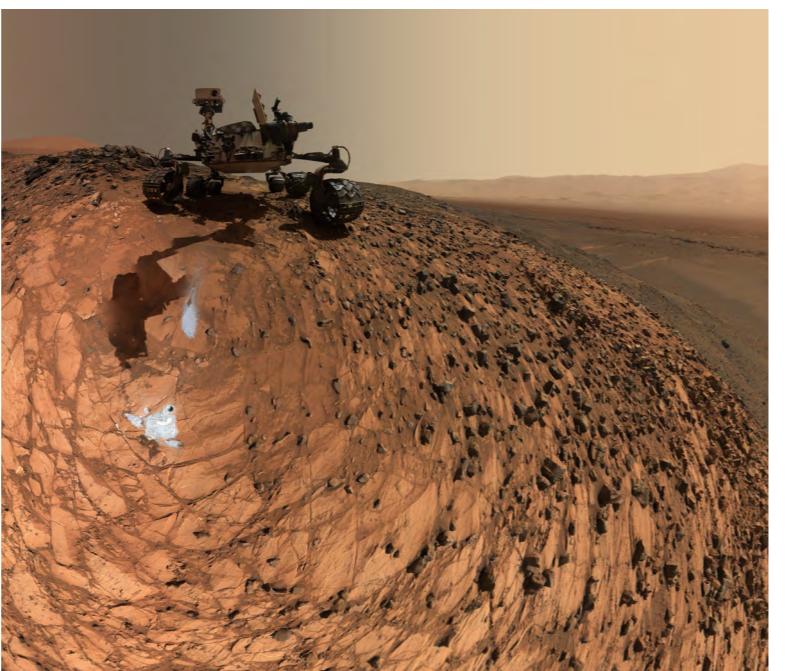


Image Credit: NASA/JPL-Caltech

Dr Barbara Cavalazzi

LE STUDIUM / Marie Skłodowska-Curie Research Fellow
Smart Loire Valley General Programme

From: University of Bologna - IT

In residence at: Center for Molecular Biophysics (CBM) - Tours

Nationality: Italian

Dates: October 2020 to October 2021

Barbara Cavalazzi is an Associate Prof. at the Univ. of Bologna and Adjunct Prof. at the Univ. of Johannesburg. She is a geobiologist/astrogeologist expert in biosignatures preserved in rocks and a reputed field geobiologist. In 2008 she received the NASA-NAI and Lewis and Clark Found for Exploration and Field Research in Astrobiology Award, in 2017 the Medal Science from the Alexandria Univ. In 2016 and 2020, she join the scientific board of the Institute of Advanced Studies and the Collegio Superiore of the Univ. of Bologna, respectively. In 2020 she has member of NASA-ESA Mars Sample Return Science Planning Group Phase 2 and of the International Mars Exploration Working Group. At moment, she is involved in the Europlanet-H20 RI EU project and in the Pan-African Planetary and Space Science Network of the Intra-Africa Academic Mobility Scheme. Since 2019, she is president of the European Astrobiology Network Association – EANA.



Dr Frances Westall

Host Scientist

Dr Frances Westall, geologist and astrobiologist, is Director of Research at the CNRS-Centre de Biophysique Moléculaire. Her multidisciplinary scientific career encompassed geology, planetology, geomicrobiology, prebiotic chemistry, and astrobiology. She is internationally renowned for her research on the geological context of the origin of life and the earliest traces of life on Earth. She was part of the science definition team that led to the ExoMars 2022 mission to search for life on Mars. Co-PI of the microscope CLUPI and Co-I on other instruments, she is the main biosignatures expert for the mission. She was president of the CNRS GDR Exobiology, president of the European Astrobiology Network Association, chair of the COSPAR Panel on Exploration and member of numerous national and international committees including the CNES Comité de Programmes Scientifiques, the H2020 Space Advisory Group, the ESA Human, Exploration and Science Advisory Group, the ESA Space Science Advisory Group and many others. She received the Medal of the Italian Chemical Society (2013), the Alfred Dumont Medal (Belgium), and was awarded an Honorary Fellowship of the International Studies Institute, Bologna as well as numerous awards from NASA.



EXPERIMENTAL MEASUREMENTS OF ATMOSPHERIC CHEMICAL REACTIONS

The goal of this project is to obtain accurate and precise data on the rates and products associated with chemical reactions occurring in the atmosphere, using a wide variety of measurement techniques available at ICARE. Some of these measurements are challenging and the fellow will be required to utilize his experience to try to address long-standing uncertainties within atmospheric chemistry. He will also help to develop experimental protocols and techniques at the host laboratory.

Achievements so far: The fellow has been focusing on the reaction of sulphur dioxide with the OH radical. This is a very important reaction in atmosphere, since it leads to the formation of sulphuric acid, which is of crucial importance to aerosol formation, and therefore has a major effect in terms of air pollution and climate change. However, there remain some key uncertainties in this reaction rate, primarily related to the effect of pressure on this reaction. To begin with, a thorough survey of the literature regarding this reaction was performed, and the gaps in the knowledge were assessed. Accordingly the fellow has conducted a series of careful measurements in the presence of a variety of bath gases (helium, nitrogen and argon) using the pulsed laser photolysis-laser induced fluorescence (PLP-LIF) technique. The maximum pressure available to the PLP-LIF technique is ~400 Torr (below atmospheric pressure), and therefore to complement this technique, a series of simulation chamber measurements have been made in the presence of nitrogen, oxygen, argon and air at 760 Torr. By measuring this reaction using different techniques over a wide range of conditions, we have made definitive progress regarding understanding the pressure dependence of this reaction. This allows us to compare with previous measurements, and to determine, which, if any, are accurate. It is expected that this work will result in a publication that will be of interest to the atmospheric chemical community. The fellow has also taken the responsibility of instructing a PhD student, Ms. Hajar Elothmani, in atmospheric chemistry and the techniques involved in making accurate gas-phase kinetic measurements. Dr McGillen has also supervised a project of a post-doctoral appointee, Dr Soukaina Foulal, which investigates the impact of jet-fuel emissions upon air quality. This has led to an ongoing collaboration with Dr Bernard Aumont at the Laboratoire Interuniversitaire des Systèmes Atmosphériques in Paris, which will also be worthy of publication in the future.

Dr Max McGillen

LE STUDIUM Research Fellow
ARD 2020 PIVOTS Programme

From: University of Bristol - UK

In residence at: The Institute of Combustion Aerothermal Reactivity and Environment (ICARE) - Orléans

Nationality: British

Dates: September 2018 to December 2018
April 2019 to September 2019
January 2020 to March 2020

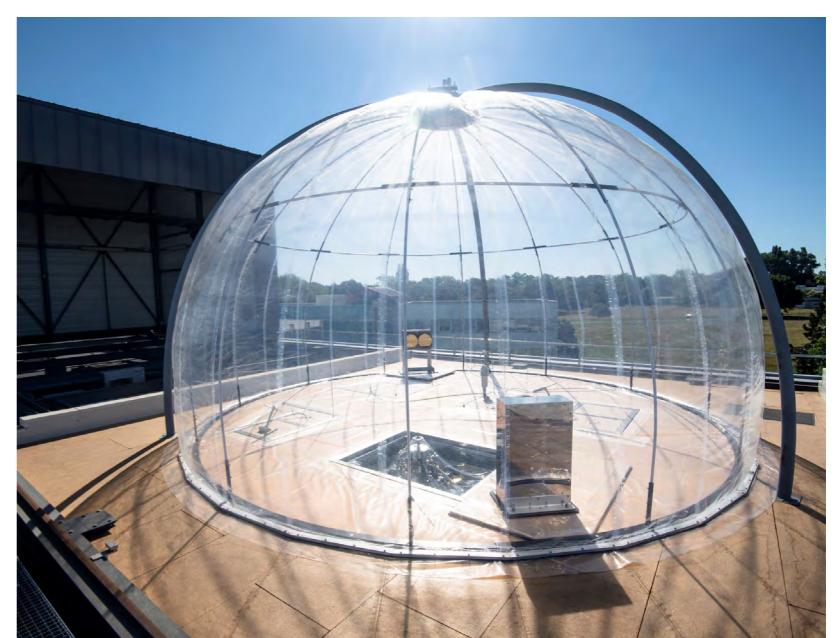
Dr Max McGillen has worked in several laboratories in the UK, and has earned international experience in the USA, Ireland and France. He has worked in a variety of areas including laboratory measurements, field measurements and structure activity relationships. This has resulted in a broad understanding of atmospheric chemistry. Max has been the recipient of an ESF exchange grant, a Marie Skłodowska Curie Research Fellowship, and is now enjoying his status as a Le Studium Fellow. He is also an active member of an international expert panel on the evaluation of structure-activity relationships, and is currently leading their efforts to compile and review an extensive atmospheric kinetic database.



Dr Abdelwahid Mellouki

Host Scientist

Dr Abdelwahid Mellouki's undergraduate and graduate studies were conducted in the Universities of Tours, Orleans and Paris 7 (France). He spent two years as a Research Associate at the National Oceanic and Atmospheric Administration's Aeronomy Laboratory (Boulder-Colorado). His main research fields are Chemical Kinetics, Atmospheric Chemistry, Air Pollution and Climate change. He joined the CNRS in 1992, where he is currently a Research Director at ICARE in Orléans (France), leading the Atmospheric Reactivity Group. He has been nominated National Distinguished Professor at Shandong University (China) and Guest Professor at the Chinese Academy of Science (CAS/RCEES-Beijing) and Fudan University (Shanghai). His research focus on many aspects of atmospheric chemistry, including the study of the atmospheric oxidation mechanisms of anthropogenic and biogenic carbon-containing species and halogen chemistry. He is author or coauthor of over 200 scientific publications/chapters related to atmospheric chemistry.



Dr Juanita Mora-Gómez

LE STUDIUM Research Fellow
ARD 2020 PIVOTS Programme

From: Bangor University - UK

In residence at: Earth Sciences Institute of Orléans (ISTO) - Orléans

Nationality: Colombian

Dates: April 2019 to September 2020

Juanita Mora-Gómez is a PhD in Environmental Sciences. Her research explores microbes in the carbon cycle in flowing waters, organic soils, and transitional zones, such as wetlands. Microbes contribute to the nutrients cycling in the earth through decomposition of dead plant and animals, and they release carbon dioxide and methane during the process, becoming in a crucial driving of greenhouse gasses emission. She studies the mechanisms behind the microbial decomposition including environmental conditioners, links between microbial function and composition, and human environmental pressures. The fellow is author of more than a dozen of publications and has participated in several international and European scientific meetings. She has also successfully assured funding for her research including a Marie Skłodowska-Curie Fellowship (MSCA-IF), an INTERACT action, and a LABEX Voltaire project.



Dr Fatima Laggoun Host Scientist

She is an expert on biogeochemistry and functioning of peatlands with more than 20 years of research experience. She has coordinated numerous research projects funded by local and international institutions, has ca. 85 articles in peer-reviewed journals and ca. 125 conference communications. Former Co-Head of the Isto, she is currently Scientific Head Deputy of CNRS – INSU, France. She has supervised over 16 PhD theses, 4 post-docs and ca. 25 Masters.



Dr Sébastien Gogo Host Scientist

He is PhD in Environmental Sciences from Oxford Brookes University. He is a researcher at Isto and coordinates the French Peatland Observatory System. He has a broad experience in the study of peatland responses to global change at different scales and part of his research is heading towards ecosystems restoration. He has more than 30 peer-reviewed scientific publications and numerous participations in national and international scientific conferences.

ROLE OF MICROORGANISMS IN THE CARBON CYCLING OF PEATLANDS

Peatlands are wetlands systems with a strategic role in the global carbon cycle as they keep 1/3 of the carbon stored in the soil [Fig 1]. Dead plant and animal material are decomposed very slowly by microbial degradation due to constrained environmental conditions in peat soil, such as low levels of pH and oxygen. In the soil, organic material [OM] is broken down by Extracellular Enzymes Activities (EEA) produced by microorganisms, and eventually resulting in the emission of methane and carbon dioxide to the atmosphere (Freeman et al. 2001). Environmental variations, both natural or anthropogenic, may affect OM degradation and therefore greenhouse gas (GHG). Globally, there are still many gaps in our understanding of the mechanisms behind microbial carbon cycling and filling them is essential to propose mitigation strategies and solve urgent environmental issues, such as the ongoing climate change (Cavicchioli et al. 2019). In this context, the fellow developed a research program aimed to improve our knowledge of microbial OM metabolism in French peatlands by supporting an existing research project in the host laboratory (GHG Exchange between Soils and the Atmosphere in peatland – PESAt, in the framework of the ARD 2020 PIVOTS Programme).

The research program involved an initial set up and standardisation of the experimental protocol for measuring EEA in soil and pore water (interstitial water) in peatlands. This research tool is currently available in the laboratory. The fellow also collaborated in two research experiments: 1) to evaluate the effect of temperature increase on microbial metabolism (EEA) [Fig. 2], and 2) to study the links between microbial metabolism (EEA) in pore water and peat soil at different depths, and in relation to CO₂ production and emission at the La Guette peatland [Fig. 3].

Results showed a slight stimulation effect of experimental warming on the microbial activity measured in the pore water, which has a pronounced seasonal variation. The observed effect on microbial metabolism may be one potential explanation of the higher CO₂ emission found under the warming condition in the same experiment.

Studies on the relationship between pore water and soil activity in waterlogged environments, such as peatlands, are scarce. Our results are novel and have shown that water activity is not only a mirror of soil activity, as it has usually been assumed, and that both compartments might be playing complementary role in the total microbial metabolism in peaty soils.

Additionally, the researcher started a project during her fellowship on the effect of microplastics in the microbial carbon cycle of wetlands [Fig.4], in collaboration with the host laboratory, Bangor University (UK), National University of Colombia, and Yugra University (Russia).

References:
Cavicchioli, R., Ripple, W.J., Timmis, K.N., Azam, F., Bakken, et al. 2019. Scientists' warning to humanity: microorganisms and climate change. *Nat. Rev. Microbiol.* 17, 569–586.

Freeman, C., Ostle, N., Kang, H., 2001. An enzymic "latch" on a global carbon store. *Nature* 409, 149.



Figure 1. Overview of a peatland in the high Colombian Andes.



Figure 3. La Guette peatland, a long-term study site in the region.



Figure 4. Fieldwork conducted in Siberian peatlands, September 2019. Part of the microplastics in wetlands project that the fellow is developing in collaboration with the host laboratory.



Dr Illia Zymak

LE STUDIUM / Marie Skłodowska-Curie Research Fellow
Smart Loire Valley General Programme

From: J. Heyrovský Institute of Physical Chemistry - CZ

In residence at: Laboratory of Physics and Chemistry of Environment and Space (LPC2E) - Orléans

Nationality: Ukrainian

Dates: January 2020 to August 2021

Before starting Le STUDIUM fellowship, Illia Zymak worked as a postdoctoral scientist at the Laboratory of Mass-spectrometry, Heyrovský Institute of Physical Chemistry, CZ. The main focus of his research was a study of chemical processes in the atmosphere of Earth and other planets, and moons of the Solar System (e.g., Titan, Mars). Moreover, he studied physical processes in plasma and low-temperature chemical processes relevant to astrochemistry using a 22-pole RF ion trap cooled down to 22 K. He has numerous publications in highly ranked (Q1) journals. I. Zymak invests much time and effort into building new laboratory experimental setups and research stations, from scratch to the commissioning. On top of that, I. Zymak took active part in organizing international conference "XUV/X-ray light and fast ions for ultrafast chemistry (XLIC)". I. Zymak had few scientific stays in different French laboratories as a holder of three COST STSM grants.



