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FEMMES & SCIENCES

SHE

Sciences . Héritage . Émergence

Women in Research & Innovation

April 2nd 2026

University of Angers
Faculty of Sciences
Amphi L002

Keynote speakers

Oral presentations

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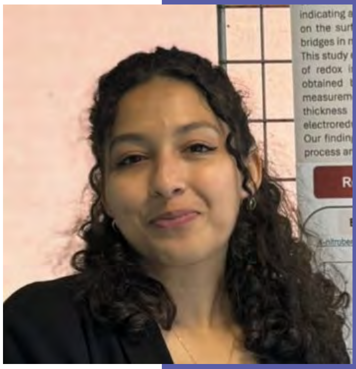
Introduction by the creators of SHE



Sara Helis
PhD student at MOLTECH-Anjou
(University of Angers)

Léa Daoud
PhD student at MINT Laboratory
(University of Angers)

What does **SHE** stand for?

Sciences, Heritage, Emergence, three pillars at the core of this scientific day.

Initiated and organized by PhD students Sara Helis and Lea Daoud at the **MOLTECH-Anjou and MINT laboratories**, SHE highlights **the scientific heritage built by women researchers**, while giving strong visibility to the **next generation of scientists shaping the future of research**. The event showcases women's contributions across **chemistry, physics, materials science, and life sciences**, and promotes dialogue at the interface of disciplines.

A central ambition of **Femmes & Sciences: SHE** is to support women scientists at **key stages of their careers**, PhD preparation, postdoctoral research, and early academic or industrial positions, by providing a platform to present their work, share experiences, and connect with the broader scientific community.

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Keynote speakers

Lucie Sancey
CNRS Research Director
Institute for Advanced Biosciences

Birgit Habenstein
CNRS Research Director
CBMN - Institute of Chemistry and Biology of Membranes and Nano-objects

Claire de March
CNRS Researcher
Institute of Chemistry of the Natural Substances (ICSN)

Oral presentations

Maria Maniadi - PhD student at MOLTECH-Anjou (University of Angers)
Sara Helis - PhD student at MOLTECH-Anjou (University of Angers)
Léa Daoud - PhD student at MINT Laboratory (University of Angers)
Marie-Léa Lalanne - PhD student at CEISAM (Nantes University)
Meenakshy Suresh - PhD student at MOLTECH-Anjou (University of Angers)
Océane Baffroy - Postdoctoral researcher at CEISAM (Nantes University)
Rita Aflak - PhD student at MOLTECH-Anjou (University of Angers)
Nouran Zahran - PhD student at MINT Laboratory (University of Angers)
Teodora Mocanu - Postdoctoral researcher at MOLTECH-Anjou (University of Angers)

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PROGRAM

April 2nd 2026
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9:00 **Opening**

9:10 Introduction: **Catherine Passirani**
Vice President for International Affairs and Equality - University of Angers

9:25

Lucie Sancey - CNRS Research Director / Institute for Advanced Biosciences
Shedding Light on Tumors: Fluorescent Probes in Cancer Surgery

10:00 **Maria Maniadi** - PhD student at MOLTECH-Anjou (University of Angers)
Quadratic Non-Linear Optical (NLO) response and pressure measurements on 2D double halide perovskites

10:15 **Sara Helis** - PhD student at MOLTECH-Anjou (University of Angers)
Transparent Carbon Electrodes: a Platform for Advanced Electrochemical Systems

10:30 **Coffee Break & Poster Session**

11:00

Birgit Habenstein - CNRS Research Director / Institute of Chemistry and Biology of Membranes and Nano-objects Biosciences
Seeing biomolecular self-assemblies through Nuclear Magnetic Resonance spectroscopy

11:35 **Léa Daoud** - PhD student at MINT Laboratory (University of Angers)
Light triggered poly(2-oxazoline) for ROS generation and photodynamic therapy

11:50 **Marie-Léa Lalanne** - PhD student at CEISAM (Nantes University)
Magnetic hyperthermia for liver cancer: understanding how iron oxide nanoparticles interact with cells

12:05 **Lunch**

14:00

Claire de March - CNRS Researcher / Institute of Chemistry of the Natural Substances (ICSN)
Smell under the microscope: the little-known role of olfactory receptors

14:35 **Meenakshy Suresh** - PhD student at MOLTECH-Anjou (University of Angers)
Tetrameric Design of Perylene diimide-based Non-Fullerene Acceptors for Improved Morphology in Organic Photovoltaics

14:50 **Océane Baffroy** - Postdoctoral researcher at CEISAM (Nantes University)
Advanced Organic Near-Infrared (NIR) Photosensitizers for Fully Transparent and Colorless Dye-Sensitized Solar Cells (DSSCs)

15:05 **Coffee Break & Poster Session**

15:45 **Rita Aflak** - PhD student at MOLTECH-Anjou (University of Angers)
Benzanthracene Imide–Based Heavy-Atom-Free Photosensitizers: A New Strategy for Photodynamic Therapy

16:00 **Nouran Zahran** - PhD student at MINT Laboratory (University of Angers)
Development of nano-immunotherapy for targeting a triple negative breast cancer (a vaccination strategy)

16:15 **Teodora Mocanu** - Postdoctoral researcher at MOLTECH-Anjou (University of Angers)
Conductive and Chiral Metal–Organic Frameworks Based on Redox-Active TTF Ligands

16:30 **Closing**

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9:25

Lucie Sancey

CNRS Research Director

Institute for Advanced Biosciences

Grenoble Alpes University

Shedding Light on Tumors: Fluorescent Probes in Cancer Surgery

Lucie SANCEY is Director of Research of the French CRNS at the Institute for Advanced Biosciences, in Grenoble, France. Her research activities focus on the development and evaluation of innovative compounds for cancer imaging and treatment. This includes the development of nano-agents for cancer diagnosis and therapy, in particular for BNCT, as well as new multimodal optical contrast agents and new imaging techniques for biological tissues including fluorophores for image-guided surgery. She was responsible for translational activities to bring a theranostic nanoparticle from the lab to the bedside to improve radiation therapy (investigated in 8 clinical trials). She is co-author of more than 120 scientific communications, and participated in 2 start-up and 4 patents. She is a member of Scientific Steering Committee of the Cancéropôle Lyon Auvergne Rhône-Alpes, for the thematic axis "Innovations Technology for Health ». She is vice-president of the SFNano board (the French Society of Nanomedicine), codirector of the French research group “Nuclear Methods and Tools against Cancer”, vice-president of one of the French National Research Agency (ANR) committees, and member of the French National Research committee (CoNRS) section 26.

