

# Postdoctoral fellow in molecular sieve biomembranes derived from polysaccharides and MOFs for bioelectrochemical sensors

## Laboratories

The CNRS is the only research organization in France that brings together all scientific disciplines. Its strength lies in having specialists in highly specific fields, capable of deeply understanding and advancing their subject. The interdisciplinarity approach consists of bringing these experts together for joint scientific projects. Our approach aims at the exploration of new scientific questions - which require cooperation between disciplines - and the development of global strategies to address major scientific challenges - which are by nature intersecting and interdisciplinary - such as climate change, health and the environment, or educational inequalities. The CNRS strives to facilitate dialogue between the sciences themselves, as well as with societal actors. The CNRS is a leader in national and international rankings: 4th in the 2020 Nature Index, 2nd in the 2019 SCImago Institution Rankings, and has the 6th most filed patents in France.

The CERMAV institute is a leader in glycosciences in Europe, and the activities of its five research teams, addressing various aspects of glycosciences, consequently addressing major societal challenges in the fields of human health, emerging energies, and materials for new technologies. This CNRS-based institution makes a significant contribution to research-based training to prepare students and young researchers for the professional, industrial, and academic world.

The Department of Molecular Chemistry (DCM) in Grenoble is a joint research unit (UMR 5250) linked to both the CNRS and the University Grenoble Alpes. The DCM was created on January 1, 2007, following the merger of the Laboratory of Organic Electrochemistry and Redox Photochemistry (LEOPR, UMR 5630,) and the Laboratory of Dynamic and Structural Studies of Selectivity (LEDSS, UMR 5616). As of today, the DCM employs approximately 150 people, whose scientific orientations are focused on major societal themes: health and well-being, new energies, and also fundamental aspects.

## Team

The BIOCEN team is based in the state-of-the-art Nanobio complex on campus with direct access by foot to the Chimie Nanobio ICMG platform as well as the CERMAV institution. BioCEN's activity is focused on molecular electrochemistry and bioelectrochemistry with the development of electrode materials whose applications include analytical chemistry with biological sensors (enzyme electrodes, immunosensors, aptasensors and DNA sensors), bioreactors and electrochemical biomimetic systems, energy conversion, biofuel cells and abiotic fuel cells. BIOCEN is a leading European research team in enzymatic biofuel cells and biosensors. The team comprises 3 permanent CNRS researchers, 1 emeritus CNRS researcher, 1 professor, 2 lecturers, and 2 CNRS engineers. Dr Gross is a specialist in molecular surface chemistry, electrochemistry, and nanostructured (bio)materials for sensing and energy (44 publications, 9 patents, co-founder of BeFC SAS on paper-based biofuel cells).

The research activities of the SMP team are focused on the chemistry and physicochemistry of polysaccharides. Polysaccharides are bio-based polymers, derived from renewable resources, generally biocompatible and biodegradable. We develop methods for chemically modifying