Dr Christelle Briois Host Scientist

Christelle Briois is an associate professor (maître de conférences) at the University of Orléans, and a researcher at LPC2E in the Planetology team. She is Co-PI and Co-Investigator of several space instruments that have flown as COSIMA and ROSINA onboard the ESA/Rosetta comet mission launched in 2004. The team was working on COSIMA, the mass spectrometer for analysis of dust in the environment of comet 67P/Churyumov-Gerasimenko (results are reported in Science, Nature etc.). Currently C. Briois is a scientific coordinator of the international CosmOrbitrap Consortium and a chair of its Comité Scientifique OrbitrapTM that has undertaken the development of a space-qualified analyzer of future HRMS space instruments based on the OrbitrapTM, for in situ planetology applications. She is Co-PI of international the NASA-led CORALS and CRATER projects. She is also contributing to preparation of the scientific interpretation of data that would be recorded by SUDA onboard the NASA/Europa-Clipper mission (expected launch in 2025, arrival 20's – 30's).

COSMORBITRAP - HIGH RESOLUTION MASS SPECTROMETER FOR SPACE APPLICATION

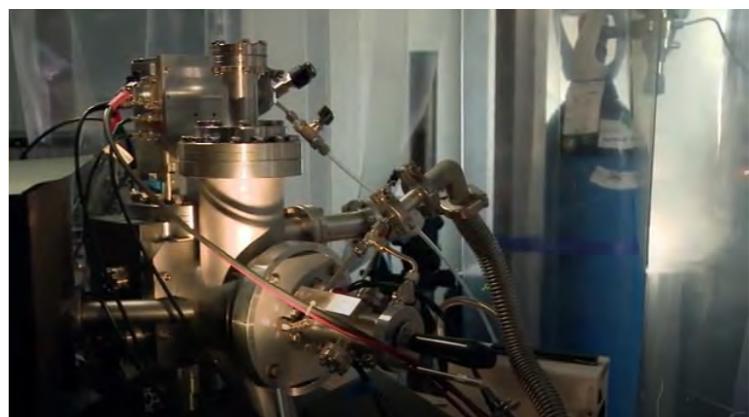
Scientific request on experimental techniques of unambiguous in-situ identification and quantitative analysis of chemical species in extra-terrestrial bodies has risen up after recent space missions. Space probes delivered to gas giant planets and their moons and small objects (e.g. comets and asteroids) of the Solar System confirmed their complex, organics rich chemical composition. However, the existing space-qualified instruments cannot provide high enough mass-resolution, e.g. mass spectrometer for Rosetta mission has resolution < 3000 at 1% of peak height, and required advanced chemical models to confirm detection of heavy organic species.

One of the objectives of the C. Briois group is to develop a space-grade Orbitrap™-based high-resolution mass spectrometer for future space missions. Two different homemade instruments are operated in the laboratory: a Laser-CosmOrbitrap prototype (with its analytical part (CosmOrbitrap), space Technology Readiness Level 5 and the OLYMPIA (Orbitrap analyLyer MultiPle IonisAtion) test bench with interchangeable ion sources at laboratory level (TRL3)). Initial development of OLYMPIA was performed by a previous Le Studium Fellow J. Zabka.

Briois's group is currently involved in two laser ionisation/desorption orbitrap based mass spectrometer projects selected by NASA (CORALS and CRATER), and also as co-investigator in the Europa-Clipper NASA mission. The goal of the latter is enhancement of calibration and interpretation of future data analyses recorded by SUDA (Surface Dust Analyzer equipped with a Time-of flight mass analyser) with laboratory data recorded by OLYMPIA.

The present Le Studium project is aimed to evaluate parameters, propose a design and test ion sources for the Orbitrap™-based high-resolution mass spectrometers required for the in-situ sampling of solid, gas-phase and liquid materials required for CORALS, CRATER, and Europa-Clipper SUDA. Another objective is optimisation of the data acquisition system.

Numerical models and laboratory tests of several ion sources to Orbitrap™ interfaces were performed. Developed software can be used both for the laboratory work and as a prototype of the software for the on-board computing units for future flight missions. Optimisation of the data-acquisition system has been finished. Improved high-resolution OLYMPIA and CosmOrbitrap mass analyser has been used to obtain essential calibration data for CRATER and CORALS projects. Recently mass resolution higher than 50 000 at m/z range 28–86 has been confirmed for OLYMPIA. This resolution is sufficient to complement databases with calibration data required for space applications. Current phase of the project is analysis of obtained experimental data and preparation of publication. The potential discoveries expected with such High Resolution Mass Spectrometer (HRMS) instruments may change our current understanding of chemical history of the Solar System, habitability zones and redefine their limits. HRMS instruments are also essential for the identification and abundance measurements of biosignatures (e.g., glycine in comets and phosphine recently detected – although yet a controversial result – in the atmosphere of Venus).





Dr Dominique Arrouays

CONSORTIUM COORDINATOR

LE STUDIUM
CONSORTIUM SMART LOIRE VALLEY

Dr Dominique Arrouays is a senior research Engineer at the InfoSol Unit, INRAE, Orléans, France. He had been the head of the unit from 2000 to 2011. He has been member of the IPCC who received the Nobel Peace Prize in 1997. He has 175 publications in the Web of Science (WoS) and an h-index of 47. He is member of the editorial board of several international scientific journals. He got the gold medal of the French Academy of Agriculture (2014) and was awarded several “best papers” in scientific journals. He is Chairman of the “GlobalSoilMap” Working Group (WG) of the International Union of Soil Sciences (IUSS), which is working on the “bottom-up” approach for generating fine grids of soil properties. He has been recently nominated member of the Pilar 4 WG (soil information) of the FAO-UN Global Soil Partnership.

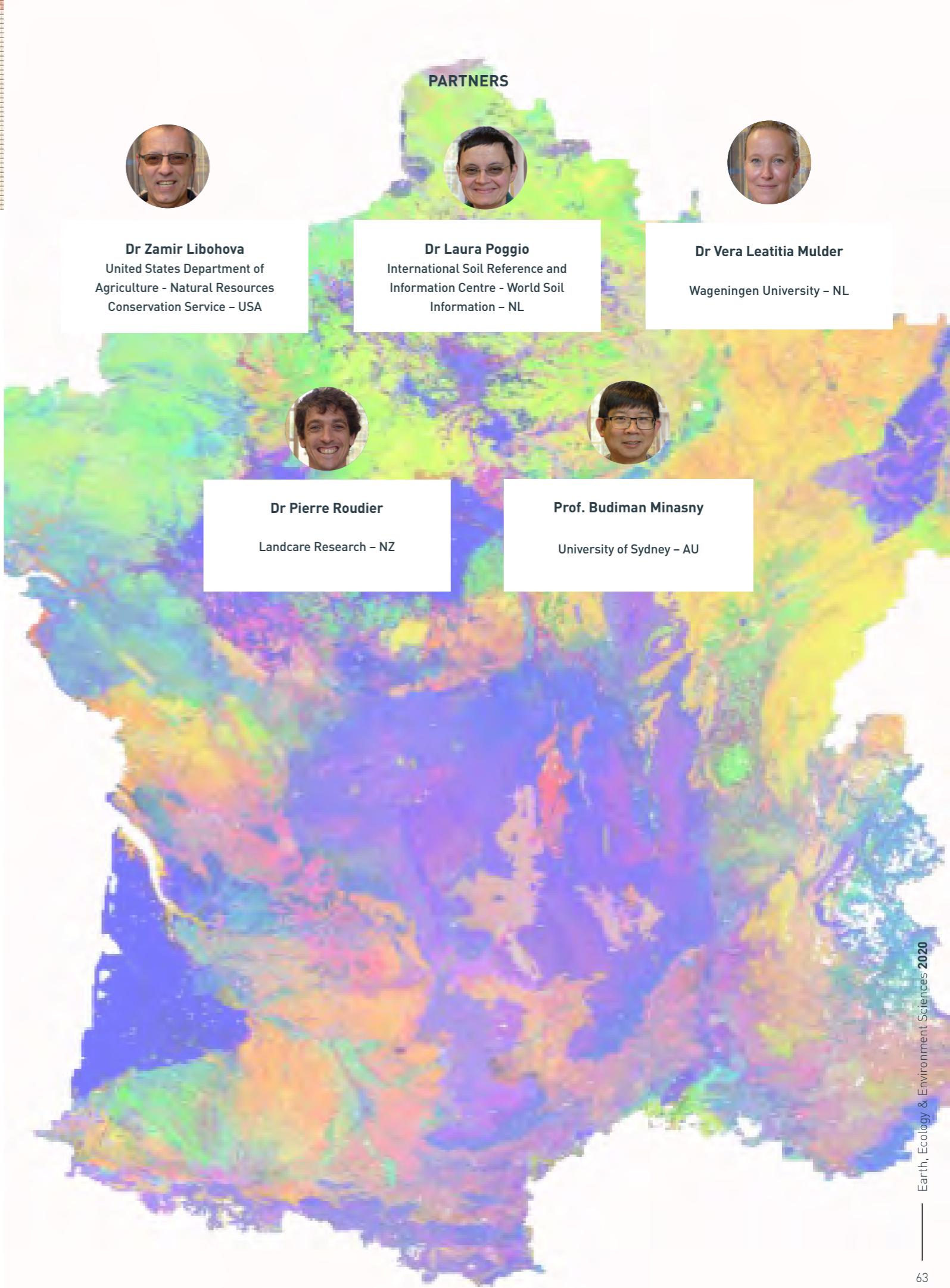
GLADSOILMAP (GLOBAL DIGITAL SOIL MAP)

Soils have critical relevance to global issues, such as food and water security, climate regulation, sustainable energy, desertification and biodiversity protection. All these examples require accurate national soil property information and there is a need to scientific support to develop reliable baseline soil information and pathways for measuring and monitoring soils. Soil sustainable management is a global issue, but effective actions require high-resolution data about soil properties.

Two projects, GlobalSoilMap and SoilGrids, aim at delivering the first generation of high-resolution soil property grids for the globe, the first one by a bottom-up approach (from country to globe), the latter by top-down (global). The GLobAl Digital SOIL MAP (GLADSOILMAP) consortium brings together world scientific leaders involved in both projects. The consortium aims at developing and transferring methods to improve the prediction accuracy of soil properties and their associated uncertainty, by using legacy soil data and ancillary spatial information. This approach brings together new technologies and methods, existing soil databases and expert knowledge.

The consortium aims at transferring methods to achieve convergence between top-down and bottom-up approaches, and to generate methods for delivering maps of soil properties. These maps are essential for communities from climate and environmental modeling to decision-making and sustainable resources management at a scale that is relevant to soil management. The consortium will ensure links with the numerous actors in geosciences of the world, and will contribute to improving their skills in digital mapping and their national and international legibility. The consortium involves very experienced soil scientists and younger ones well aware of up to date technologies and methods in DSM. It covers the entire world, which is a guarantee that the results will be largely disseminated and used.

Achievements to date include the first kick-off meeting held in Orléans in November 2019, and a related detailed plan of actions and several video-meetings in 2020. The website is operational. Three members of the consortium are finishing editing a special issue of a scientific journal (only the introductory paper remains to write). Numerous articles were published in the framework of this consortium, covering various parts of the world and various methodological approaches. The Consortium GLADSOILMAP has been presented to the Scientific Council and the international researchers of “LE STUDIUM” in Orléans, France, June 16th 2020. Progress have been presented in an invited conference to Zeijhang University, China, end of 2019. In 2020, due to Covid-19, face-to-face meetings and travels to Orléans of the members were cancelled, and the STUDIUM decided to extend the consortium duration for one more year.



COMPUTER SCIENCE, MATHEMATICS & MATHEMATICAL PHYSICS

HOST LABORATORIES IN COMPUTER SCIENCE,
MATHEMATICS & MATHEMATICAL PHYSICS

PROF. SERGEY SOLODUKHIN

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HOST LABORATORIES IN COMPUTER SCIENCE, MATHEMATICS & MATHEMATICAL PHYSICS

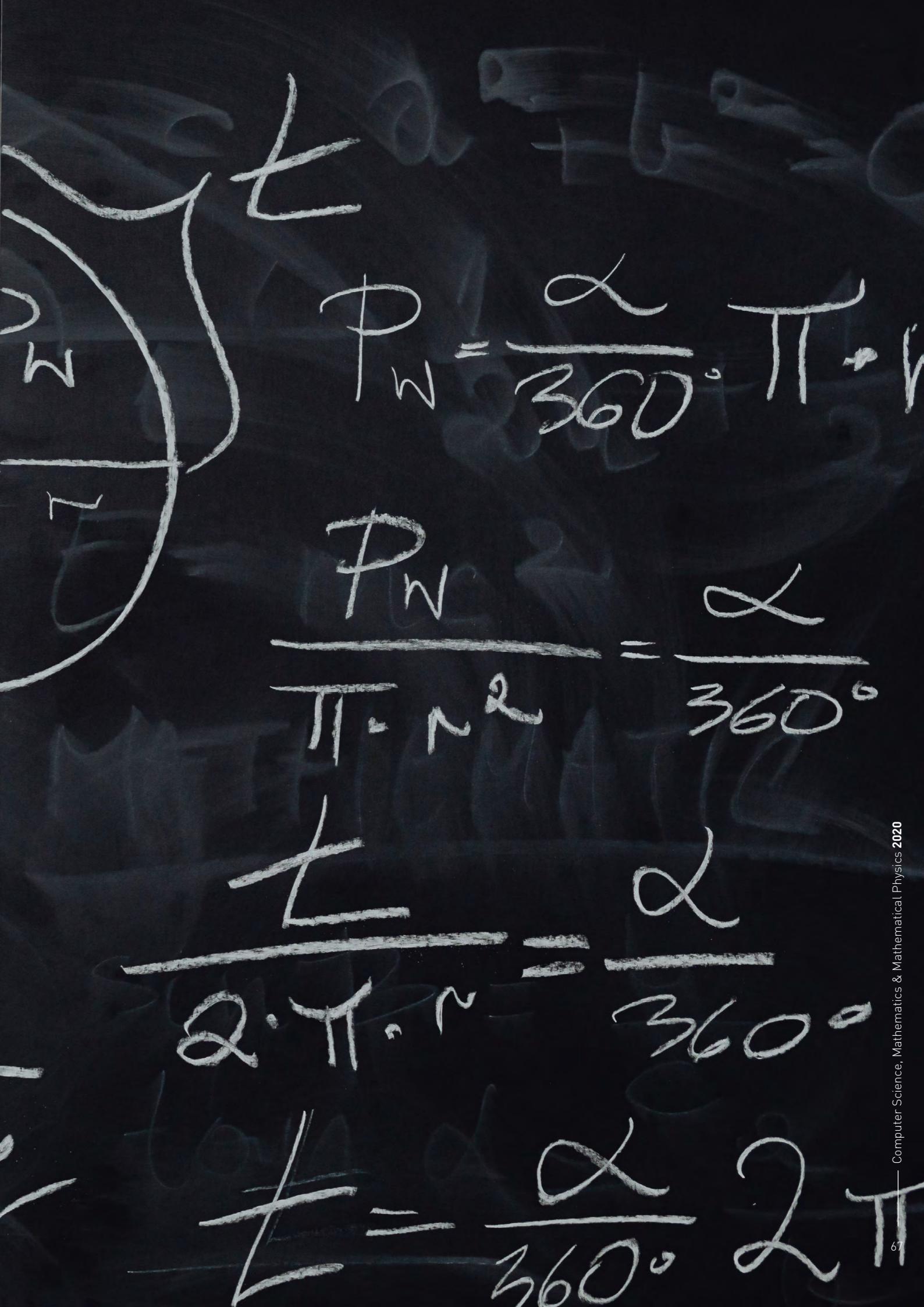
INSTITUT DENIS POISSON (IDP)
UMR 7013 – CNRS , UNIVERSITE D'ORLEANS, UNIVERSITE DE TOURS

 The Institut Denis Poisson (IDP) was created in 2018 on the basis of two laboratories: Laboratory of Theoretical Physics and Mathematics (LMPTP) based in Tours and Laboratory of Mathematics (MAPMO) based in Orleans.

The IDP is a multidisciplinary laboratory with mathematicians and theoretical physicists working in a large variety of fields. It is well-known for its high standard works in gravitational physics, quantum field theory, Riemannian geometry and dynamical systems. Several directions of current research pursued in the Laboratory are relevant for the subject of the present project.