11:00

Birgit Habenstein

CNRS Research Director

Institute of Chemistry and
Biology of Membranes and
Nano-objects Biosciences

University of Bordeaux

Seeing biomolecular self-assemblies through Nuclear Magnetic Resonance spectroscopy

Birgit Habenstein is a CNRS Chemistry research director focusing her work on the application and development of solid-state Nuclear Magnetic Resonance spectroscopy to reveal the mechanistic bases in biomolecular self-assemblies. After her studies at the Technical University Berlin, a shared PhD work at the University of Lyon and the ETH Zürich, she left in 2011 for a post-doc at the Max-Planck Institute Göttingen. With an independent funding, she joined the CNRS and the University of Bordeaux in 2014 to build her research team at the Institute of Chemistry and Biology of Membranes and Nano-objects, where she now leads the group of Multiscale Biophysics. From 2020-2022, family circumstances led to her return to Germany where she served as managing director of the German Society for Biomedical Engineering (DGBMT within VDE), leaving fundamental research for two years. She received >2 M€ funding for her research from regional, national and European organisms and has co-authed 82 peer-reviewed publications with 19 as corresponding author. A key feature of her work is the dual focus on methodological innovation and biologically grounded applications.

14:00

Claire de March

CNRS Researcher

Institute of Chemistry of the Natural Substances (ICSN)

Paris-Saclay University

Smell under the microscope: the little-known role of olfactory receptors

Claire de March is a CNRS researcher, where she explores the mysteries of olfaction, a common thread that has guided her career since its inception. After studying chemistry, she briefly worked in industry, an experience that enriched her vision of applied research. However, she chose to pursue a career in academia, devoting herself to the study of olfactory receptors through chemistry and biology. In 2023, her work was recognized with the Joliot-Curie Prize from the Ministry of Research and Higher Education and the Academy of Sciences, in recognition of her contributions to understanding the molecular mechanisms of smell. In particular, she participated in the publication of the first structure of a human olfactory receptor, a major breakthrough in the field. Committed to a more inclusive science, she is also involved in initiatives aimed at reducing gender inequality and the lack of diversity in research.

Maria Maniadi

PhD student at MOLTECH-Anjou (University of Angers)

“Quadratic Non-Linear Optical (NLO) response and pressure measurements on 2D double halide perovskites”

Maria Maniadi[1], D. Gindre,[1] E. Tailleur,[2] M. Deutsch,[2] S. Pillet,[2] V. Dupray,[3] C. Tyrpenou,[4] G. Volonakis,[4] A. Pantousas,[5,6] K. Skrzyńska,[5] A. Pakhomova,[5] C. Botta,[7] Nicolas Mercier[1], Alexandre Abhervé[1]

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In the field of perovskite semiconductors, the need to replace Pb^{2+} with non-toxic metals, have led to the emergence of 2D double halide perovskites (DHPs). In this context, we report new 2D materials with the general chemical formula of $(Cyst)_2Cs_{2n-2}(AgM^{III})_nBr_{6n+2}$, where $Cyst^{2+}$ = cystaminium, M^{III} = Sb or Bi, n = number of adjacent layers. The first compound is the monolayer 2D $(Cyst)_2AgSbBr_8$. DSC measurments showed that one reversible phase transition between four phases occur, going from Phase 1 (p1) to Phase 3 (p3) (C2/c to Cc, T = 40°C) and from p3 to Phase 4 (p4) (Cc to Cm, T = 84°C) upon heating, and, upon cooling, from p4 to Phase 2 (p2) (Cm to C2, T = 58°C) and from p2 back to the original compound at T < RT. Temperature-dependent SHG measurements highlighted the switchable SHG properties of the compound and by using a heating pen we were able to selectively induce the phase transition of a part of a single crystal, proving that p1 and p2 could coexist at RT (Figure a).[1] The second compound is the bilayer 2D $(Cyst)CsAgBiBr_7$. This perovskite emits in the deep red region, as a result to a direct band gap. Studies under pressure, revealed an enhancement of the photoluminescence (PL), the maximum of which occurs around 0.5 GPa, before its intensity starts to gradually decrease, leading to a plateau, before completely disappearing. Moreover, first-principle calculations revealed a pressure-induced direct-to-indirect bandgap transition, accounting for the changes of the PL spectrum under compression, due to the relocation of the conduction band minimum (CBM) and the valence band maximum (VBM) for P > 1 GPa (Figure b).[2]

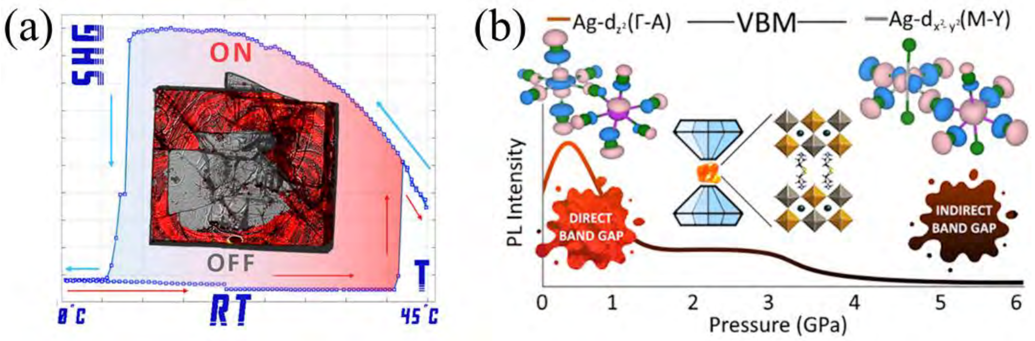

Fig. 1. Illustration of a) I(SHG)= f(T) curve in the range of 0 – 45 °C and a single crystal displaying both SHG-inactive and -active phases (p1 and p2, respectively) at RT. Illustration of b) the reversible pressure-dependent PL, correlated with a pressure-induced direct-to-indirect bandgap transition due to the redistribution of Ag-d orbitals at the valence band edge.

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Sara Helis

PhD student at MOLTECH-Anjou (University of Angers)

"Transparent Carbon Electrodes: a Platform for Advanced Electrochemical Systems"

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Electrochemical methods provide powerful tools to probe interfacial reactivity, yet direct observation of electrochemical interfaces remains limited. This limitation calls for the development of coupled approaches combining optical and electrochemical techniques, enabling real-time and in situ monitoring of interfacial processes. In this context, electrode materials that combine electrochemical performance with optical accessibility represent powerful platforms to elucidate structure–reactivity relationships at functional interfaces.