	<p>these biopolymers and we exploit their new properties to design functional, stimuli-responsive biomaterials for advanced applications in healthcare. Prof R. Auzély, SMP team leader (CERMAV), is an expert in modification and characterization of polysaccharides for the development of smart biomaterials (110 publications, 14 patents). D A. Szarpak (AS), MCF / lecturer in the SMP team strengthens the consortium relating to the modification and characterization of polysaccharides and composites.</p>
<p><b>Location</b></p>	<p>Département de Chimie Moléculaire (CNRS/UGA UMR 5250), 570 Rue de la Chimie, Université Grenoble Alpes, 38058 Grenoble</p>
<p><b>Project name</b></p>	<p>Molecular sieve biomembranes derived from polysaccharides and MOFs for bioelectrochemical sensors</p>
<p><b>Project description</b></p>	<p>Enzyme-based electrochemical biosensors have revolutionised diabetes care and offer considerable promise for monitoring of biomarkers to improve human health. State-of-the-art devices combining robust enzymes with petroleum-based polymers are limited to the monitoring of glucose over short periods of time. The development of biosensors beyond glucose is challenging due to factors such as enzyme and sensor fragility, selectivity and specificity. In this project, we propose to develop a new class of porous and biocompatible polysaccharide-based membranes to modulate the selectivity and reactivity of electrochemical biosensors to enable reliable monitoring of alternative biomarkers in biofluids. Metal organic frameworks, highly porous “sponge-like” materials formed via the self-assembly of metal ions and organic linkers, are being widely explored for gas adsorption and separation as well as catalytic reactions. Here we will push their development in combination with polysaccharides to obtain new materials for the niche application of electrochemical biosensing.</p>
<p><b>Mission</b></p>	<p>Within the framework of Labex ARCANE (laboratoire d'excellence) - University of Grenoble funding, we are looking for a post-doctoral researcher to develop polysaccharide-based membranes incorporating metal-organic frameworks and their application for electroenzymatic biosensing. Labex Arcane is a consortium of scientists from the University of Grenoble whose common scientific objective is biomotivated chemistry: <a href="https://arcane.univ-grenoble-alpes.fr">https://arcane.univ-grenoble-alpes.fr</a></p>
<p><b>Responsibilities</b></p>	<p>The recruited person will work on a highly multi-disciplinary topic that will involve working on several sub-topics relating to chemistry and materials science. There are three principle work packages dedicated to (1) synthesis and characterisation of polysaccharide hydrogels, (2) Synthesis and characterisation of polysaccharide-MOF hydrogels, including the use of cross-linking methods, and (3), the fabrication, characterisation and evaluation of modified enzymatic electrodes for electrochemical sensing of analytes found in-vivo such as peroxide, lactate and nitrate. The chemical and mechanical properties of the hydrogels including swelling and mechanical properties will be studied via CERMAV. The MOF materials will be characterised using techniques including powder XRD, FTIR, Raman and electron microscopy. Membrane properties including charge and diffusional properties are also of interest. Electrochemistry (cyclic voltammetry and chronoamperometry) will be used for simple characterisation and applied sensor performance evaluation. Characteristics of interest may include membrane charge and diffusional properties.</p>

<b>Expected results</b>	<ul style="list-style-type: none"> <li>● The preparation and characterisation of new polysaccharide-based hydrogel materials, including new MOF-polysaccharide materials, with comprehensive understanding of their properties.</li> <li>● The realisation of a new range of electrochemical biosensors comprising mixed inorganic-biopolymer membranes for practical monitoring of an analyte of interest in complex artificial fluids, including new understanding of membrane structure and properties on biosensing performance.</li> </ul>
<b>Skills</b>	<ul style="list-style-type: none"> <li>● Ph.D. in chemistry or related field seeking to develop a multi-skilled profile, and possessing an interest in synthetic chemistry (biopolymers/polysaccharides and inorganic) for material fabrication, and physical chemistry (electrochemical biosensors for health).</li> <li>● Strong competence in <b>at least one of the three main subjects</b> (chemistry of (bio)polymers, electrochemistry, MOF chemistry) <b>with motivation/experience in a secondary subject.</b></li> <li>● Excellent experimental skills.</li> <li>● Excellent writing abilities, aptitude for reporting, publishing, and promoting results.</li> <li>● Ability to work independently and in a team on highly multidisciplinary topics.</li> <li>● Excellent communication and organizational skills.</li> <li>● Ability to solve complex problems</li> <li>● Critical and curious mindset</li> <li>● Initiative</li> <li>● Rigor</li> <li>● Ability to work in a team</li> <li>● Well-thought-out future vision</li> </ul>
<b>Experience</b>	From 2 to 5 years, beginners accepted
<b>Applications Close</b>	30/04/2024
<b>How To Apply</b>	Application file including CV, cover letter, and at least one recommendation letter to be sent to the project leaders: ( <a href="mailto:andrew.gross@univ-grenoble-alpes.fr">andrew.gross@univ-grenoble-alpes.fr</a> ; <a href="mailto:rachel.auzely@cermav.cnrs.fr">rachel.auzely@cermav.cnrs.fr</a> ; <a href="mailto:anna.szarpak@cermav.cnrs.fr">anna.szarpak@cermav.cnrs.fr</a> )
<b>Funding</b>	Funding for 18 months by Labex Arcane: <a href="https://arcane.univ-grenoble-alpes.fr">https://arcane.univ-grenoble-alpes.fr</a>