The IDP in Tours consists of 42 professors and lecturers and 7 CNRS researchers (4 Chargés de Recherche and 3 Directeurs de Recherche). The administrative and technical support is provided by 3 secretaries, 1 librarian and 2 technicians. It is responsible for teaching within the Master programs «Fundamental physics and applications» (M1), «Non-linear models in Physics» (M2).




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Prof. Sergey Solodukhin

CONSORTIUM COORDINATOR

LE STUDIO
CONSORTIUM

SMART LOIRE VALLEY

Sergey Solodukhin (the coordinator of the project) is a professor of physics (classe exceptionnelle since 2018) at the University of Tours. He is a world class expert in the field of theoretical high energy physics and gravitation. He is author of about 90 papers with more than 6000 citations. Among many other things he has established, in a 2008 paper, a fundamental relation between the conformal anomaly and the entanglement entropy, known in the literature as Solodukhin's formula.

EXPLORATION OF DUALITY, GEOMETRY, AND ENTANGLEMENT (EDGE)

The aim of this proposal is to bring a European group of experts together to discuss and work on the recent developments in the rapidly growing field lying in the intersection of geometry, quantum field theory and duality, to help grow a research effort in this fast moving area. Our goal is to coordinate the international efforts and generate new ideas. We intend this small initial collaboration to grow into something larger in the near future.

To the date we have organized the first (on-line) meeting in June 2020.

It included the following communications:

- Johanna Erdmenger - Holographic RG Flows for Kondo-like Impurities
- Andy O'Bannon - Central Charges of 2d Boundaries and Defects
- Manuela Kulaxizi - Conformal Correlators, Black Holes and Holography. Part 1
- Andrei Parnachev - Conformal Correlators, Black Holes and Holography. Part 2
- Domenico Seminara - Analytic bootstrap and Witten diagrams for (ABJM) Wilson line as defect CFT_1
- Erik Tonni - On entanglement hamiltonians in one-dimensional quantum systems
- Jan de Boer - Capacity of Entanglement and Quantum Hypothesis testing
- Chris Herzog - Graphene and Boundary Conformal Field Theory





HUMAN & SOCIAL SCIENCES

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HOST LABORATORIES IN HUMAN AND SOCIAL SCIENCES

CENTRE D'ÉTUDES SUPÉRIEURES DE LA RENAISSANCE (CESR) UMR 7323 - UNIVERSITÉ DE TOURS, 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 of Tours in 1970. Successive agreements in 1983 and 1992 enhanced the institutional links between the CESR and the CNRS. In 1996 the CESR reaffirmed 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 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'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.



CITÉS, TERRITOIRES, ENVIRONNEMENT ET SOCIÉTÉS (CITERES) UMR 7324 - UNIVERSITÉ DE TOURS, CNRS



The interdisciplinary research unit (CNRS UMR) CITERES was created in 2004 to strengthen and structure the research capabilities of the University of Tours on the broad topic of "Cities, Territories, Environment and Society", performed by a team of specialists from sociology, geography, anthropology, history, economics, urban planning, and political sciences. Four research teams work on archeology and paleontology of the Loire Basin (LAT), on social-political analysis (COST), on the Arab World and North African Mediterranean (EMAM), and on Environmental and Urban Management (DATE). The latter hosted the LeStudium fellow (by DATE member Karl M. Wantzen, UNESCO Chair Fleuves et Patrimoine – River Culture).



INTERACTIONS CULTURELLES ET DISCURSIVES (ICD) EA 6297 - UNIVERSITÉ DE TOURS



The interdisciplinary research unit Interactions Culturelles et Discursives (ICD, EA 6297) was born in 2012 with the merger of four groups belonging to the Letters, Languages and Human Sciences sector and grouping colleagues from two faculties (Letters & Languages, and Arts & Human Sciences). The new entity allows the collaboration of academics working in different departments such as Anglo-American Studies, Spanish, Ibero-American and Portuguese Studies, Law and Languages, Ancient and French literatures, Philosophy, etc. The programme for 2018-2023 is entitled 'Liberties' and, in the wake of the previous programme ('Paradigms of authority' - 2012-2017), it deals with the description and analysis of forms of liberty, and the times/places where liberty was/is in crisis, in the various fields of the arts, literature, and social and political life. It is devised around three main research axes: 1) Culture and politics, colonial and postcolonial studies: the politics of cultural and national diversity, subversion of the norm and creation of the possible, postcolonial modernities and transformations in/of culture; 2) Writing and other discursive practices: liberty and censorship or esthetic constraint, creation and interpretation (literature, music, theatre, cinema), translations and cultural transfer; 3) Constructed and deconstructed identities, genders: popular and mass cultures, re-reading of «gender discourses», representations of the body and environmental humanities. While never renouncing the specificities of academic research corresponding to the sections inherent to the French university system, the group encourages transdisciplinary studies. All of the axes are characterized by convergences in the problematics contemplated and researchers may move freely between them. The members of the group may thus work along several axes.



POUVOIR, LETTRES, NORMES (POLEN) EA 4710 - UNIVERSITÉ D'ORLÉANS



POLEN's areas of research concerns the issues of power and authority in their different forms (political power, religious authority, social practices, cultural, literary and artistic models, legal frameworks and judicial norms). It addresses their different modes of expression, representation and diffusion (texts, images and all forms of symbolic and artistic production). These topics raise a contrario, questions of contestation, subversion and marginality.

This general project is addressed in particular ways by the different component research groups according to their particular focus and the research fields of their members.

Teams of POLEN :

- CESFIMA : Centre for Research into the Late Middle Ages : the construction of norms and models by centres of authority and learning ; the diffusion, contestation and reconstruction of knowledge, norms and models.
- CLARESS : From the Classical Age to the Restoration of the French Monarchy: private and public practices of writing and reading; the writings of the inner self; authority and the written word; the interaction of the public and the private in written practices.
- CEPOC : Centre for Contemporary Political Studies: the types and norms of political discourse; the social and cultural connections between literature and politics; memory and its written expression; non-discursive political writing (images, rituals, ceremonies).

POLEN is member of Human Sciences Loire Valley's Home.





Dr Raphaël Cahen

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: Contextual Research in Law (CORE) - BE

In residence at: POLEN (POuvoirs, L'Etres, Normes) / - Orléans

Nationality: Belgian

Dates: September 2020 to October 2021

Raphaël Cahen is a Post-doctoral Fellow as well as a visiting professor in Legal History at the Vrije Universiteit Brussel (VUB). He has studied law, history and political sciences in Aix-en-Provence, Perugia and Munich, and holds a Joint PhD in Law and political sciences from Aix-Marseille University and the LMU Munich (Prize Montesquieu AFHIP 2017, 2th Best Phd Prize of AHFD 2015, AMU Prize Peiresc for the best international PhD). He has been awarded an FWO Incoming Pegasus Marie-Sklodowska Curie Fellowship (2017-2019) and has been teaching a master course on the history of International Law at the VUB (2018-2021). He is doing research on intellectual history, as well as history of institutions and international law. He is co-supervising the PhD thesis of Wouter de Rycke on "The Legal Construction of Peace before 1870. Networks and Arguments" for which he has been co-awarded a FWO Junior Fellowship Research Project (2020-2024).



Prof. Pierre Allorant Host Scientist

Contemporary Historian for Political Studies, Professor Pierre Allorant is also a Lawyer, and since 2016 Director of Law, Economy and Management unit of formation and research in University of Orleans. He works on French prefectorial corps, municipalities, and the relationship between the Minister of internal affairs and the departments and regions since the French revolution. He has published several books on War memories, letters, private papers, and representations. Such a book on the « Lieux de mémoire » in Loire Valley and Berry. Furthermore, he is investigating the French administration and the questions of centralisation and decentralisation. He has studied the foundation of Compared Legislative Society, the first French « think tank » appeared in 1869, at the end of the Second Empire.

INTERNATIONAL LAW IN FOREIGN AFFAIRS MINISTRIES (1793-1871): SOCIOLOGICAL AND CULTURAL HISTORY OF INTERNATIONAL LAWYERS

It was recently observed that the jurists involved in the Austrian foreign affairs ministry from 1815 onwards had not been studied (Gruner, 2017). The same can be said about international lawyers in France, one of the most important cases involving jurists is, of course, the question of indemnities that France had to pay after the Treaty of 1815 and the occupation of the country (Haynes, 2018; De Graaf, 2020). But to get an insight in the cultural and sociological interaction between foreign affairs and international lawyers (in the French case) one must also study first the office of "Legal Adviser (Jurisconsulte du ministère des affaires étrangères) and then the litigation committee that was created in 1835. This five-member committee was established to deal with the growing number of affairs after the Peace of 1815 (Cahen, 2019). Although mentioned in studies of the French foreign affairs ministry, this committee has not yet been studied (Baillou, 1984). Yet, its importance and the fact that its activities were growing, especially at the time of the Second Empire, were underlined (Bruley, 2012). The most recent research has also stressed its importance, but again for the period after 1871 (Rygiel, 2018). The foreign affairs archives contain extensive unpublished sources on the committee (about 500 boxes) that need to be explored: How was the committee organised? What types of cases were mostly examined by the committee? Were they mostly related to private or public International law issues? Who were the jurists involved in it? What were their networks and connections? As a first answer to these questions, it may be noted that most of the presidents of the litigation committee were jurists who had all emigrated and belonged to the same networks, as members of the Hautevive School of Diplomacy as shown recently (Cahen, 2020).

In order to study the history of this committee, it is fundamental to do a prosopography (a collective study of the biographies) of its in line with the previous work carried out by the historian Christophe Charle about the professor of the faculty of humanities in Paris (1985-1986) or the professors of the Collège de France (1988). None of the first presidents are well known in the historiography. Neither Edouard Mounier (1784-1843), president from 1835 to 1837, who was also in charge of the debt committee from 1815 to 1818 and a member of the French delegation at the congress of Aix-La-Chapelle, nor Joseph-Balthazard Siméon (1781-1846), president from 1837 to 1846, who was both a diplomat and a jurist and whose private archive contains an unpublished manuscript upon the "law of nations" (French National Archives, Fonds Siméon, 558 AP/4) have been studied extensively to date. Regarding Joseph-Marie Portalis, president from 1854-1858, a conference proceeding has recently partially filled this research gap (Cahen, Laurent-Bonne, 2020).

This case study would also have a transnational and comparative dimension as it aims to compare the French case with Belgium and Austria to see how jurists have been involved in Foreign offices in these countries. Indeed, although juridical sections of foreign offices have mostly been created only after the First World War, precisely in 1919 in Belgium (Coolsaet, Dujardin, Roosens, 2014) and in Austria, international lawyers were involved in foreign offices in the period 1815-1871 in the making of treaties, as well as arbitration and in other legal cases concerning international relations, thus shaping the culture of international law (Genin, 2018; Matsch, 1986, Conze 2013; Bullen 1984).



Prof. Richard Freedman

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: Department of Music, Haverford College - US

In residence at: Centre for Advanced Studies in the Renaissance (CESR) - Tours

Nationality: American

Dates: January 2019 to January 2020

Freedman's scholarly research focuses on the music of the Renaissance: its cultural context and its contrapuntal workings. His writings have appeared in leading scholarly journals, and in two books, *The Chansons of Orlando di Lasso and their Protestant Listeners: Music, Piety, and Print in Sixteenth-Century France* (Rochester, 2001) and *Music in the Renaissance* (W.W. Norton, 2012). Freedman has also taken on leadership roles in digital work for the leading academic societies devoted to musicology. He was chair of the Technology Committee of the American Musicological Society (the leading organization of the field), and board member and chair of the Digital and Multimedia Committee of the Renaissance Society of America, another leading academic society. In 2019 he began a term as a member of the Board of Directors of the Répertoire International de Littérature Musicale (RILM), the leading bibliographical resource for musicology.



Prof. Philippe Vendrix Host Scientist

Philippe Vendrix is the former Director of the Centre d'Études Supérieures de la Renaissance (2008- 2015). He obtained his PhD in 1991 in musicology with the highest distinction from the examination jury at the University of Liège. He has been a member of Council of the American Musicological Society, 2001-2004. Elected in 2010 to the Alumni College of the Belgian Royal Academy. He has editorial management responsibilities of various collections including Ricercar. He is on the editorial board of leading publications in musicology and a member of the Scientific Council of Répertoire International de Littérature Musicale, New York and the European Science Foundation. He was the president of the University of Tours from 2016 to 2020.

CITATIONS: THE RENAISSANCE IMITATION MASS (CRIM)

CRIM poses a simple but provocative question: What is similarity in music? The allusiveness of musical discourse is so fundamental to the Western tradition that it is hard to imagine a work that does not in some way make reference to some other composition, type or topic. Indeed, over the last 1000 years music has continued to reference earlier pieces, from rampant borrowing of George Frideric Handel to the looped sampling heard in hip-hop. Citations: The Renaissance Imitation Mass (CRIM) focuses on an important but neglected part of this allusive tradition: the so-called "Imitation" or "Parody" Mass of the sixteenth century, in which short sacred or secular pieces were transformed into long five-movement cyclic settings of the Ordinary of the Catholic Mass: Kyrie, Gloria, Credo, Sanctus, and Agnus Dei. The resulting works are far more than collections of quotations. The sheer scope of the transformation required the composer to re-think the model: shifting, extending, or compressing ideas in new musical contexts and to meet new expressive purposes. If counterpoint is a craft of combinations, then the Imitation Mass involves the art of recombination on a massive scale. These works offer an unparalleled way to learn how composers heard (and understood) each other's music.

Freedman's fellowship with Le Studium gave him the time to:

1. evaluate the results of the first phase of work on CRIM
2. select works for the next phase of CRIM
3. work with IT specialists to elaborate the CRIM web site
4. explore machine-assisted systems for analysis and discovery of musical patterns
5. craft interpretive essays and commentaries based on data gathered to date

The pace of collaborative work, and especially the collaborative development of digital tools, often proceeds both more slowly and more quickly than originally anticipated. The year in Tours was no exception in this respect. Curation the archive of CRIM analyses was painstaking. Some aspects of our technical development of software were also slow, mainly on account of the limited availability of some of our part-time consultants. But on other fronts we made much progress. Thanks to the presence in Tours (and at the CESR) of Le Studium Fellow Emilio Sanfilippo, we advanced the conceptual and computational standing of our analytic categories, in particular via the notion of «ontologies» by which machines can identify and locate related digital objects. Work with Daniel Russo-Batterham, an Australian musicologist and data-scientist and long-time CESR collaborator, produced meaningful visualization and pattern-finding engines that will help scholars understand «similarity» in new ways. Meanwhile Freedman's interactions with other Le Studium scholars showed how tools from other fields might be used to explore musical data, too. But by far the most important progress was made at the human level, as Freedman traveled to give conference presentations, teach graduate seminars, and finally in convening the workshop-conference (see below) that helped us refine our methods, identify new repertoires, and outlined a series of modular units in which research and pedagogy would mutually inform each other in the years ahead.



Dr Jean-François Deluchey

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: Federal University of Pará - BR

In residence at: Cultural and Discursive Interactions (ICD) - Tours

Nationality: French

Dates: January 2020 to July 2021

Dr. Jean-François Deluchey is a political scientist, with a PhD in Political Science / Public Policies from the Sorbonne Nouvelle University (Paris 3). He is Professor of Applied Social Sciences Institute / Faculty of Social Work/ Master and PhD of Law Studies/Master and PhD of Social Work in the Pará Federal University (UFPA). He has been a postdoctoral Fellow in Law from PUC University (Rio de Janeiro) and in Sociology at Sophiapol / Paris-Nanterre University. He also leads the CESIP-MARGEAR CNPq research group (Study Group on Violent Normalizations of Lives in the Amazon). He is an active member of the GENA research network (Study Group on Neoliberalism and Alternatives, Laboratory Sophiapol, Université Paris Nanterre). His expertise lies in political science and sociology of law, especially critical theory, state theory, public safety and methodology of social sciences. In his research, he studies the following fields: criminal law enforcement system, neoliberal governmentality, public safety, police forces, state and political system, democracy, state management, Brazil and Amazonian Region. His current research concerns «the extermination of peripheral youth in the Brazilian Amazon region».