In this work, transparent carbon electrodes are developed using a fabrication strategy based on pyrolyzed photoresist films (PPF).[1] Carbon films deposited on silicon substrates are used as model systems, providing smooth and rigid surfaces with low roughness, enabling precise and reproducible studies of grafted molecular layers. These well-defined platforms allow reliable comparison of interfacial properties and facilitate quantitative analysis of film thickness and organization.[2]

The fabrication process is then transferred to quartz substrates in order to obtain transparent carbon electrodes while preserving the structural and electrochemical properties of the initial system.[3] The resulting materials are characterized using conventional electrochemical techniques and localized methods such as scanning electrochemical cell microscopy (SECCM), providing insight into their interfacial behavior across multiple scales.

These results demonstrate the potential of transparent carbon electrodes as versatile platforms for the investigation of interfacial processes, with perspectives in sensing, electrocatalysis, and optically coupled electrochemical systems.

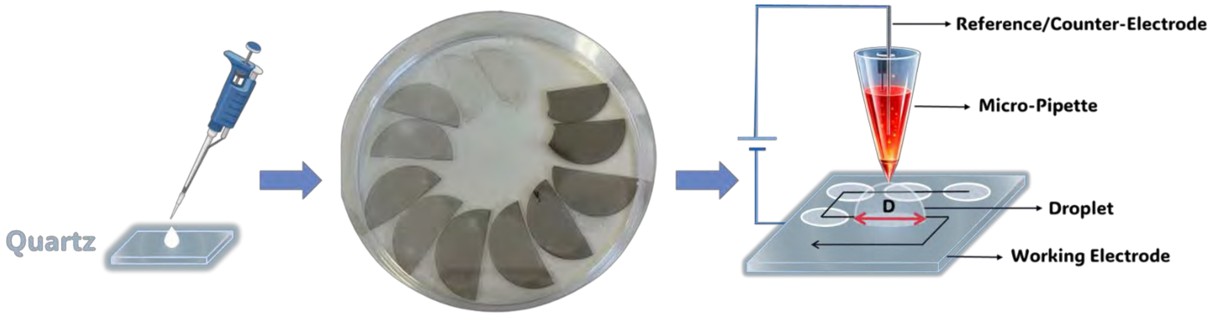

Figure 1: Schematic representation of the preparation and use of transparent carbon electrodes.

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Léa Daoud

PhD student at MINT Laboratory (University of Angers)

“Light triggered poly(2-oxazoline) for ROS generation and photodynamic therapy”

Léa Daoud,[1] Tetiana Dumych,[2] Solomiya Paryzhak,[2] Piétrick Hudhomme,[3] and Oksana Krupka[1]

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Photodynamic therapy (PDT) is a minimally invasive treatment that induces cancer cell death through the light-triggered generation of reactive oxygen species (ROS). Perylenediimides (PDIs) are promising photosensitizers due to their high photostability and low dark toxicity; however, their poor solubility in aqueous media limits their biomedical applications. Poly(2-oxazoline)s (POx) are biocompatible polymers with tunable hydrophilicity that can improve the aqueous compatibility of hydrophobic molecules and support the formation of nanostructured delivery systems.

In this work, a monothionated PDI initiator was used to initiate the cationic ring-opening polymerization (CROP) of 2-oxazoline monomers, producing PDI-functionalized POx polymeric photosensitizers. Two systems were investigated: a hydrophilic poly(2-methyl-2-oxazoline) and an amphiphilic poly(2-butyl-2-oxazoline)-b-poly(2-methyl-2-oxazoline) capable of self-assembling into micelles in aqueous media. The amphiphilic polymers formed stable micelles with an average diameter of approximately 60 nm as measured by dynamic light scattering, with morphology confirmed by transmission electron microscopy. Optical characterization by UV–vis spectroscopy showed the characteristic PDI absorption with a maximum around 620 nm. Thionation effectively suppressed fluorescence emission, promoting intersystem crossing and enhancing triplet-state formation, which is favorable for photodynamic activity.

ROS generation was evaluated using DPBF and RNO assays under 617 nm irradiation and confirmed efficient singlet oxygen production with quantum yields of approximately 0.6. In vitro studies in HeLa and B16F10 cells showed excellent cytocompatibility in the absence of irradiation, with nearly 100% cell viability under dark conditions. Upon irradiation for 10 minutes at 617 nm, significant phototoxicity was observed, reducing cell viability to approximately 20–30%.

Overall, thionated PDI-initiated POx polymers represent promising polymeric photosensitizers for PDT. The POx platform enhances aqueous compatibility while enabling the formation of micellar nanostructures that could facilitate cellular delivery and the co-encapsulation of therapeutic agents for combined photodynamic and chemotherapeutic strategies.

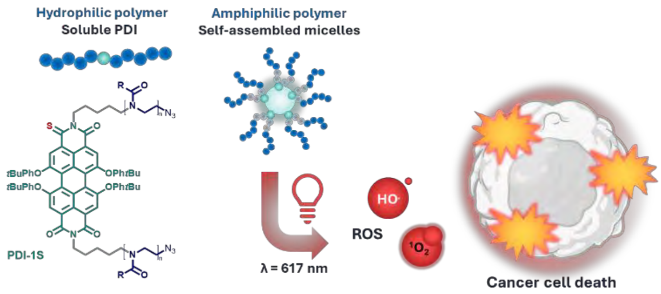

Figure 2. *PDI-1S/POx Systems for Light-Triggered ROS Generation and Photodynamic Therapy.*

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Marie-Léa Lalanne

PhD student at CEISAM (Nantes University)

“Magnetic hyperthermia for liver cancer: understanding how iron oxide nanoparticles interact with cells”

Liver cancer remains a major global health challenge, with limited therapeutic options for many patients. Magnetic hyperthermia is an emerging strategy in which magnetic nanoparticles are exposed to an alternating magnetic field, causing them to generate heat locally inside tumors. When maintained at moderate levels, this heating can weaken cancer cells and make them more vulnerable, while minimizing damage to surrounding healthy tissue.

In our study, we focus on iron oxide nanoparticles coated with two biocompatible polymers commonly used in nanomedicine applications — dextran or dextran-PEG. Although the magnetic core is identical, the surface coating plays a key role in how nanoparticles interact with biomolecules present in biological fluids, including blood proteins. These interactions shape the biological identity of the particles and ultimately influence how cells recognize, internalize and process them.