Dr Nathalie Champroux Host Scientist

Nathalie Anna Champroux passed her Habilitation to Supervise Research in November 2017 and was appointed Professor at the University of Tours in Sept. 2018. At the Faculty of Letters and Languages, her teaching mainly concerns British history and economic life. Her research focusses on British monetary policy since 1945 and she has worked extensively on the MTFS implemented by the Thatcher governments. At the University of Tours, she gathered a group of researchers of ICD and IRJL around the theme of the Anglo-American neoliberalism of the 1980s, its origins, characteristics and spread. She launched a monthly seminar (Le Libéralisme dans tous ses États) in January 2019 and proposed a two-day conference to be held in March 2021, for which her group was granted 9 200 euros by the University Research Commission and 2 000 euros by the Region. She is currently busy supervising the organisation of both and helping Jean-François Deluchey in his projects.

AT THE MARGINS OF NEOLIBERAL GOVERNMENTALITY: THE EXTERMINATION OF PERIPHERAL YOUTH IN THE BRAZILIAN AMAZON REGION

This project proposes to analyze and describe the phenomenon of the extermination of peripheral young people in Amazonia and will try to discover to what extent this politics of death (thanatopolitics) constitutes a structuring apparatus of the neoliberal governmentality, by operating a calculation of the value of the human in market-oriented terms, in an outermost region of the neoliberal capitalist order. This aim shall be complemented by the implementation of four specific aims:

1. Analyze, quantitatively and qualitatively, the phenomenon of "chacinas" (multiple killings), putting it in perspective with the national situation and the growth of lethal violence in the Amazon region during the 2010 decade;
2. Identify, in written media and sociological interviews, how certain discourses explain (and/or legitimize) the extermination of peripheral (black) youths in Brazil and the Amazon, as well as the process of social differentiation to which it is related;
3. Identify if there is, and through what modalities it is carried out in the Brazilian Amazon, a calculation serving as a basis for a social differentiation between, on the one hand, those who are useful to the market and deserve to live and, on the other hand, those who are useless and deserve to die or to be imprisoned;
4. Reflect on the relation between the phenomena under study (extermination of peripheral youth and neoliberal governmentality) and the concepts of life/survival/death, war, (ultra)periphery, marginality, value, human capital, precariousness, colonialism, biopolitics/thanatopolitics and racism.



LE STUDIUM CONFERENCES

WHAT ARE OUR LIVES WORTH TO A NEOLIBERAL GOVERNMENT?

CAPITALISM, WAR AND BIOPOLITICS IN THE PANDEMIC ERA

The conference entitled "What are our lives worth to a neoliberal government?" took place virtually on November 18 and 19, 2020.

As Michel Foucault taught us, neoliberalism is an «art of governing». Based on the «regime of truth» of the market, this governmentality normalizes and moralizes subjectivities under the horizon of capital accumulation (economic, social, cultural, symbolic). Neoliberalism has shaped a biopolitical «way of the world» which, through the logic of a radical utilitarianism based on competition, individual responsibility, economic inequalities and the universal empire of value, downgrade the value of human lives in favor of profit opportunities. In the neoliberal order, the value of human life has always been a critical issue; with the COVID-19 pandemics, this issue is even more relevant and needs to be addressed urgently. More recently, neoliberal governments have deployed authoritarian neoconservative political agendas that promote a policy of destruction of the Commons, that is also combined with a policy of death (necropolitics) towards the populations or social groups considered as useless (or surplus) under the neoliberal processes of normalization and moralization. This is the reason why we are witnessing today, in the political field, clashes that radically oppose identities, nationalities, religions, and ways of life. These clashes embody a somehow «global civil war», where violence is felt everywhere and by everyone, and where hegemonic groups intend to neutralize the lives of those who represent obstacles for the implementation of their political agenda. The aim of this scientific colloquium is therefore to put into perspective critical interdisciplinary reflections on the issue of the value of the human being under a neoliberal and bio-necro-political capitalist order.



AROUND THE PROJECT

Oral communications

- « Le nécro-gouvernement néolibéral ». December 14th, 2020. (ICD Seminar, *Le libéralisme dans tous ses États*).
- **Neoliberalism, Authoritarianism and Neo-conservatism.** Panel Moderation. November 19th, 2020. (Le Studium Conference, *What are our lives worth for a neoliberal government? Capitalism, war and biopolitics in pandemic era*).
- **The Capitalism's War on Human Lives (with Silvia Federici).** Panel Moderation. November 19th, 2020. (Le Studium Conference, *What are our lives worth for a neoliberal government? Capitalism, war and biopolitics in pandemic era*).
- « L'extermination des jeunes Noirs au Brésil : une manifestation cruelle du nécrogouvernement néolibéral ». November 18th, 2020. (Le Studium Conference, *What are our lives worth for a neoliberal government? Capitalism, war and biopolitics in pandemic era*).
- « Le néoliberalisme est-il un totalitarisme? ». Séminaire Philosophie (M2, Prof. Juliette Grange). Université de Tours. October 6th, 2020.
- **“Necropolítica e abjeção dos corpos na guerra pandémica”.** July 6th, 2020. (Virtual Conference at Catholic University of Rio de Janeiro – PUC/RJ, *Pandemia e Pós-pandemia: Caminhos e Desafios*).
- **“At the margins of neoliberal governmentality: the extermination of peripheral youth in the brazilian Amazon region”.** June 16th, 2020. (Seminar Le Studium Conseil Scientifique 2020 Programme).

Scientific Publications

- Book Chapter (14 pages) **“Historicité et legs de l'esclavage pour notre contemporanéité”**. To be published at Kimé Editions in 2021 in the collective book: *Esclavages et antiesclavagismes : réalités, discours et représentations*.
- Contribution to the collective book of the GENA research group, to be published in French in the first semester 2021, with Prof. Christian Laval & Prof. Pierre Dardot as leading editors (the book should be entitled *Le Choix de la Guerre Civile*).
- Book Edition Project: The oral contributions to *Le Studium Conference* (**“What are our lives worth for a neoliberal government? Capitalism, war and biopolitics in pandemic era”**), held November 18th and 19th, 2020, will be published in French in 2021 as a collective book edited by Prof. Nathalie Champroux and myself, with Kimé Editions. The title of the book should be the following: *La valeur néolibérale de l'Humain. Capitalisme et biopolitique à l'ère pandémique*.
- Published Article 1 (18 pages, in English) co-written with Bárbara Dias: **“The total continuous war and the Covid-19 pandemic: Neoliberal governmentality, disposable bodies and protected lives”**. Law, Culture and the Humanities, v. Nov20, p. 1-18, 2020.
- Published Article 2 (02 pages, in French) co-written with Dr. Antonio Pele (PUC-RJ, Brazil): **“Au Brésil et ailleurs : Risques noirs, sécurité blanche”**. The Conversation, December 2020.



Dr Valérie Hayaert

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: Käte Hamburger Kolleg «Law as Culture», University of Bonn - DE

In residence at: Center for Advanced Studies in the Renaissance (CESR) - Tours

Nationality: French

Dates: September 2020 to October 2021

Valérie Hayaert is a classicist, historian and humanist researcher of the early modern European tradition. Her particular interest lies in the mens emblematica, the humanist lawyers' invention of woodcut depictions of legal and theological themes, in the tradition of playful seriousness or serio ludere. In 2006, she was awarded the Prize for the best interdisciplinary thesis by the Alumni Association of the European University Institute. Her first book 'Mens emblematica et humanisme juridique' was published in 2008 by Droz, Geneva. She has been a co-editor of the journal Emblematica: an Interdisciplinary Journal for Emblem Studies (AMS Press, New York) from 2014 to 2017. Her subsequent work looked at the aesthetics of justice in courthouses of the early modern period until today, carrying a reconstruction of the visual promulgation of law further by examining not only the tradition of juristic emblems but also reviving the analysis of the wide variety of images - trees, diagrams, illustrations, genealogies, allegories and various artefacts. In 2017 and 2018, she contributed to two major exhibitions both held in Belgium at the Groeningen Museum of Bruges, "The Art of Law" (16-10 2016 to 7/01/2017) and at the Museum Hof Van Busleyden in Mechelen, [Call for Justice 23 March-June 24, 2018].



Prof. Stephan Geonet Host Scientist

Professor Stéphan Geonet, graduated from ENS Fontenay/Saint-Cloud, teaches at the CESR. He is a junior member of the Institut universitaire de France since 2009. He makes his research in Renaissance Literature in the perspectives of ethical and legal questions. Major historical figures in his research include Rabelais, Montaigne and Marguerite de Navarre, not to speak of Louis Le Caron, to whom most of his recent interests are dedicated, particularly La Claire. Ou De la prudence de droit (1524). Professor Geonet's activities cover many other areas including the site Epistemon (University of Poitiers) and the Bibliothèques virtuelles humanistes (University of Tours). He published 15 books and 50 articles: For instance, La notion de perplexité à la Renaissance (Genève: Droz, 2006) and Littérature et Droit, du Moyen Âge à la période baroque: le procès exemplaire (collaboration with B. Méniel, Paris: Champion, 2008).

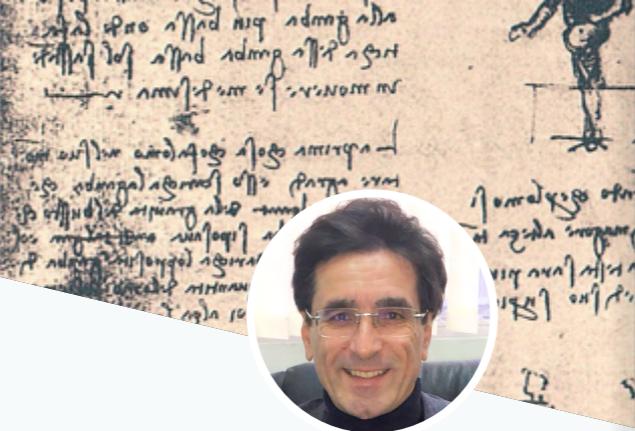
JUSTITIArt : IMAGES OF JUSTICE : A EUROPEAN SURVEY OF LEGAL SYMBOLISM

In Europe, most of today's courthouses are symbolically silent. Because Justice not only needs to be done but also needs to be seen to be done, this project challenges the claim that images of justice have an important role to play in the maintenance of social bonds. The power of judicial images is a useful ally to revive the foundational principles of fair trial and due process. What are the benefits and what are the limits of drawing on the past tradition of judicial symbols in Europe?

Drawing inspiration from visual studies, cultural legal history, visual anthropology and performance studies, this multidisciplinary investigation aims at revealing the essential dynamic function of a civic allegory : its composition or invention, its role into the dissemination of meaning and the ways in which it was perceived by different audiences, in order to question to which extent this device fulfilled didactic, persuasive, mnemonic, evidential, or deontological functions. Artworks are full social agents, situated at the interface of institutions and emotions.

The project combines historical case studies (1450-1800) with a theoretical approach aiming at defining the power of images within the legal sphere. It analyses courthouses precincts, legal symbolism and territorial patterns in four geographical areas (Belgium and the Netherlands, France, Italy and the United Kingdom).

At present, my primary focus has been to study allegories of Justice. I'm currently writing a book on the topic. Interest in the allegories of Justice is triggered by several trends in cultural and visual studies, whereby aesthetic expression is approached through cognition, performance and an awareness of Lady Justice as a sensual and spiritual body. The main goal of this book is to suggest that allegory is carnal knowledge : as a performative body, Lady Justice brandishes her attributes through powerful gestures and this aspect of the representation has rarely been recognized and analysed. Instead of focussing on the semiotic nature of the fixed grammar of attributes as objects, we will examine how she gestures towards meaning as a subject and how her moral body is used as an intermediary bridge between subject and signified. Her body will serve as an index to the analysis of salient gestures and that is the reason why the table of contents proposed follows an anatomical line.



Prof. Salvatore Magazù

LE STUDIUM Research Professor
Smart Loire Valley General Programme

From: University of Messina - IT

In residence at: Center for Molecular Biophysics (CBM) - Orléans

Nationality: Italian

Dates: July 2020 to October 2020

Salvatore Magazù is full professor of experimental Physics at Messina University, president of Interuniversity Consortium of Applied Physical Sciences, member of L'Oréal-UNESCO For Women in Science Jury, and member of the National Commission of Experimental Physics. In 2016-2017 he was Le Studium research fellow at CBM and ICMN [CNRS], from 2013 to 2015 chair of the Le Studium Consortium COSMO, from 2010 to 2012 president of scientific board of European Synchrotron Radiation Facility, from 2009 to 2010 Le Studium researcher at CEMHTI-CNRS, and from 2008 to 2010 member of the scientific college of Institut Max Von Laue - Paul Langevin. He is spin-off founder and president of the Scientific Council of the Start-up ATHENA Green Solutions. His research activity has produced 343 Scopus scientific publications, an H-index of 46, and many awards, among which the Scientia Europa 2000 Award by the French Academy of Sciences.



Prof. Pascal Brioist Host Scientist

Pascal Brioist is a University Professor in History and member of the Center for Higher Renaissance Studies (CESR) since 1994. He is specialist in cultural history and history of England (PhD from the European University Institute in Florence in 1992). His work is currently mainly in the field of the history of science and technology. He is member since 1995 of the steering committee of the French Society for the History of Science and Technology. He has published several articles on the intellectual and scientific history of the Renaissance and in 2002 designed the scientific design of Leonardo da Vinci Park in Clos-Lucé in Amboise. He is currently in charge of feeding the Renaissance website for which the CNED and the CESR share responsibility.

INTERDISCIPLINARY ANALYSIS OF THE LEONARDO DA VINCI'S STUDIES ON DYNAMICS

The main goal of the project is to study the scientific production of Leonardo da Vinci concerning the dynamics by means of an integrated approach that combines exact and human sciences, and more specifically physics and history.

Within this general goal, the following specific aims have been identified:
 i) recognition and comparative source analysis of the network of scholars, artisans and texts for a reconstruction of the cultural, scientific and technical framework in which Leonardo elaborated his dynamics concepts;
 ii) impact of the Leonardo's work on dynamics in the present research fields;
 iii) impact of the Leonardo's work on dynamics in the present educational field; iv) evaluation of the Leonardo's work as an innovative tool for the "third culture" promotion.

In order to reach these goals, the analysis of the Leonardo's studies on dynamics has followed two main driving lines: i) to place his findings in his time context and ii) to establish connections with the current scientific theories.

To date the most noteworthy achievements concern the recognition and comparative source analysis of the network of scholars, artisans and texts for the reconstruction of the cultural, scientific and technical framework in which Leonardo elaborated his dynamics concepts. In particular, the sources which so far have been taken into account are: i) sources of which Leonardo had direct knowledge and which intersect almost all the fields of his time knowledge, without having the pretension of a total and exhaustive screening; ii) sources contemporary to Leonardo from which he may have viewed the unmistakable philosophical profile of the Medici Florence; iii) indirect sources, i.e. the ancient and modern critical studies that, with variously modulated critical purposes and aims, have collected, preserved and thought about the work of Leonardo; iv) the assessment of the fundamental contribution constituted by the corporative knowledge transmitted orally to Leonardo in his training workshop ("bottega"). Furthermore, the Leonardo's concept of physical infinitesimal has been investigated and compared with the infinitesimal concept introduced by Aristotle and Archimedes.

Finally, it has been shown how the interdisciplinary approach adopted by Leonardo made him an icon of the "third culture" and his work able to stimulate critical interdisciplinary thinking.

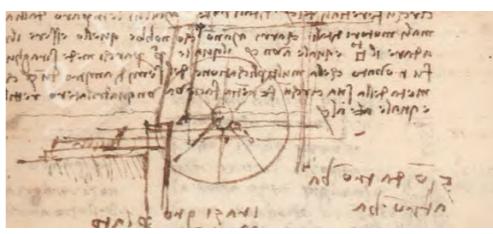


Fig. 1 Manuscript G folio 96r. Operative approach for the calculation of the circumference length as introduced by Leonardo da Vinci.