Once internalized, iron-based nanoparticles do not remain inert. Inside the cellular environment, they can partially degrade and release iron ions. This iron can participate in chemical reactions that generate reactive oxygen species (ROS), highly reactive oxygen-derived molecules. In excess, ROS can damage cellular components such as membranes, proteins and DNA, ultimately leading to cell death. However, ROS are not only harmful: in moderate amounts, they act as signaling molecules that can trigger inflammatory pathways and potentially stimulate anti-tumor immune responses. Inflammation itself is a complex biological reaction designed to protect tissues, but if excessive, it may also contribute to toxicity.

Our work seeks to better understand this delicate balance: when does oxidative stress become toxic, and when might it contribute to beneficial anti-tumor mechanisms? By evaluating cytotoxicity, ROS production, iron degradation and inflammatory responses in liver cancer cells, we aim to clarify how surface coating influences the cellular fate and biological impact of these nanoparticles. In parallel, the effects of the treatment will also be investigated in healthy hepatocytes — the main functional cells of the liver — in order to evaluate potential toxicity toward non-cancerous tissue.

Importantly, we extend this analysis to macrophages — key immune cells that orchestrate inflammation and coordinate immune responses. Studying macrophages allows us not only to assess the impact of the treatment on non-cancerous cells, but also to explore how nanoparticle-induced stress may shape immune activation. Because macrophages can both promote and suppress tumor progression depending on their activation state, understanding their response is essential to anticipate potential therapeutic benefits or unintended inflammatory effects.

Magnetic hyperthermia is often described as a controllable physical therapy, yet its success ultimately depends on how cells interpret and respond to the presence of nanoparticles. By examining both tumor and immune cell responses, our study seeks to better define the balance between therapeutic stress and unintended toxicity.

Meenakshy Suresh

PhD student at MOLTECH-Anjou (University of Angers)

“ Tetrameric Design of Perylene diimide-based Non-Fullerene Acceptors for Improved Morphology in Organic Photovoltaics”

Meenakshy Suresh[1], Marcin Kielar[1], Maxime Rémond[1], Guillaume Andrivot[1], Cristina López Cava[2], David Beljonne[2], Clément Cabanetos[1] and Philippe Blanchard[1]

[1]University of Angers, CNRS, MOLTECH-Anjou, Angers, France,
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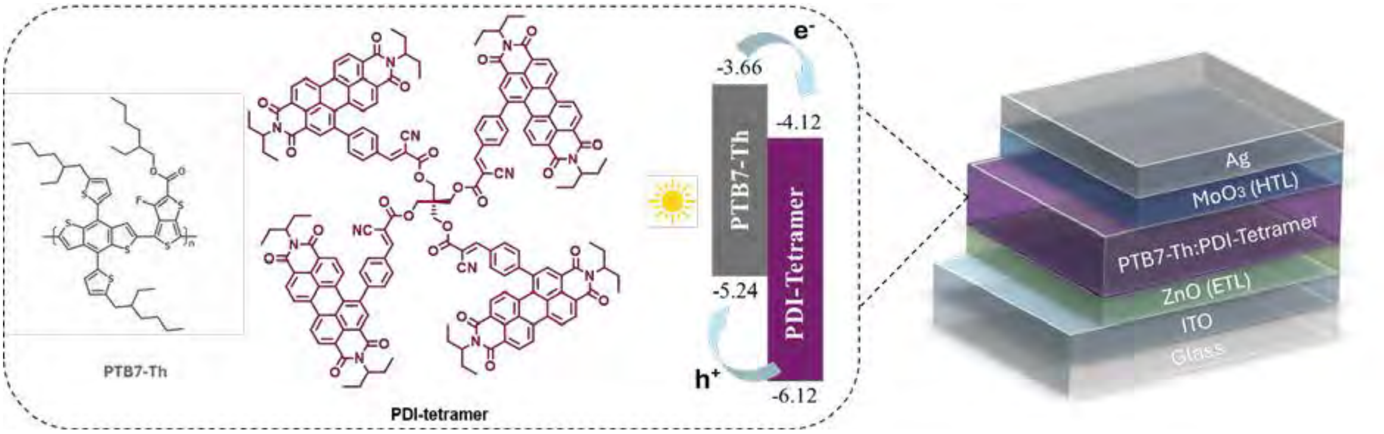
Among the various non-fullerene acceptors (NFAs), perylene diimide (PDI) stands out for its large, planar π-surface, good charge transport properties, and absorption in the visible spectrum. However, the highly planar structure of PDI units leads to intense π-π stacking interactions, resulting in strong aggregation and crystallisation in the active layer of organic photovoltaic cells (OPVs), which hinders exciton dissociation. In addition, molecular diffusion of small acceptors further lowers the device efficiency. To address these challenges, we designed and synthesized a tetrameric PDI architecture based on a flexible pentaerythritol core, employing a straightforward and readily accessible synthetic route. This strategy enhances solubility and spatial geometry, making thin films more homogeneous [1]. The properties of the PDI tetramer were compared with its corresponding monomer synthesized in a similar way. The tetramer showed stronger absorbance (εmax = 126,000 M-1 cm-1) compared to the monomer. Moreover, the thermal analysis revealed a less crystalline nature for the tetramer relative to the monomer, along with a significant increase in the glass transition temperature (Tg), resulting in lower diffusion coefficient [2,3]. This is crucial for achieving reduced domain sizes and stable active layer morphology with satisfactory OPV performance. Photovoltaic performance was evaluated in inverted-type OPV devices fabricated from blends of PDI acceptors with a complementary donor polymer (PTB7-Th). Overall, this synthesis approach highlights the potential of high molecular weight acceptors for NFA-based OPVs.



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Océane Baffroy

Postdoctoral researcher at CEISAM (Nantes University)

“Advanced Organic Near-Infrared (NIR) Photosensitizers for Fully Transparent and Colorless Dye-Sensitized Solar Cells (DSSCs)”

Océane Baffroy*, Thibaut Baron, Simon Pascal, Yann Pellegrin, Fabrice Odobel

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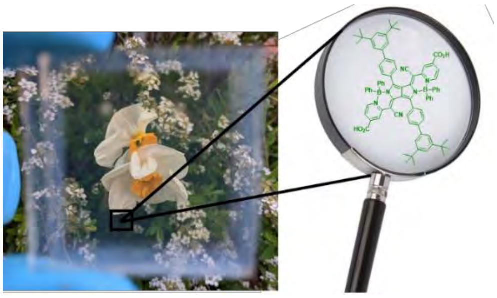
The worldwide energy consumption increases more and more every year. Yet the major part of our energy comes from fossil resources; the decreasing stock of these resources and more importantly its impact on the environment make it an unsuitable solution for the energetic problem that we are currently facing. Thus, it becomes a necessity to improve solutions relying on renewable energies. Sunlight, and more specifically photovoltaics (PVs), is a perfect alternative to non-sustainable fossil fuels. In particular, the development of transparent and colorless solar panels is a promising strategy for integration of solar panels in the windows of edifices (i.e., building-integrated photovoltaics (BIPV)) but also for electric vehicles and self-powered greenhouse. 1
Dye-sensitized solar cells (DSSCs) are well-suited candidates for the development of colorless PV cells.2 Indeed, they can be cheap to produce and their efficiencies are less dependent of the light incidence angle and intensity. Moreover, they are naturally semitransparent and the color of the device is afforded by the dye itself. Thus, the integration of selective near-infrared (NIR) absorbing dyes in such devices would lead to perfectly colorless PV systems.3 Toward this objective, new NIR-absorbing dyes were synthetized and characterized. The preliminary devices present outstanding results, with an efficiency close to 4 % combined with a transparency higher than 65 %.4,5



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Rita Aflak

PhD student at MOLTECH-Anjou (University of Angers)

“ Benzanthracene Imide–Based Heavy-Atom-Free Photosensitizers: A New Strategy for Photodynamic Therapy”

Rita Aflak[1] *, Ahmad Kassem[1], Claudia Wilfinger[1], Magali Allain[1], Arthur H. G. David [1], Clément Cabanetos[1]

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The synthesis of red-absorbing photosensitizers is essential for a broad range of light-driven applications that rely on the efficient population of long-lived triplet excited states under mild irradiation conditions, including photopolymerization and photocatalysis. Absorption in the red or near-infrared region enables deeper light penetration, reduced scattering, and minimized photodamage compared to higher-energy excitation[1]. These advantages are particularly critical for photodynamic therapy (PDT), where the controlled generation of reactive intermediates under low-energy light underpins high performance and selectivity.[2] In this context, benzothioxanthene imide derivatives and their analogues have emerged as a promising platform for PDT due to their outstanding optoelectronic properties, especially their exceptionally high singlet oxygen sensitization quantum yield[3]. Given that their optical properties are largely confined to the visible region, we pursued extension of the π-conjugated core to red-shift their absorption spectra.

To this end, six analogues incorporating benzene, naphthalene, or thiophene units with either non-extended or π-extended structures, were synthesized and characterized. Their optoelectronic properties were systematically characterized to establish structure–property relationships and assess their potential as next-generation of red-to-near infra-red absorbing heavy-atom-free photosensitizers.

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Nouran Zahran

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“Development of nano-immunotherapy for targeting a triple negative breast cancer (a vaccination strategy)”

Triple-negative breast cancer (TNBC) is an aggressive breast cancer subtype lacking effective targeted therapies and associated with poor prognosis and high recurrence rates. This project aims to develop a targeted nano-immunotherapy platform for systemic delivery of the oncolytic peptide LTX-315 to enhance its therapeutic selectivity and immunostimulatory potential. A liposomal nanocarrier functionalized with tumor-homing peptides will be designed to improve tumor targeting and reduce off-target toxicity. The formulation will be physicochemically characterized and evaluated for cytotoxicity, cellular uptake, and induction of immunogenic cell death in TNBC models. The immunological response will be investigated through dendritic cell maturation and activation assays. Therapeutic efficacy will be assessed in murine TNBC models.This strategy aims to stimulate adaptive antitumor immunity and establish long-term immune memory against tumor recurrence.

Teodora Mocanu

Postdoctoral researcher at MOLTECH-Anjou (University of Angers)

“ Conductive and Chiral Metal–Organic Frameworks Based on Redox-Active TTF Ligands”

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Conductive metal–organic frameworks combine permanent porosity, high internal surface area, and structural modularity with electrical conductivity and redox activity, enabling emerging applications in electrocatalysis, chemical sensing, energy storage.1 The incorporation of chirality into conductive porous coordination networks provides a versatile platform for next-generation spintronic devices and spin-selective materials.2 Tetrathiafulvalene (TTF) derivatives serve as archetypal electroactive building blocks in organic electronics and molecular conductors, where efficient charge transport arises from close intermolecular contacts and increased sulfur orbital overlap.3 Sulfur-rich tetrathiafulvalene–tetrathiapentalene (TTF–TTP) derivatives further enhance intermolecular coupling and charge delocalization, offering a rational strategy to approach metallic transport in crystalline organic assemblies4 and potentially in coordination networks.

The M2TTFTB series (M= Zn, Cd, Co, and Mn) represents a prototypical class of through-space conductive MOFs, in which the metal nodes modulate charge transport by controlling π–π and S···S interactions within helical TTF stacks.5 Herein, we demonstrate the induction of chirality in such conductive frameworks using enantiopure chiral additives (Figure 1a). Furthermore, we introduce a new tetratopic bis-fused TTF ligand that forms 3D conductive networks by bridging rod-like alkali-metal SBUs (figure 1b), reaching conductivities up to 300 S/cm.

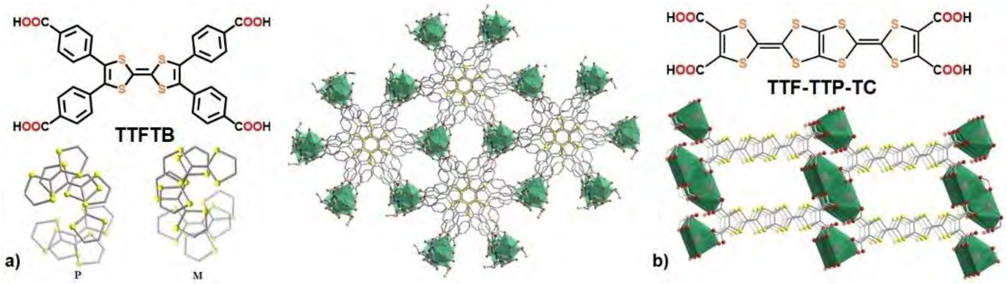

Figure 1. a) Induction of opposite helicity in TTF stacks by incorporating chiral additives in TTFTB-Cd(II) system; b) Perspective of the 3D net assembled from TTF-TTP linkers and alkali metal ions.