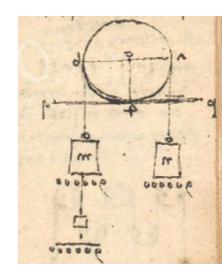


Fig. 3. Codex Forster II folio 125 r. Application of the concept of physical infinitesimal, namely of a finite quantity conveniently small.



Fig. 2: Codex Atlanticus folio 230r. Operative procedure for the evaluation of the definite integral as proposed by Leonardo da Vinci.



Dr Margriet Hoogvliet

LE STUDIUM / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: University of Groningen - NL

In residence at: Centre for Renaissance Graduate Studies (CESR) - Tours

Nationality: Dutch

Dates: June, 2019 to June, 2020

Dr Margriet Hoogvliet earned her PhD "cum laude" (the highest honour in the Netherlands) in 1999 with the thesis "Pictura et Scriptura": a study of text-image relations in maps of the world from the twelfth to the early seventeenth century (published in 2007 in the Brepols series *Terrarum Orbis*). Alternating with teaching and researching, positions with the universities of Groningen, Utrecht, Amsterdam, Paris Sorbonne/EPHE, and Leeds, she has worked since 2009 as a postdoctoral researcher, first for the project *Holy Writ and Lay Readers: A Social History of Vernacular Bible Translations in the Fifteenth Century*. She is a successful co-applicant of COST Action IS1301 "New Communities of Interpretation" (2013-2017) and of the project "Cities of Readers: Religious Literacies in the Long Fifteenth Century" (Dutch Research Council [NWO], 2015-2020). Margriet Hoogvliet has published frequently and widely on the biblical and religious reading cultures of lay people living and working in the towns of late medieval France and the advanced religious participation of middle-class and poor laypeople.



Prof. Chiara Lastraoli
Host Scientist

Prof. Chiara Lastraoli is the vice-direktor of the Maison des Sciences de l'Homme Val de Loire. Professor of Italian Studies at the CESR and at the Faculty of Languages and Literatures of the University of Tours; her teaching and research explore the relation of Italian and French Renaissance Literatures to theology, propaganda, book trade, and the history of scholarship. She is in charge of the "Bibliothèques Virtuelles Humanistes" program (CESR), and she has published numerous essays on Renaissance authors and printers. Recently she has published a monographic volume on Pasquinate, grillate, pelate e altro Cinquecento librario minore. She is also the coordinator of the EDITEF project on Italian Books and Book Collections in Early Modern French Speaking Countries, financed by the "Agence Nationale pour la Recherche", and the project ECRISA (L'Ecriture, ses supports, ses archives) financed by Region Centre-Val de Loire.

RELIGIOUS « LIEUX DE SAVOIR » IN PREMODERN TOURS AND ORLÉANS: A SOCIAL AND SPATIAL APPROACH TO RELIGIOUS READING IN FRENCH (C. 1450-C. 1550)

This project intends to show that up to ca. 1550 many of the inhabitants of "average" French towns as Tours and Orléans were literate and that they did have access to religious texts in French. Centuries-old documents from the historical archives and library collections, such as surviving administrative records, handwritten books, and early prints will provide information about the wide range of social backgrounds of the readers, from a stocking maker in Orléans to well-off merchants and lawyers. The research also aims to retrace how religious texts were disseminated through social networks connecting these readers. Furthermore, the religious reading activities by lay people in Tours and Orléans are analysed from a spatial perspective. Where could late-medieval city-dwellers go to learn to read, to purchase books, or to consult religious texts in open access? What happened to a private home or workshop when it was also a space of religious reading? Reading activities, books, libraries, and book collections are also studied as places of knowledge (lieux de savoir), where knowledge was created, stored, accessed, or disseminated.

The historical data often allow plotting these places of knowledge on historical maps of premodern Tours and Orléans. Further analysis of these places of religious knowledge by making use of computerized Geographical Information Systems will allow for even more refined conclusions about spreading, concentrations, and accessibility. The research plans to explore the possibilities of a smartphone app for a touristic route and other outreach activities.

Since June 2019, the wonderful library of the CESR delivered a detailed knowledge of the existing research publications concerning the urban history of Tours and Orléans, most notably about book production, book ownership, libraries, schools and other places of knowledge. Next to this ongoing study of the scientific literature, I have researched the following historical sources i) in the inventory of a book seller in Tours, (Chereau in 1868), ii) in Tours public library archives showing enormous document-based bureaucracy of the town and the socially widespread use of written documents in the urban culture, iii) in Books from the collections of the public libraries of Tours and Orléans, Bibliothèque Nationale de France, Bibliothèque de l'Arsenal showing considerable number of manuscripts and early prints that can be related to Tours and Orléans, iv) the minutier des notaires in the Archives Départementales in Tours. I have furthermore identified five manuscripts with religious texts accompanied by a family diary (livre de raison) noted by the lay book owners themselves. Another witness of the writing activities by lay people is Tours, BM, Ms 231, a Book of Hours copied by Nicolas Rolet in the early years of the sixteenth century. There are several indications that this book originated from the Loire Valley (references to Vendôme and to Saint-Martin in Tours). Sources as these will be the basis of an additional publication about lay people as writers and authors in late medieval Tours and Orléans.

LE STUDIUM CONFERENCES

SPATIAL HUMANITIES AND URBAN EXPERIENCES DURING THE LONG FIFTEENTH CENTURY

Due to the COVID-19 crisis and the "confinement" in France the STUDIUM conference was replaced by an online conference of one afternoon on 11 May 2020. Professor David Bodenhamer (Indiana University – Purdue University) gave a very relevant key-note lecture about the shortcomings of GIS and its "positivistic" epistemology, as well as possibilities to adapt GIS packages for historical and cultural research ("deep maps"). All participants could present their paper online and addressed various aspects of GIS mappings for the Digital Humanities and the usefulness historical urban plans. A number of the papers presented will be published in the online journal "Peregrinations" (<https://digital.kenyon.edu/perejournal/>), with a foreword by David Bodenhamer, an introduction by Margriet Hoogvliet and Chiara Lastraoli, and an article written by Margriet Hoogvliet and David Rivaud (researcher CESR).



Scientific Publications

- Margriet Hoogvliet, "Une collection de livres en français à lire, à copier, à emprunter et probablement à vendre, à Tours vers 1500", online publication Renumar <http://renumar.univ-tours.fr/publication/une-collection-de-livres-en-francais-a-lire-a-copier-a-emprunter-et-probablement-a-vendre-a-tours-vers-1500/>
- Margriet Hoogvliet, "A List of 267 French Texts in Tours: A Hub for Reading in the Vernacular", *Studi di Storia Medievale e di Diplomatica n.s.* 4 (2020). In print.
- Margriet Hoogvliet, Chiara Lastraoli, "Introduction: Some Thoughts about Spatial Humanities and Urban Experiences During the Long Fifteenth Century", *Peregrinations: Journal of Medieval Art and Architecture*. Submitted.
- Margriet Hoogvliet, David Rivaud, "Tours around 1500: Deep Mapping Scribes, Booksellers, and Printers", *Peregrinations: Journal of Medieval Art and Architecture*. Submitted.
- Margriet Hoogvliet, "Rhétoriqueurs and Amateurs: Lay People writing Religious Texts in Tours around 1500", will be submitted shortly to *Viator: Medieval and Renaissance Studies (Brepols)*



Dr Esperanza Rodríguez-García

LE STUDIO Guest Research Fellow

From: NOVA University of Lisbon - PT

In residence at: Centre for Advanced Studies in the Renaissance (CESR) - Tours

Nationality: Spanish

Dates: September 2020 to August 2022

I am currently a Marie Skłodowska-Curie Actions Individual Fellow at the CESR-Université de Tours (my project was rated 100/100), while on leave from my post as a researcher at the CESEM-Universidade Nova de Lisboa (Portugal). I have also worked for higher education institutions in the UK, where I obtained my PhD. My research interests concern music-within-culture in the Early Modern period in Italy and the Iberian Peninsula. I have specialised in methodological approaches such as the history of reading, source studies and critical editing, historiography, prosopography, and museum and heritage sciences. Also, Digital Humanities is a very strong component of my research, and I have worked on database design and curating, computer-assisted musical analysis, music encoding, and valorisation of music as intangible heritage through the re-enactment of historical soundscapes.



Dr David Fiala Host Scientist

David Fiala is an Associate Professor in Musicology at the CESR-UT since 2009 and editor (2007-2013) of the *Revue de Musicologie*. He has published widely on musical patronage and musicians' careers in the late medieval and early modern periods. His other specialisms are digital humanities and e-musicology. His interests include Modelling of historical documentation; Digital Music Encoding (in MEI), investigating addressability of musical scores, digital libraries and analysis of imitation in musical works of the Renaissance and 3D/4D Modelling of musical spaces, specially by reconstructing historical buildings no longer extant. He is a member of the Scientific Board of the TGIR Huma-Num. He has co-directed three PhDs and has an extensive experience in supervising and training postdoctoral researchers from Italy, Australia, Canada, France and The Netherlands.

EXPERIENCING HISTORICAL SOUNDSCAPES: THE ROYAL ENTRIES OF EMPEROR CHARLES V IN IBERIAN CITIES'

The MSCA Individual Fellowships have a two-layer component (research and training) with complementary objectives.

The goals concerning research are:

R01. To identify, describe and assess the structural sonic and spatial elements of Royal entries in Iberian cities during the life of Emperor Charles V (d.1558). A musicologically informed overview of all the entries' accounts will enhance, through comparison, the quality of our understanding of the sources and their vocabulary.

R02. To map and contextualise sonic events within their spatial coordinates, so as to provide them with full historical and cultural meaning.

R03. To facilitate the experiencing of soundscapes through the creation of tools to retrieve and valorize them as intangible cultural heritage, in the shape of an immersive multimedia event.

The goals concerning training are:

T01. To master advanced tools for data organisation and management, including Data mining and archiving.

T02. To become proficient in managing and transforming historical data for use in digital formats through the creation of a relational database anchored to a GIS map contextualising and spatialising soundscapes.

T03. To become competent in designing multisensory immersive events (through the modellisation of the soundscape of a Royal entry).

T04. To master the theoretical framework and the techniques of digital mediation of culture, heritage and tourism applied to management and museography of intangible heritage.

In the period September-December 2020 the main focus has been on the training goals: Through the MA programme "Digital Mediation of Culture and Heritage", I have received training in Data treatment, Relational databases, theoretical framework and the Digital Humanities, and Heritage management.

As regards the research goals, I have worked on R01, with the acquisition of the data about Royal entries finished and the analysis of the information started.



Prof. Eugeen Schreurs

LE STUDIO / Marie Skłodowska-Curie Research Fellow
Smart Loire Valley General Programme

From: University College Antwerp - BE

In residence at: Centre for Advanced Studies in the Renaissance (CESR) - Tours

Nationality: Belgian

Dates: September 2020 to October 2021

Eugeen Schreurs is both a professional performer and musicologist. He studied viola da gamba (W. Kuijken) at the Brussels Conservatory (1982) and musicology at the University of Leuven (1980). He obtained his PhD in 1991 with a study on musical life in Tongeren (c.1400-1797), applying the so-called urban musicology method. As director of the Alamire Foundation, international centre of the Music in the Low Countries (1990-2002) he laid the fundament for similar studies of other cities (i.e. Antwerp, Brussels, Diest, Ghent, Lier, Maastricht). He was editor-in-chief of the Yearbook of the Alamire Foundation (1994 – 2008), and of the series *Monumenta Flandriae Musica* (1996 ff.). He taught at the University of Leuven (2002-2006) and at Antwerp Royal Conservatory (1989-present), in 2002 he co-founded, and led until 2009, Resonant, Centre for Flemish Musical Heritage. He received several awards (Province of Limburg; Belgian Royal Academy; Cera-Jeunesse Musicales).



Prof. Philippe Vendrix Host Scientist

Philippe Vendrix is the former Director of the Centre d'Etudes Supérieures de la Renaissance (2008-2015). He obtained his PhD in 1991 in musicology with the highest distinction from the examination jury at the University of Liège. He has been a member of Council of the American Musicological Society, 2001-2004. Elected in 2010 to the Alumni College of the Belgian Royal Academy. He has editorial management responsibilities of various collections including *Ricercar*. He is on the editorial board of leading publications in musicology and a member of the Scientific Council of Répertoire International de Littérature Musicale, New York and the European Science Foundation. He was the president of the University of Tours from 2016 to 2020.

MUSIC IN THE COLLEGiate CHURCH OF OUR LADY IN ANTWERP (C. 1370 - C.1530): AN EUROPEAN HUB?

Until now, research on music in the collegiate church of Our Lady in Antwerp has mainly focused on the 'Golden' sixteenth century, but not on the fifteenth when its foundations were laid. The latter period has not been the subject of a comprehensive musicological study meeting today's scholarly standards, yet it was precisely then when composers of international renown were employed at Antwerp's main church. This immense building, then still unfinished but with the magnetism of a Gothic cathedral, was the city's musical epicentre. Composers such as Ockeghem, Barbireau, and Obrecht flourished here. Close ties with the chapels of both the Burgundian-Habsburg court and the pope, its position of favour with the Habsburg monarchs, bustling commercial contacts throughout Europe, and donations to the church from wealthy citizens wanting to ensure their salvation made it of northern Europe's most important capitals, famous among many things for music.

The primary intention of this study is to arrive at a better understanding of the mechanisms underlying this rich music scene, and to place them in their urban, socio-cultural, and European contexts. This contextualization, along with an interdisciplinary approach to the issue, will undoubtedly provide a new and better explanation for the blossoming of this extraordinary musical culture. The existing studies on the subject mostly consider the period after c.1490 and do not take account of an essential part of the cathedral's archives or of the historical context. The project described here proposes new approaches that consider music to be an essential element of a vital liturgical and urban context. This research will improve our understanding of how the many Renaissance compositions at the Church of Our Lady were performed and heard, and permit better historical reconstructions of their acoustical and visual environments.





Dr Emilio Maria Sanfilippo



LE STUDIUM Research Fellow
ARD 2020 INTELLIGENCE DES PATRIMOINES Programme

From: Laboratory of Digital Sciences of Nantes (LS2N) - Nantes

In residence at: Centre for Advanced Studies in the Renaissance (CESR) - Tours

Nationality: Italian

Dates: April 2019 to August 2020

I got a bachelor and master degree in Philosophy at the University of Catania (Italy). The interest for interdisciplinary research brought me at Saarland University (Germany), where I had a research position at the Institute for Formal Ontology and Medical Information Science (IFOMIS). I then moved to the Italian CNR and I got a PhD in Information and Communication Technologies from the University of Trento with a thesis on formal ontologies for manufacturing. I moved to France with a postdoctoral position at the Laboratory of Digital Sciences of Nantes (at the École Centrale de Nantes and CNRS), where I continued the research line of my PhD thesis. Thanks to the Le Studium fellowship, I had a great research experience at the CESR (University of Tours and CNRS) about the use of ontologies for cultural heritage. I am permanent researcher at the Italian CNR since October 2020.

Prof. Benoist Pierre Host Scientist



Benoist Pierre is a full Professor (First Class) at the University of Tours. In 2016, he has been elected Director of the CESR (UFR and UMR 7323) and of I-Pat (Intelligence des Patrimoines Programme) for five years, led by the CESR which involves several hundred researchers and more than 40 laboratories in the Centre-Val de Loire Region. His research work, which was initially on the relations between religion and politics in modern-era Europe, is currently being developed within the CESR according to three axes (i) the analysis of court societies and their relation to the State in modern Europe; (ii) the study of heritage and more particularly châteaux heritage in the Val de Loire; (iii) the notion of mediation and promotion of sciences principally on culture, heritage and humanities. Prof. B. Pierre has published 12 books, 60 papers in international peer review journals and presented 70 public talks.

ONTOLOGY-BASED DATA INTEGRATION FOR THE DIGITAL HUMANITIES

The project addresses fundamental and application research in the context of the Digital Humanities. The driving idea is about the development of computational ontologies by which multiple and heterogeneous datasets can be published in a Web environment.

Why do these efforts require research support? Let us assume that your data are about musical scores published in multiple editions. The way in which you model and describe the data depends on both your understanding of the musical domain and the terminology adopted in your working environment. Here the research challenge starts to emerge. Indeed, when you share data with other fellows, you must be sure that they understand what you mean, hence, that the intended semantics of the data is preserved in the data sharing process. For instance, what you call 'musical piece' may be called 'musical composition' by others for whom 'piece' may be used only for compositions' parts. As simple as this example can be, it depicts a source of traps, because there is no guarantee that third-parties fully understand your data when the latter are shared. Nor computer systems can fix this situation by their own, since they cannot access data meanings if the latter are not explicitly encoded.

Ontologies are formal models representing the intended meaning of a vocabulary of terms used, e.g., for data modeling/sharing in such a way to make it processable by both humans and machines. The main purpose is to enhance communication between humans, machines, or humans-machines interactions.

In the context of the LE STUDIUM fellowship, I contribute to the design of a Semantic Web ontology covering data spanning across several domains, including musicology and the study of ancient documents, as well as biology and natural heritage. The challenge is to define a conceptual framework that is general enough to encompass such a variety of data while being useful for concrete application settings. Also, despite the state of the art is quite rich, there are several notions which lack a robust conceptual and formal treatment, e.g., that of musical or literary work. For instance, when two people read Shakespeare's Hamlet, one in English and the other in French, we commonly claim that they read the same novel, even though the texts are different. Are there any principles behind this common-sense intuition? Is it possible to make a cut-off distinction between a novel and its various texts? These and other questions are fundamental when data on works have to be managed.

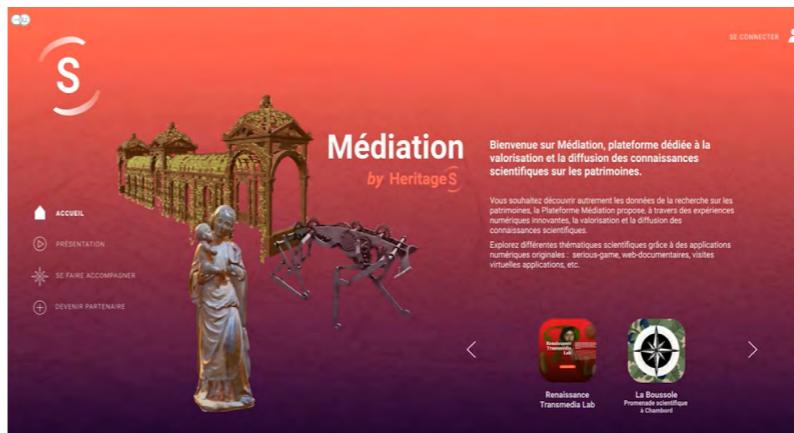
LE STUDIUM CONFERENCES

FAIR HERITAGE: DIGITAL METHODS, SCHOLARLY EDITING AND TOOLS FOR CULTURAL AND NATURAL HERITAGE

The purpose of the conference was to bring together multiple research communities and stakeholders working with Open Science and FAIR principles (Findable, Accessible, Interoperable, Reusable) for data management/sharing in the context of heritage studies. As advocated by the European Commission, FAIR principles play a decisive role to define guidelines and valuable tools for managing data in robust ways. We were particularly interested in research questions addressing both methodological and application challenges emerging from data management practices (e.g., data modeling, sharing, integration, analysis, etc.).

With the many talks given during the conference, participants exchanged a lot of thoughts about research in the Digital Humanities by coming to know about interesting research projects and initiatives world-wide. From a personal side, the conference has also contributed to enrich my academic networking allowing me to meet researchers with whom I have then started a fruitful collaboration.

The Web conference was organized in collaboration with Xavier Rodier, Director of the Maison de Sciences de l'Homme Val de Loire (MSH VdL). We had about 30 talks about fundamental and application research in the Digital Humanities; about 60 people participated to the conference. Many of them engaged in discussions and produced a document that is available on the Le Studium Web site. The recording of the conference is available, too.



AROUND THE PROJECT

Oral communications

- Sanfilippo, E.M., Towards the ontological analysis and modularization of CIDOC-CRM [v.6.2.1]. AT: 48th CIDOC-CRM SIG, virtual event, 22 November 2020
- Sanfilippo, E.M., Ontology engineering for geological modeling. AT: Knowledge's frontiers in water unsaturated hydrogeosystems: interface dynamics, heterogeneities & couplings, Le Studium Workshop, 27-28 June, 2019, Orleans, France
- Sanfilippo, E.M., Introduction to ontology engineering: Use of CIDOC-CRM for research and development at the ARD Intelligences des Patrimoines; support for tutorial on OnTop and 3M. AT: L'École DONIPAT, 14-18 October 2019, Aussois, France
- Sanfilippo, E.M., Ontology engineering for data modeling in musicology. AT: Conference on Counterpoints: Renaissance Music and Scholarly Debate in the Digital Domain, 14-16 November, 2019, Tours, France

Scientific communications

- Sanfilippo EM, Markhoff B, Pittet P. Ontological Analysis and Modularization of CIDOC-CRM. Proceedings of the 11th International Conference Formal Ontologies in Information Systems (FOIS); IOS Press, 2020.
- Masolo C, Sanfilippo EM, Lamé M, Pittet P. Modeling concept drift for historical research in the digital humanities. In 1st International Workshop on Ontologies for Digital Humanities and their Social Analysis (WODHSA). CEUR vol. 2518, 2019
- Lamé M, Pittet P, Ponchio F, Markhoff B, Sanfilippo EM. Heterotoki: non-structured and heterogeneous terminology alignment for Digital Humanities data producers, vol. 2375, 2019



Dr Rebecca Tharme

LE STUDIO / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: Riverfutures Limited - UK

In residence at: Clés, TERritoires,
Environnement et Sociétés (CITERES) - Tours

Nationality: British

Dates: November 2019 to November 2020

Rebecca Tharme collaborates with government agencies and other public, private and non-governmental organisations, to provide policy appropriate technical guidance, solutions, and capacity to meet challenges in the sustainable management of water, land, and other natural resources. She is a leading international specialist in river conservation and environmental water management and policy, with over 29 years of experience in multicultural, interdisciplinary programmes, projects and partnerships across Africa, Asia-Pacific and Latin America. Rebecca is an independent consultant and Principal of Riverfutures, and an Adjunct Principal Research Fellow of the Australian Rivers Institute. She is also a member of the Freshwater Conservation Committee of IUCN's Species Survival Commission, and of a new Technical Advisory Group for the development of Science Based Targets for Water under the Global Commons Alliance.



Prof. Karl Matthias Wantzen Host Scientist

After studying the Rhine (German Federal Institute of Aquatic Sciences), Karl M. Wantzen worked as fellow at the Max Planck- Society to undertake his PhD on stream ecology and coordinate a BMBF-funded project on the ecology of the Pantanal wetland. Since 2010 he has been professor (1st class) at the University of Tours, where he lectures river ecology and management, sustainable development and tropical ecology across different faculties, and researches in the DATE team (Landscape and urban ecology, and management) of CITERES. In 2014 he was awarded the UNESCO Chair on River Culture (Fleuve et Patrimoine, renewed in 2018), and in 2015, "Talent de la Région Centre". From September 2020, Wantzen was awarded a one-year CNRS Delegation fellowship at the University of Strasbourg, France, to continue research on river culture. He is currently editing the UNESCO book "River Culture – life as a dance to the rhythm of the waters".

BIOLOGICAL AND CULTURAL DIVERSITY, AND FLOW REGIMES - A UNIFYING APPROACH FOR MANAGING RIVERSCAPES

The project aims to highlight and explore the complex and diverse interlinkages existing between the biological diversity and the cultural diversity of large river systems, with a particular focus on the potential implications for environmental water management. It aims to help synthesise the diversity of case study evidence globally that demonstrates how biodiversity and cultural diversity are intimately coupled in riverscapes, including through the flow regime as a driving and dynamic connector. It is posited that transdisciplinary, joined-up conservation and management of rivers, including through the implementation of environmental flows, has greater potential to synergistically address the detrimental impacts of flow alteration on biological and cultural diversity than their independent treatment. It is hoped that the project will provide a source of information for the elaboration of new approaches to aid future implementation of environmental flow and freshwater conservation policies, and thus more generally support the achievement of the water and environment related Sustainable Development Goals.

Through a review of the knowledge base on river cultural and biological heritage, diversity and flow regimes, based on published scientific literature, programme websites, and online databases, pertinent conceptual frameworks and case studies were identified, as well as a subset of data sets and associated biocultural indicators with potential for application in relation to river flow management at basin and global scales. Virtual consultations were held with, among others: InFish Network on inland fisheries of the world; Ramsar Culture Network; International Union for Conservation of Nature (IUCN); International Council on Monuments and Sites (ICOMOS) and partner programmes on world heritage and water; and various specialists on areas of global significance for joint conservation of nature and cultures. A meta-database of data sets and indicators was compiled, and the consultation findings led to the initiation of new projects incl: a global analysis of the biocultural importance of select megafauna (e.g. large migratory fishes, crocodilians, and mammals) in free-flowing and flow-altered rivers, in collaboration with IGB Berlin Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Germany, and McGill University, Canada; and a Ramsar Culture Network concept note for a new global project on cultural aspects of water and wetlands 'Compiling and using information on cultural values and practices related to water and wetlands'.

Knowledge synthesis and exchange for use in policy and large-scale situation assessments of river nature-culture interrelationships with basin flow management included, among others: co-authored chapters of a new River culture book (K.M. Wantzen as Editor, R. Tharme as Scientific Reader); guidance to support better management practices for sites managed for both their natural and cultural heritage values management guidance, in collaboration with an intern (L. Yousry) and site managers for the Loire World Heritage Site and Dordogne Biosphere Reserve, France; exchanges with four PhD students researching river culture in Congo Basin, China, and India; and collaboration with European researchers on conceptualisation of human-river encounter sites for urban rivers.



Dr Alexandre Vanautgaerden

LE STUDIO / Marie Skłodowska-Curie
Research Fellow
Smart Loire Valley General Programme

From: Royal Academy of Belgium - BE

In residence at: Centre for Advanced Studies in the Renaissance (CESR) - Tours

Nationality: Belgian

Dates: October 2020 to October 2021

Dr Alexandre Vanautgaerden was a film director at RTBF (French-speaking Belgian television radio, 1990-1994). Then, he was the Head of the Erasmus museum, Brussels, Belgium (1994-2012). He was also lecturer and person in charge of the "Inventory and Heritage" module, Master of Advanced Studies "Conservation and Heritage" at the University of Geneva, Lausanne and Fribourg (Fall 2016, 2017 and 2018). From 2012 to 2018, Dr Vanautgaerden was the Head of the Geneva Library, Switzerland. He was the Director of Publications and Scientific Director of Exhibitions at the Musée Granet, Aix-en-Provence from 2018 to 2019. Finally he is a research fellow at the University of Bonn, Kate Hamburger Kolleg (2019-2020). Dr Vanautgaerden received several awards such as Prize of the Royal Belgian Academy for his work Erasmus and the Printers in 2008, and Diploma of Honour of the Community Association of the European Order of Merit (ACOEM) in 1998.



Prof. Benoist Pierre Host Scientist

Benoist Pierre is a full Professor (First Class) at the University of Tours. In 2016, he has been elected Director of the CESR (UFR and UMR 7323) and of I-Pat (Intelligence des Patrimoines Program) for five years, led by the CESR which involves several hundred researchers and more than 40 laboratories in the Centre-Val de Loire Region. His research work, which was initially on the relations between religion and politics in modern-era Europe, is currently being developed within the CESR according to three axes [i] the analysis of court societies and their relation to the State in modern Europe; [ii] the study of heritage and more particularly châteaux heritage in the Val de Loire; [iii] the notion of mediation and promotion of sciences principally on culture, heritage and humanities. Prof. B. Pierre has published 12 books, 60 papers in international peer review journals and presented 70 public talks.

MUSEION. FROM SPACE TO PLACE : REBUILDING MEMORY INSTITUTIONS

This research project is at the crossroads of museography, digital humanities, and library science. It aims to analyze the transformation of physical areas in heritage spaces (museums, libraries, archives) consequent to the development of digital humanities. Until the present time, research in museography and library science has taken parallel paths that rarely converge. However, today museums, libraries and archives are obliged to rethink their public spaces in light of the fact that new practices of their often identical publics, navigate into virtual worlds generated by the digital revolution.

For some twenty years, museums, libraries and archives have been forced to reconsider the way they function. In a first stage, they developed, in parallel with the collections and spaces they managed, digital databases as if they were building physical architectures. In many cases, these virtual collections only mirrored of the physical collections, but they could not communicate with each other. Moreover, and this was a significant disadvantage, virtual collections unconnected in their own silos, were unable to exchange their data. Fortunately, over the past decade, new digital programmes based on the interoperability of texts and images have emerged.

Interaction design is now part of museum scenography, and the user experience becomes one of the fundamental data of digital projects designed by museums or libraries.

The crucial question today is how to design and develop these new heritage spaces by offering a real dialogue between the physical collections and the digital humanities projects that are developed from them. Our research project aims to take stock of the research carried out in innovative places in order to propose new ways of developing heritage spaces in line with the current of the public. Six geographical areas will be considered (France, Belgium, Netherlands, England, Denmark, and Switzerland) over time.

To start with the project will focus on a theoretical and historical review of these spaces:

- 1 - Theory : Literature review of the last 15 years on the convergence between museums - Library - Archives
- 2 - History : A summary of the development of digital projects in France since 2006 and the digital Grand Versailles project
- 3 - Conceptual : Inventory of the different notions at work in museology projects based on current digital humanities such as: immersion, geolocation, augmented reality, user experience, soundscape.

At the same time, we will investigate the literature currently being produced on surveys of professionals following the consequences of the Covid-19 crisis. They cover critical emerging subjects for the museums landscape:

- Citizen approach: a project in England (The museum of the future)
- Hybrid Museum
- Empty Museum (The Empty Museum)

TRANSDISCIPLINARY APPROACH

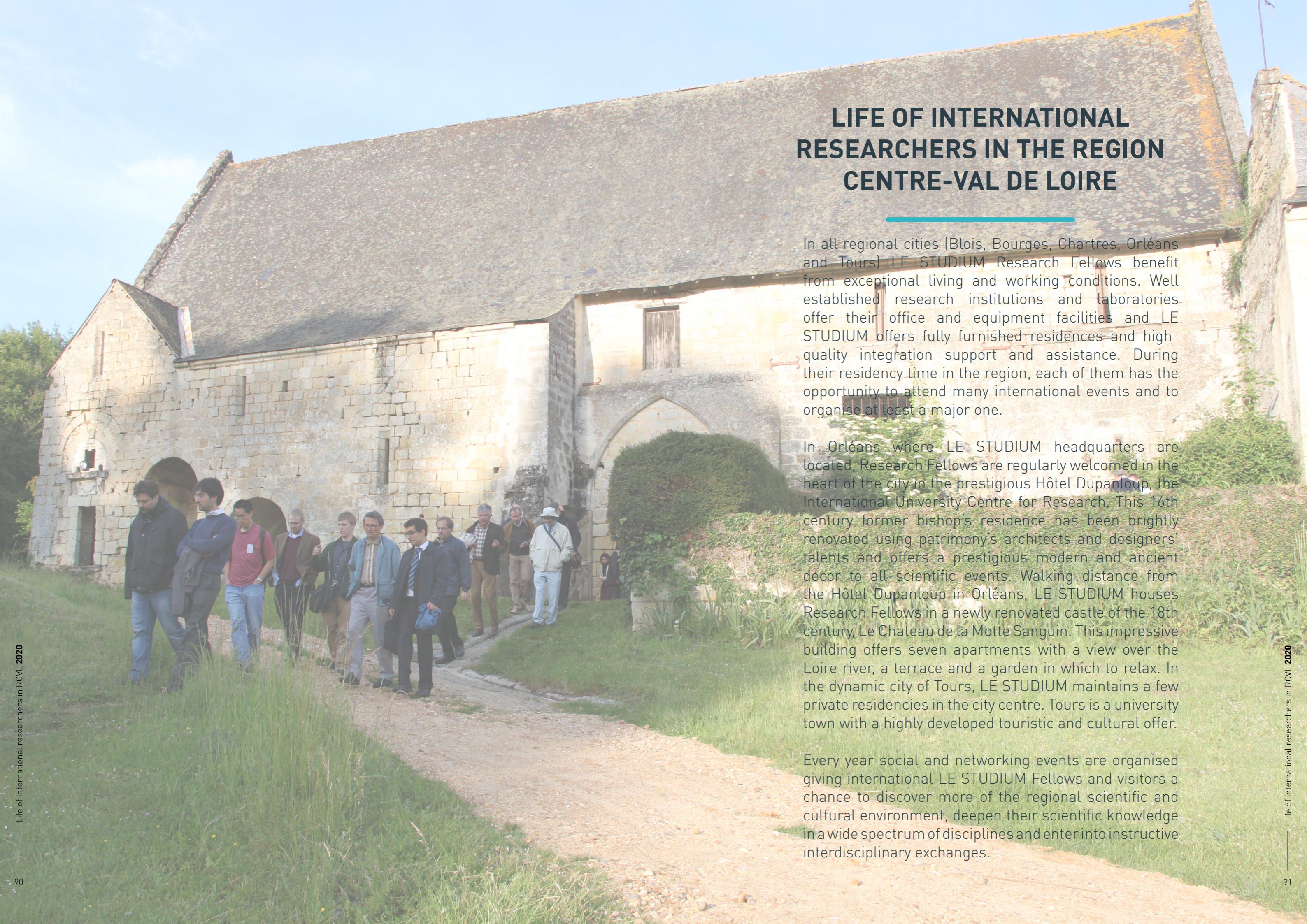
Emblematic of the transdisciplinary approach developed by LE STUDIUM Loire Valley Institute for Advanced Studies since 2010 to energize the regional scientific community exchanges are LE STUDIUM THURSDAYS monthly seminars.