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Sarah Couppoussamy

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“Novel conducting polymers for superior organic capacitors”

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Energy storage has become a central challenge of energy transition. The continuous growth of energy demand, combined with the increasing deployment of renewable energy sources such as wind and solar power, makes the development of efficient, reliable, and sustainable storage systems essential to ensure a secure electricity supply. While lithium-ion batteries currently dominate the market, their economic, environmental, and sustainability limitations raise significant concerns. In this context, organic batteries have emerged as a promising approach to reconcile energy storage performance with environmental sustainability. However, there is still no organic material that meet the specification of storage in terms of energy density, power and stability. Our ambition is to develop organic conducting polymers (CPs) with intrinsic porosity and mixed ion-electron-conductivity as a new generation of sustainable electrochemical storage materials.

This work aims to combine the advantages of both porous polymers and mixed ion-electron-conducting polymers to enhance their performance for energy storage applications.1,2 To achieve this far-reaching goal, polyethylene glycol (PEG)-type monomers are synthesized as building blocks to prepare conducting polymers with intrinsic porosity and chemical environment well suited for improving both ion and electron conductivities (Figure 1). Unfortunately, the measurement of both ion and electron conduction with the same experimental setup remains very challenging because these different conduction modes differ from each other by several order of magnitude. This work presents a solution to that problem which remained unresolved for too long.

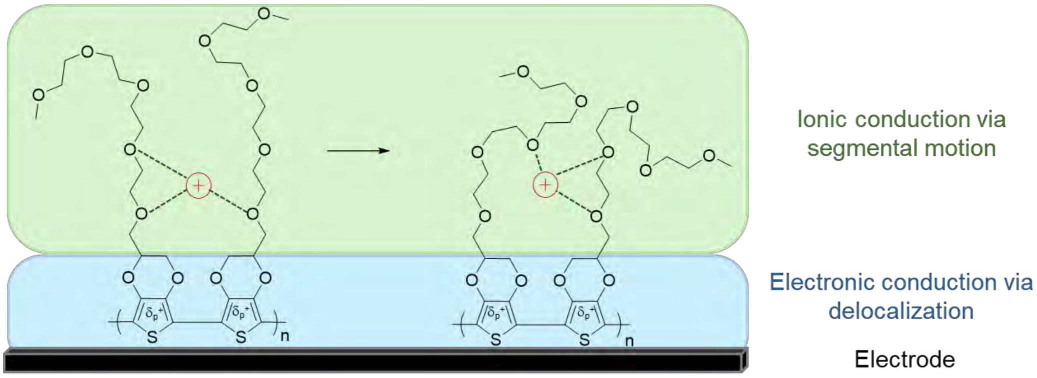

Figure 1. Schematic representation of ionic and electronic conduction on Monomethylether-Tetraethyleneglycol-EDOT polymer.

Acknowledgment

This research was funded by the cellule Energie du CNRS through the framework of the project ECO-Batt, and the Agence Nationale de la Recherche (ANR) through the framework of the project ECHO-Mix (grant number ANR-25-CE05-6977).

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Sindoora Suresh

PhD student at MOLTECH-Anjou (University of Angers)

"Redox Controlling the Binding Ability of Coordination Cages Grafted on Monolayered Surfaces"

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The possibilities to tune the physio-chemical characteristics of surfaces by immobilizing diverse molecules have drawn wide interest due to diverse applications in the fields of smart surfaces such as molecular sensors. This can be achieved through immobilization of hosts capable of interacting selectively with given guests, and in the most advanced systems, of controlling this interaction using an external stimulus.

To this end, molecular cages constructed by self-assembly of electroactive ligands and metals have recently been developed in the laboratory.1 Controlling the release of a guest could be obtained by oxidation of extended tetrathiafulvalene (exTTF) based ligands, a unit that shows unique electronic and geometric properties. Nevertheless, the development of such stimuli responsive architectures is currently restricted to conceptual studies in solution. To target applications, their integration into nano-functionalized devices is highly desirable.

Among the surface functionalization methods, reducing diazonium salts offers the advantage of producing stable organic layers. However, controlling their thickness remains a significant challenge. Thanks to an original methodology recently pioneered in the laboratory, involving the introduction of an alkyl chain between the reactive aryldiazonium and the terminal functional moiety, stable monolayers are now readily attainable. 2

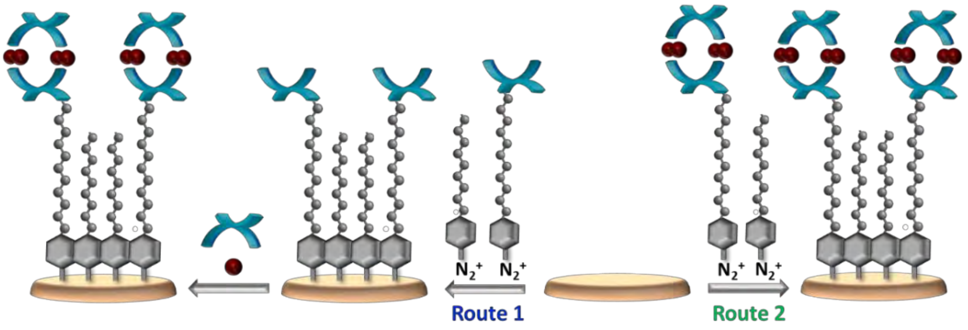

Figure 1. *Two paths (Route 1 and Route 2) considered for the preparation of functional surfaces.*

Grafting molecular cages on surfaces is considered through two strategies[3] (Figure 1). One involves the formation of the cage on the surface subsequent to ligand immobilization, while the other entails the direct immobilization of the preformed cages.