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. Each month, two of them are invited to present their research project and scientific objectives.

All international researchers visiting the Centre-Val de Loire region are invited to attend these meetings.

Regional PhD students of Doctoral Schools have the possibility to register and attend these seminars to enlarge their scientific field and discover new disciplines. A regular attendance enables them to validate credits.





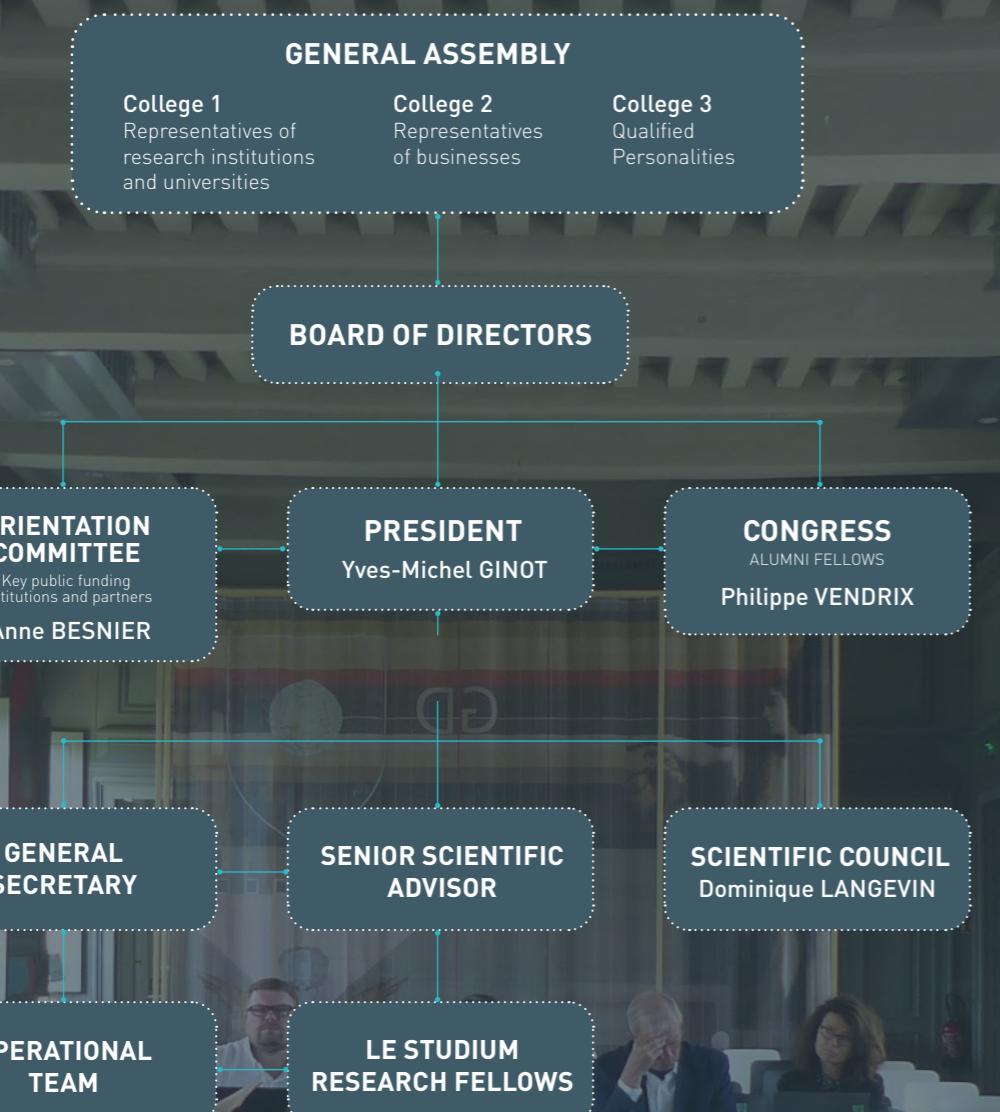
LIFE OF INTERNATIONAL RESEARCHERS IN THE REGION CENTRE-VAL DE LOIRE

In all regional cities (Blois, Bourges, Chartres, Orléans and Tours) LE STUDIUM Research Fellows benefit from exceptional living and working conditions. Well established research institutions and laboratories offer their office and equipment facilities and LE STUDIUM offers fully furnished residences and high-quality integration support and assistance. During their residency time in the region, each of them has the opportunity to attend many international events and to organise at least a major one.

In Orléans where LE STUDIUM headquarters are located, Research Fellows are regularly welcomed in the heart of the city in the prestigious Hôtel Dupanloup, the International University Centre for Research. This 16th century former bishop's residence has been brightly renovated using patrimony's architects and designers' talents and offers a prestigious modern and ancient décor to all scientific events. Walking distance from the Hôtel Dupanloup in Orléans, LE STUDIUM houses Research Fellows in a newly renovated castle of the 18th century, Le Château de la Motte Sanguin. This impressive building offers seven apartments with a view over the Loire river, a terrace and a garden in which to relax. In the dynamic city of Tours, LE STUDIUM maintains a few private residencies in the city centre. Tours is a university town with a highly developed touristic and cultural offer.

Every year social and networking events are organised giving international LE STUDIUM Fellows and visitors a chance to discover more of the regional scientific and cultural environment, deepen their scientific knowledge in a wide spectrum of disciplines and enter into instructive interdisciplinary exchanges.

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 past year's activities. Every four years, this General Assembly reviews the composition and elects a new Board of Directors. Local and regional institutions are represented at LE STUDIUM Orientation Committee. The Board of Directors and the Orientation Committee meet two to three times a year to review the activities according to an agreed strategic plan. The Board of Directors prepares reports and decisions to be submitted to the General Assembly. The President of LE STUDIUM is appointed for four years and reports to the Board of Directors. LE STUDIUM President oversees the activities performed by a small dynamic team based in Orléans.

SCIENTIFIC COUNCIL

LE STUDIUM Scientific Council establishes the final ranking of applications and recommends Fellowship, Professorship, Visiting researcher and Consortium awards. It is composed of independent external senior scientists who gather once a year in June to analyse applications and the scientific reviews provided by a pool of a thousand experts. They finalize the selection of the Smart Loire Valley General Programme Awards. The Scientific Council members are also regularly consulted for their expertise to perform independent evaluations in the course of required recruitments occurring across the Ambition Research Development 2020 programmes.

For the campaign and call for applications 2020-2021, LE STUDIUM Scientific Council members were:

PRESIDENT

Dominique LANGEVIN

Research Director in physical chemistry, Centre National de Recherche Scientifique, Laboratory of Solid State Physics at the University of Paris-Sud - FR

MEMBERS

Dominique ALLART

Professor, Director of Service d'Histoire et Technologie des Arts plastiques (Temps modernes), Université de Liège - BE

Laura BACIOU

Professor, Biophysicist, Laboratory of Physical Chemistry at the University of Paris-Sud, FR

Jean-Claude BERNIER

Professor, Chemistry and Interfaces in Physics and Biology, Strasbourg - FR

Marc DRILLON

Research Director in Materials Sciences, Centre National de Recherche Scientifique, Institut de Physique et de Chimie des Matériaux de Strasbourg, FR

Gordon CAMPBELL

Professor in Renaissance and seventeenth century studies, University of Leicester - UK

James A. DIAS

Professor, Biomedical Sciences, University of the State of New York - USA

Mark GOERBIG

Professor Theoretical Physics, CNRS Research Director, Laboratoire de Physique des Solides, Université Paris-Sud, Saclay - FR

John O'BRIEN

Professor, Director of Studies in the School of Modern Languages and Cultures, Durham University - UK

PERMANENT GUESTS: REPRESENTATIVES OF UNIVERSITIES, RESEARCH ORGANIZATIONS AND REGIONAL INSTITUTIONS

Christian ANDRES

Inserm Scientific Correspondent

Catherine BEAUMONT

President Centre Inra Val-de-Loire

Nicolas GASCOIN

Director INSA Centre-Val de Loire

Hélène PAUWELS

Research Branch, BRGM, Orléans

Philippe BELLEVILLE

CEA Le Ripault, Tours

Daniel ALQUIER

Vice-President Research, University of Tours

Ioan TODINCA

Vice-President Research, University of Orléans

Anne BESNIER

Vice-President Higher Education and Research, Region Centre-Val de Loire (2016-2019)

David OGDEN

Director of Research, Laboratory of Brain Physiology and Biophysics, University Paris-Descartes, Paris - FR

Alain PAVE

Professor, Biometrics and Evolutionary Biology, Lyon, Member of the Academy of Technologies - FR

Alain PRIOU

Professor, Physics, Université Paris Ouest Nanterre La Défense - FR

Jean-Pierre SAMAMA

Research Director in Biophysics, Centre National de Recherche Scientifique, Synchrotron Soleil, FR

Laurent TISSOT

Professor, Contemporary history, University of Neuchâtel, CH

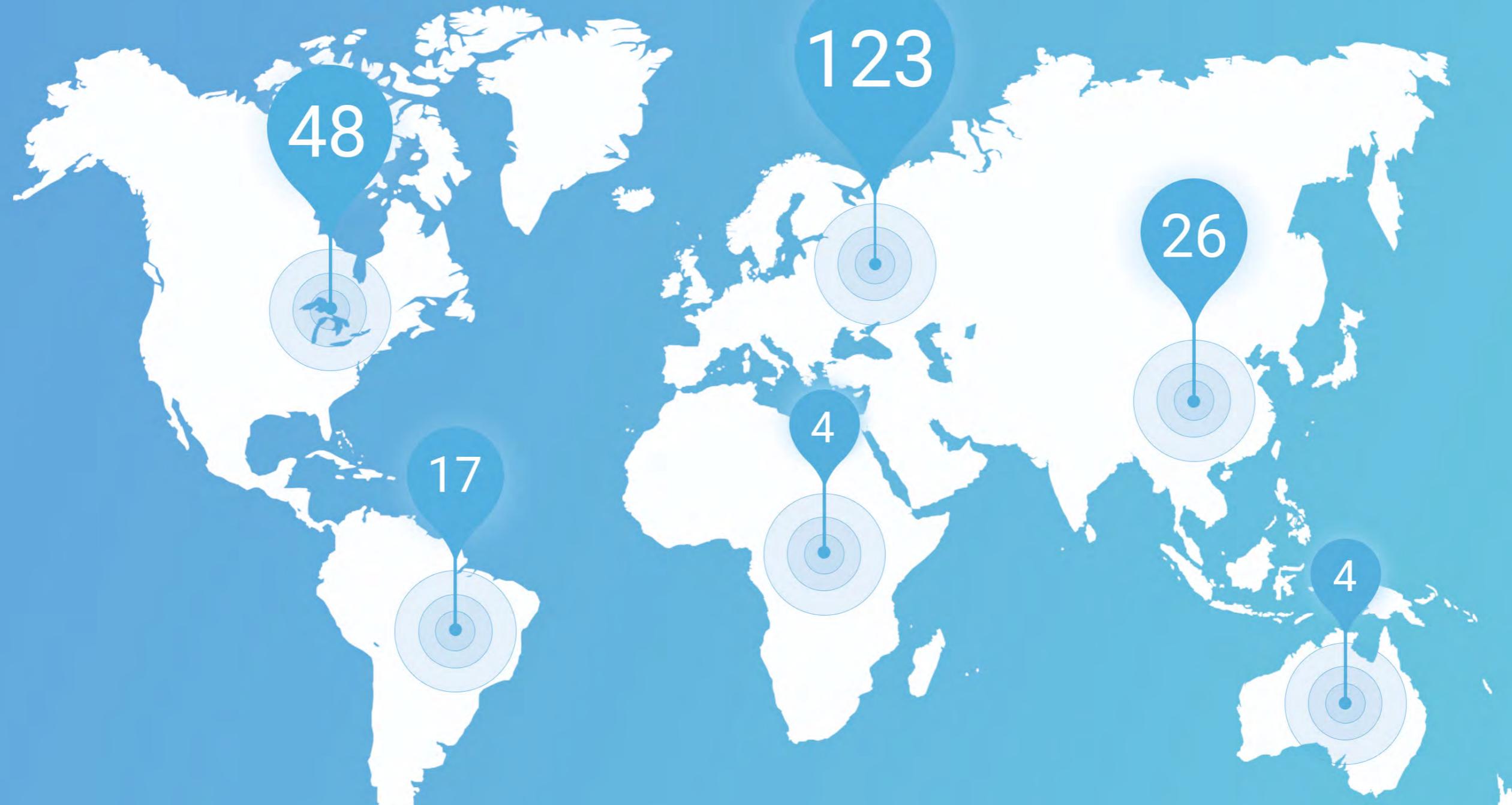
Emmanuel TRELAT

Professor, Mathematics, Sorbonne University, Director of the Mathematical Sciences Foundation in Paris, FR

Ralph WATZEL

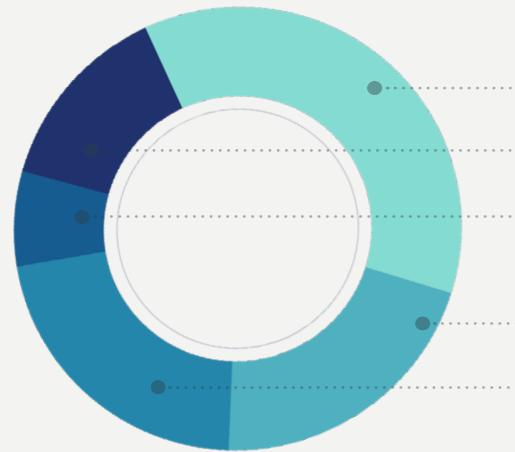
Professor, Geology and geophysics, President of the Federal Institute for Geosciences and Natural

ORIGIN OF LE STUDIUM RESEARCH FELLOWS



IN THE CENTRE-VAL DE LOIRE REGION SINCE 1996

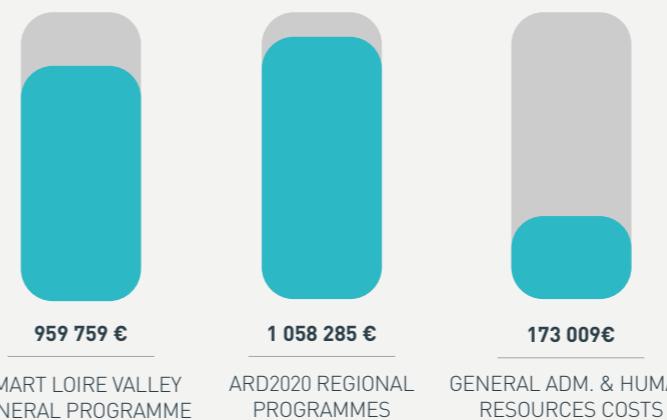
THEMATICS REPARTITION SINCE 1996



| | |
|--|------|
| LIFE AND HEALTH SCIENCES | 37 % |
| EARTH, ECOLOGY AND ENVIRONMENTAL SCIENCES | 14 % |
| COMPUTER SCIENCE, MATHEMATICS AND MATHEMATICAL PHYSICS | 7 % |
| HUMAN AND SOCIAL SCIENCES | 22 % |
| MATERIALS AND ENERGY SCIENCES | 21 % |

2020 FINANCIAL DATA

2020 EXPENDITURES REPARTITION



| 2020 FINANCIAL RESOURCES | |
|----------------------------|-----|
| REGION CENTRE VAL DE LOIRE | 65% |
| EUROPEAN FUNDS | 25% |
| UNIVERSITY OF TOURS | 3% |
| UNIVERSITY OF ORLEANS | 3% |
| ORLEANS METROPOLE | 2% |
| PRIVATE CONTRIBUTIONS | 1% |
| VARIOUS | 1% |

2020 EVENTS PANORAMA

Themes in color

- CONFERENCE
- PUBLIC LECTURE
- THURSDAY
- SUMMER SCHOOL
- RENCONTRE LEONARDO
- CONSORTIUM
- AFFILIATED EVENT
- EXPERT DAY
- WORKSHOP



LIST OF RESEARCHERS IN RESIDENCE IN 2020

SMART LOIRE VALLEY GENERAL PROGRAMME

Dr VISHWANATHA THIMMALAPURA MARULAPPA

Development of novel chemoselective ligation techniques for protein synthesis

February 2019 – May 2020

In residence at : Centre de Biophysique Moléculaire (CBM) CNRS UPR430

Host scientist: Dr Vincent Aucagne

Prof. RICHARD FREEDMAN

CRIM: the Renaissance Imitation Mass

January 2019 – January 2020

In residence at: Centre d'Etudes Supérieures de la Renaissance, Université de Tours, CNRS

Host scientist: Prof. Philippe Vendrix

Prof. MANUELA SIMONI

Pleotropism of Gonadotropin action

April 2019 – April 2020

In residence at: Physiology of Reproduction and Behaviors Institution - INRAE Centre de Recherches Val de Loire - UMR7247 INRAE, CNRS, Université de Tours, IFCE

Host scientist : Dr Pascale Crépieux

Dr ARLETTE RICHAUD-TORRES

Coordination compounds as antioxidants: activity evaluation by combining first-principle calculations and solid-state NMR

June 2019 – May 2020

In residence at: CEMHTI - Conditions Extrêmes et Matériaux : Haute Température et Irradiation, CNRS UPR3079

Host scientist: Dr Pierre Florian

Dr MARGRIET HOOGVLIET

Religious «lieux de savoir» in premodern Tours and Orléans: A Social and Spatial Approach to Religious Reading in French (c. 1450-c. 1550)

June 2019 – June 2020

In residence at: Centre d'Etudes Supérieures de la Renaissance, Université de Tours,CNRS

Host scientist: Prof. Chiara Lastraoli

Dr WOLFGANG WISNIEWSKI

Mechanisms of glass crystallization analyzed by electron backscatter diffraction (EBSD)

September 2019 – August 2020

In residence at: CEMHTI - Conditions Extrêmes et Matériaux : Haute Température et Irradiation, CNRS UPR3079

Host scientist: Dr Mathieu Allix

Dr GUILLAUME COLLET

Earlier tumor diagnostic combined with radio-preconditioning in cancer therapy : a novel near-infrared emitting nanomofs for oxygen delivery

September 2019 – August 2020

In residence at: Centre de Biophysique Moléculaire, CNRS

Host scientist: Prof. Stéphane Petoud

Dr KI-WON HONG

Theory of justice by Guillaume Budé (1468-1540): arguments, method, and influence on the sixteenth-century lawyers

September 2019 – September 2020

In residence at: Centre d'Etudes Supérieures de la Renaissance , Université de Tours,CNRS

Host scientist:Dr Stephan Geonget

Dr REBECCA THARME

Biological and cultural diversity, and flow regimes – a unifying approach for managing riverscapes

November 2019 – November 2020

In residence at: CITERES - Clés, TERritoires, Environnement et Sociétés, Université de Tours, CNRS

Host scientist: Prof. Karl Matthias Wantzen

Dr JEAN-FRANÇOIS DELUCHY

At the margins of neoliberal governmentality: the extermination of peripheral youth in the brazilian Amazon region

January 2020 – July 2021

In residence at: ICD - Interactions culturelles et discursives, E.A. 6297, Université de Tours

Host scientist: Dr Nathalie Champroux

Dr ILLIA ZYMAK

CosmOrbitrap - high resolution mass spectrometer for space application

January 2020 – August 2021

In residence at: LPC2E Laboratoire de Physique et Chimie de l'Environnement et de l'Espace, CNRS, Université Orléans, CNES

Host scientist: Dr Christelle Briois

Prof. EUGEEN SCHREURS

Music in the collegiate church of our lady in Antwerp (C.1370 - C.1530): An European hub?

September 2020 – October 2021

In residence at: Centre d'Etudes Supérieures de la Renaissance, Université de Tours, CNRS

Host scientist: Prof. Philippe Vendrix

Prof. ADRIAN WOLSTENHOLME

Further development of *caenorhabditis elegans* as a tool for studying drug targets in parasitic nematodes

September 2020 – October 2021

In residence at: Infectiologie et Santé Publique (ISP), INRAE- Centre Val de Loire

Host scientist: Dr Cédric Neveu

Dr RAPHAËL CAHEN

Sociological and Cultural History of International Law (1815-1871)

September 2020 – October 2021

In residence at: POLEN (POuvoirs, LEttres, Normes) - CNRS, Université d'Orléans

Host scientist: Prof. Pierre Allorant

Dr VALÉRIE HAYAERT

Justitiart. Images of justice: a European survey of legal symbolism

September 2020 – October 2021

In residence at: Centre d'Etudes Supérieures de la Renaissance, Université de Tours, CNRS

Host scientist: Dr Stephan Geonget

Dr BARBARA CAVALAZZI

Analogues in the search for life on mars

October 2020 – October 2021

In residence at: Centre de Biophysique Moléculaire-CNRS

Host scientist: Dr Frances Westall

Dr MARÍA-CRISTINA DEL RINCON-CASTRO

Analogues in the search for life on mars

October 2020 – October 2021

In residence at: Institut de Recherche sur la Biologie de l'Insecte, Université de Tours, CNRS

Host scientist : Dr Elisabeth Herniou

Dr ALEXANDRE VANAUTGAERDEN

Museion. From space to place : rebuilding memory institutions

October 2020 – October 2021

In residence at: Centre d'Etudes Supérieures de la Renaissance, Université de Tours,CNRS

Host scientist: Prof. Benoist Pierre

Dr KATHIA ZALETA

Mechanisms of glass crystallization analyzed by electron backscatter diffraction (EBSD)

November 2020 – October 2021

In residence at: Inserm, Université de Tours

Host scientist: Prof. Patrick Vourch'

Prof. MAXWELL HINCKE

Evolution of innate immunity at biomimetic barriers

March 2020

In residence at: INRAE-Centre Val de Loire - UR83

Recherches Avicoles

Host scientist: Dr Sophie Rehault-Godbert

Prof. SALVATORE MAGAZU

Chiral matter: theory and applications

July 2020 - October 2020

In residence at: CESR - Centre d'Etudes Supérieures de la Renaissance, Université de Tours,CNRS

Host scientist: Prof. Pascal Brioist

Prof. IGOR DENYSENKO

Modeling of reactive plasmas for nanoparticle synthesis

November 2020 - December 2020

In residence at: GREMI - UMR7344 ,CNRS,Université d'Orléans

Host scientist:Dr Maxim Mikikian

Prof. GEORG VON SAMSON-HIMMELSTJERNA

It's a wormy world - Parasitic nematode infections: relevance, challenges and options for more sustainable treatment

October 2019 – September 2020

In residence at: Infectiologie et Santé (ISP) UMR Université-INRAE 1282 -

Host scientist: Dr Cédric Neveu

Dr LAURA PIVETEAU

NMR study of disordered inorganic materials using spin diffusion

September 2019 – September 2021

In residence at: CEMHTI - Conditions Extrêmes et Matériaux : Haute Température et Irradiation, CNRS UPR3079

Host scientist: Dr Dominique Massiot

Dr MICHAEL PITCHER

New metastable oxides by rapid cooling from the melt and low temperature devitrification

September 2019 – September 2020

In residence at: CEMHTI - Conditions Extrêmes et Matériaux : Haute Température et Irradiation, CNRS UPR3079

Host scientist: Dr Mathieu Allix

ARD 2020 BIOPHARMACEUTICALS PROGRAMME

Dr FRÉDÉRIC JEAN-ALPHONSE

Targeting CGPR with antibodies

November 2018 – September 2020

In residence at : INRAE Centre Val de Loire

Host scientist : Dr Eric Reiter

Dr GRÉGORY GUIRIMAND

Bio-production of vindoline and catharanthine by recombinant yeast cell factories

June 2019 – March 2021

In residence at : BBV - Laboratoire Biomolécules et Biotechnologies Végétales, Université de Tours

Host scientist : Dr Vincent Courdavault

Dr MAGDIEL PÉREZ-CRUZ

Therapeutic use of Periostin antibody and CAR Treg in papain and HDM induced severe asthma in mice

October 2019 – September 2020

In residence at : INEM - Immunologie et Neurogénétique Expérimentales et Moléculaires , CNRS, Université d'Orléans

Host scientist : Dr Bernhard Ryffel

ARD 2020 PIVOTS PROGRAMME

Dr MAX MCGILLEN

Experimental measurements of atmospheric chemical reactions

January 2020 - March 2020

In residence at : ICARE - Institut de Combustion Aérothermique Réactivité Environnement, CNRS

Host scientists : Dr Véronique Daële & Dr Wahid Mellouki

Dr JUANITA MORA-GÓMEZ

Role of microorganisms in the Carbon Cycling of Peatlands

April 2019 - September 2020

In residence at : ISTO - Institut des Sciences de la Terre d'Orléans, CNRS, Université d'Orléans, BRGM

Host scientist : Dr Fatima Laggoun Défarge & Dr Sébastien Gogo

ARD 2020 COSMETOSCIENCES PROGRAMME

Dr YURI DANCIK

Molecular imaging using Raman spectroscopy: from fundamental research to industrial applications

October 2018 – June 2020

In residence at : MNMS - Nanomédicaments et Nanosondes, Université de Tours

Host scientist : Dr Franck Bonnier

ARD 2020 LAVOISIER PROGRAMME

Dr ARUNABH GHOSH

Towards Futuristic Energy Storage; paving its way through Supercapacitors, Li-ion batteries and beyond

February 2019 – January 2021

In residence at : PCM2E - Physico-Chimie des Matériaux et des Electrolytes pour l'Energie, Université de Tours

Host scientist : Pr Fouad Ghamouss

Dr EDURNE SERRANO-LARREA

Porous materials for environmental applications

September 2019 – December 2020

In residence at : CEMHTI - Conditions Extrêmes et Matériaux : Haute Température et Irradiation – UPR3079 CNRS

Host scientist : Dr Conchi Ania & Dr Encarnacion Raymundo-Piñero

Dr GEORGIOS NIKIFORIDIS

Advanced applied batteries

January 2020 – January 2021

In residence at : PCM2E - Physico-Chimie des Matériaux et des Electrolytes pour l'Energie, Université de Tours

Host scientist : Pr. Mériem Anouti

ARD 2020 INTELLIGENCE DES PATRIMOINES PROGRAMME

Dr EMILIO MARIA SANFILIPPO

Ontology-based data integration for the digital humanities

April 2019 – June 2020

In residence at : CESR - Centre d'Etudes Supérieures de la Renaissance, Université de Tours,CNRS

Host scientist : Prof. Benoist Pierre

Dr MARION LAMÉ

Scholarly Data Editing

July 2019 – June 2020

In residence at :CESR - Centre d'Etudes Supérieures de la Renaissance, Université de Tours,CNRS

Host scientist : Prof. Benoist Pierre

SMART LOIRE VALLEY GENERAL PROGRAMME AWARDS - SELECTION OF CAMPAIGN 2020

LE STUDIUM VISITING RESEARCHER

PROF. ASUNCIÓN FERNANDEZ

Magnetron sputtering deposition with He as process gas: Understanding the formation of nanostructured / nano-porous thin films

From : Consejo Superior de Investigaciones Científicas, Spain
Host scientist : Dr Anne-Lise THOMANN
Groupe de Recherches sur l'Energétique des Milieux Ionisés [GRÉMI]- UMR7344 - Université d'Orléans, CNRS

PROF. NEIL STURCHIO

Groundwater contamination in France: A legacy of World War I

From : University of Delaware, USA
Host scientist : Dr Patrick OLLIVIER
Bureau de recherches géologique et minières (BRGM)

PROF. ADI ADIMURTHI

Conservation laws with linear source: control, fundamental solutions, and applications

From : Tata Institute for Fundamental Research, India
Host scientist : Prof. Boris ANDREIANOV
Institut Denis Poisson [IDP] - UMR 7013 - Université d'Orléans, Université de Tours, CNRS

PROF. ERIDA GJINI

Coexistence near neutrality

From : Mathematical Modelling of Biological Processes, The Gulbenkian Institute, Portugal
Host scientist : Dr Sten MADEC
Institut Denis Poisson [IDP] - UMR 7013 - Université d'Orléans, Univertité de Tours, CNRS

PROF. MARIA TERESA SALGADO GUIMARÃES DA SILVA

Leda Rio - a voice comes out of silence in Brazil

From : Universidade Federal do Rio de Janeiro, Brazil
Host scientist : Prof. Catherine PELAGE
REMELICE - EA 4709- Université d'Orléans

LE STUDIUM RESEARCH PROFESSORSHIP

PROF. VINCENT PECORARO

Lanthanide Based Metallacrowns as Near-Infrared Emitting Biological Probes

From : University of Michigan, USA
Host scientist : Prof. Stéphane PETOUD
Centre de Biophysique Moléculaire (CBM) - UPR 4301 -CNRS

DR ENDRE SZILI

InPlaSkiT AOC: INnovative PLAsma SKIn Treatments through Adelaïde-Orléans Collaboration

From : University of South Australia, Australia
Host scientist : Dr Eric ROBERT
Groupe de Recherches sur l'Energétique des Milieux Ionisés [GRÉMI]- UMR7344 - Université d'Orléans, CNRS

LE STUDIUM RESEARCH CONSORTIUM

PROF. ISABELLE SOCHET

SATURN: blaSt propAgation in an URban eNvironment

PRISME - Université d'Orléans, Institut National des Sciences Appliquées (INSA)

DR BRICE KORKMAZ

Pharmacological targeting of cathepsin C: a key therapeutic target in chronic inflammatory and auto-immune diseases

Centre d'Etudes des Pathologies Respiratoires, UMR INSERM U 1100 - Université de Tours, INSERM

DR BERNARD GRATUZE

Early medieval glass production, multi-analytical techniques, to understand the dawn of a technical revolution

Institut de Recherche sur es ArcheoMATériaux IRAMAT Centre Ernest-Babelon, UMR 5060 - Université d'Orléans, CNRS

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