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Gabrielle Ledoussal

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“Chirality related effects in helicene grafted electrodes”

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Chirality has played an important role in modern chemistry since the 19th century as chiral molecules display synergistic properties with light, magnetism or electronic transport (Chiroptics, spintronics, magnetochiral effects…). The CISS effect (Chirality Induced Spin Selectivity) is a fascinating phenomenon discovered more than 20 years ago.[1] This phenomenon allows a chiral molecule to filter the spin of electrons depending on the molecule’s handedness. This is a promising property to consider for spintronics and chiral electrocatalysis. The CISS effect allows e.g. the control of water splitting by eliminating the production of hydrogen peroxide.[2]

Helicenes are spiral shaped molecules whose aromatic cycles are *ortho*-fused, and present helical chirality. They display usually a strong CISS effect as they force the electron to follow a helical path.[3]

In this work, we have synthetized diazonium functionalized *[4]* and *[6]* helicenes, and electro-grafted them on diverse electrodes, The molecules are covalently grafted, making it a highly stable material. Protocols are developed to control the thickness of the layers. The surfaces will be characterized by electrochemical, electrocatalytic and physical methods. The CISS effect will be exploited via the Oxygen Reduction Reaction or the Oxygen Evolution Reaction.[4]

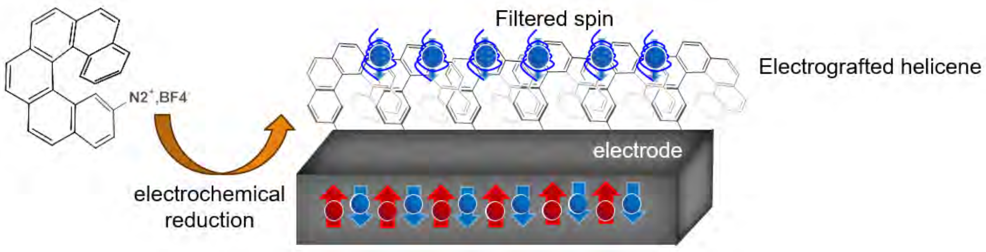

Figure 1. Overview of the CISS effect with covalent-grafted helicenes

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Camille Ménier

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“Microbiota and lung cancer: inhalable nanoparticles as an innovative strategy to fight lung cancer”

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Lung cancer is currently the leading cause of cancer-related mortality worldwide. Despite the various therapeutic strategies available, 5-year survival is still only 20%. With mostly non-specific active principles and high administration doses, patients' quality of life is severely impaired by numerous side effects. The use of nanoparticles is rapidly asserting itself as a major new approach to cancer treatment. Combined with local administration, they could reduce the dose delivered to patients, while increasing the efficacy and specificity of treatment. However, the lung is protected by several biological barriers that prevent particles from entering and eliminates those that do. Among these barriers, the local microbiota can greatly influence the response to treatment, as it can degrade and inactivate anticancer drugs.

We first discovered that bacterial strains present in the lung microbiota can degrade and reduce the effectiveness of anticancer drugs used in clinical practice.

In order to effectively administer treatment to the tumour site, self-assemblies were formulated from two amphiphilic compounds combining anticancer effect with stealth and antimicrobial properties. The first conjugate, composed of anticancer molecule and an antimicrobial peptide will protect the drug from degradation by the microbiota. The second one, formed from a polyethylene glycol coupled with the anticancer drug will allow the nanoparticles to overcome the other biological barriers inherent to the pulmonary administration route. The synthesis of the compounds is achieved through various bioconjugation chemistry techniques involving the introduction of chemical groups that are specifically cleaved in the tumour environment. This strategy has been employed to formulate various self-assembling bioconjugates. Physicochemical characterisation of these molecules and in vitro efficacy trials are currently underway.

Overall, this study aims to confirm the role of lung microbiota in chemotherapy delivery and to highlight the importance of taking all biological barriers into account when designing new therapeutic approaches.

Abdelhaq Cherradi

PhD student at MOLTECH-Anjou (University of Angers)

“Cross-linked naphthalene diimide small molecules as multifunctional electron transport layers for perovskite solar cells”

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Electron transport layers (ETLs) are key components in perovskite solar cells (PSCs). Beyond extracting and transporting electrons from the perovskite absorber, ETLs can also improve device stability by passivating interfacial defects, reducing non-radiative recombination, and mitigating degradation pathways. This expanded role motivates the development of multifunctional, colorless ETLs that combine efficient charge extraction, fast electron transport, and interfacial protection [1]. However, designing organic ETLs that meet these requirements remains challenging, particularly when incorporating self-doping motifs to enhance conductivity and crosslinkable groups to improve film robustness, solvent resistance, and long-term operational stability. In this oral presentation, we report our first results using a naphthalene diimide (NDI)-based small-molecule ETL in p–i–n PSCs employing a triple-cation perovskite absorber. Preliminary investigations showed that devices incorporating the NDI ETL reached a power conversion efficiency (PCE) of 7%. While the initial performance remains below the fullerene benchmark, these results validate NDI derivatives as solution-processable ETLs and provide a foundation for further molecular and interfacial optimization. We also present the complete synthesis of a next-generation NDI platform combining easy crosslinking and self-doping functionalities, designed to strengthen interfacial durability, protect the perovskite from moisture, and enhance electron transport. Importantly, these molecules are highly stable, straightforward to prepare, and colorless, making them promising candidates for tandem PSCs where minimal parasitic absorption is required. Additional optimization and device results will be discussed.

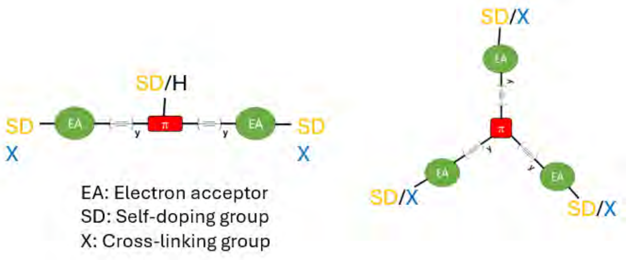

Figure 1: Targeted ETL structures

This work was funded by the French National Research Agency (ANR) through the X-ETL project.

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Ana Lígia Blanco

PhD student at MINT laboratory (University of Angers)

“Micafungin Nanoemulsion Development and Experimental Candida auris Infection Model in Galleria mellonella”

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An evaluation of the biological activity of a nanoemulsion containing micafungin against biofilms formed by *Candidozyma auris* was conducted as an alternative approach to currently available antifungal treatments. The nanoemulsion was formulated using oleic acid as the oil phase, a mixture of polyoxyethylene 20 cetyl ether (Brij® 58) and soy phosphatidylcholine in a 2:1 ratio as the surfactant system, and phosphate-buffered saline (PBS) pH 7.4 as the aqueous phase.

Biological assays revealed that the nanoemulsion with incorporated micafungin did not exhibit antifungal activity against the clinical strain of *C. auris*, whereas the solution containing free micafungin showed measurable antifungal activity with a minimum inhibitory concentration (MIC) of 0.165 µg/mL. Notably, no antifungal activity was observed against the biofilms formed by this strain, indicating that the formulations were not able to disrupt biofilm-associated cells under the conditions tested.

Acute toxicity assessments using *Galleria mellonella* larvae demonstrated that administration of both free and nanoemulsion-incorporated micafungin at doses ranging from 5 to 2000 mg/kg did not result in any mortality, confirming a favorable safety profile for both forms of the drug. Furthermore, therapeutic trials using the *Galleria mellonella* infection model revealed that larvae treated with free or nanoemulsion-incorporated micafungin displayed the highest survival rates compared to untreated controls. These results suggest that both formulations were effective in mitigating the lethal effects of *C. auris* infection *in vivo*.

Overall, these findings emphasize the potential of micafungin, particularly when delivered via a nanoemulsion, as a safe and promising intervention for controlling C. auris infections.

Figure 1*: Healthy Galleria mellonella larvae treated with the micafungin-loaded nanoemulsion are shown on the left, exhibiting normal coloration and mobility, while untreated larvae on the right, infected with C. auris, display melanization and death. This visual comparison highlights the protective effect of the nanoemulsion treatment against lethal fungal infection.*

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Louison Ledroit

PhD student at MINT laboratory (University of Angers)

“Evaluation of rheological properties of bacterial biofilms”

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[2]Universidade Estadual Paulista (UNESP), Faculdade de Ciências Farmacêuticas, Brazil.
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Introduction:

Bacterial biofilms are structured microbial communities embedded in a self-produced extracellular matrix. Their composition typically includes polysaccharides, proteins, lipids, and extracellular DNA, all contributing to mechanical stability. The resulting matrix exhibits complex rheological behavior, often displaying viscoelastic properties that protect cells from stress.
Understanding these features is crucial for controlling biofilms in medical, industrial, and environmental settings.

Materials and Methods:

Pseudomonas aeruginosa was cultivated on sterile 25-mm Isopore™ polycarbonate membrane filters (pore size 0.2 µm). Filters were placed on nutrient agar plates and inoculated with an overnight culture adjusted to the desired optical density. Biofilms were allowed to develop for 24 h at 37 °C under static conditions. Rheological characterization of the mature biofilms was performed using a Kinexus Plus rheometer (NETZSCH, Germany) using a plate-plate geometry (20-mm diameter). The biofilm-coated filter was positioned between the upper and lower plates with a controlled normal force to ensure consistent contact without compressing the biomass. The viscoelastic properties: storage (G’) and loss (G’) moduli, of the biofilm at 20°C were determined with oscillatory test in the linear regimen (constant amplitude shear strain 0.1%) with oscillatory frequency ranging from 0.1 to 10 Hz.

Results:

Increase of the normal force on the upper geometry is observed when the device touches the biofilm and therefore allows to measure the thickness of the produced biofilm. Under the experimental conditions tested, the biofilm was measured at ~75µm. G’ and G” profiles of native biofilm are ranging respectively from 1800-3200Pa & 230-480Pa, respectively. These profiles similar to those of hydrogels (G’ > G’’ and constant in the applied frequency range) can be increased with addition of antibacterial ions such as calcium to 2700-4100Pa & 550-800Pa, respectively, while maintaining a hydrogel shape.

Conclusions:

Rheology is a useful technique to evaluate the stiffness and thickness of bacteria biofilm and should be useful to evaluate the antibacterial effect of newly designed antibiotics.

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A project initiated and organized by PhD students Sara Helis and Lea Daoud at the MOLTECH-Anjou and MINT laboratories and supported by:

Founded in 2018, the UA Foundation's mission is to support and develop projects at the University of Angers. Its ambition is to strengthen the ties between the academic world and the region's socio-economic network. Thanks to donations and commitments from its partners, the Foundation funds innovative research projects, supports the emergence of talent, encourages the creation of chairs of excellence, and promotes scientific culture among the general public. Since 2024, the University of Angers Foundation has made the theme "Women in Science" a strategic development focus. The place of women in science—referring to science, technology, engineering, and mathematics (STEM)—is indeed a major societal and social concern. For about ten years, the University of Angers has been committed to supporting the presence of women in science, within its academic programs and its faculties.

The MOLTECH-Anjou laboratory (a joint CNRS-University of Angers research unit) brings together the expertise of 80 individuals, including nearly 50 CNRS researchers, academic researchers, engineers, and technical staff, as well as around 30 doctoral and post-doctoral researchers. The laboratory's scientific activity focuses on the development of molecular materials, whether organic or hybrid organic-inorganic, supporting high-visibility fields such as organic electronics, stimuli-responsive materials, nanostructuring, and energy-related materials.

The Translational Micro- and Nanomedicines Unit (MINT) is a research team accredited by the University of Angers, INSERM, and CNRS. It is composed of approximately fifty members and is part of the Health research cluster of the University of Angers. The team's organization is based on the integration and interaction of various research fields (physicochemistry of colloids and interfaces, biology, pharmaceutics, imaging, etc.), all focused on the design of micro- or nanoscale vectors intended for the delivery of therapeutic active agents (proteins, xenobiotics, DNA, siRNA, etc.) or imaging molecules.

ANR-18-EURE-0012

The LUMOMAT project is a Graduate School of Research (EUR) with a master's in chemistry (master's degree 1 in Nantes and Rennes and Master Degree 2 in Angers). This project led by the University of Angers and includes the University of Rennes 1, Nantes University, ENSCR and the CNRS. This project involves researchers from 4 laboratories in the West of France: MOLTECH Anjou (Angers), CEISAM (Nantes), IMN (Nantes), ISCR (Rennes) and is supported by 10 official international universities. In total, more than 270 researchers are involved. This project is focused on three main application areas:

- materials for energy, including organic, dye-sensitized, or hybrid perovskite solar cells, artificial photosynthesis, and OLEDs.
- materials for health and the environment, including new sensor probes for medical applications.
- materials for information storage, nanostructured systems and imaging.

The MATRIX Research Federation (SFR MATRIX) brings together research units around the shared scientific theme of the Materials Hub of the University of Angers. Its mission is to act as a key interlocutor for the University Presidency, coordinating laboratories' resource requests and their responses to calls for research funding.
In collaboration with local, regional, and inter-regional partners, the federation defines a prioritization strategy aligned with the main research axes. It pools intellectual and material resources through four technical platforms, with the aim of optimizing research activities, supporting new initiatives, increasing the visibility of the hub, and promoting scientific exchange and training. The federation also plays an advisory and mediating role, without interfering in the scientific policy of the individual research units.
The two main research units that make up SFR MATRIX are the LPHIA and MOLTECH-Anjou laboratories.