

INRAE UR1268 BIA – BIBS

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Postdoctoral researcher position in development of high energy activation process for structural mass spectrometry applied to carbohydrate analyses



18-month



January 1, 2025



Nantes, France

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JOB DESCRIPTION

Carrageenan and agar are long, mainly unbranched sulfated galactans with alternating α -1,3/ β -1,4 glycosidic bonds which may be further modified by sulfations or other chemical groups. The structure of these complex polysaccharides remains incompletely described. However, lower molecular weight oligosaccharides derived from these polymers (and their derivatives) have shown interesting clinical activities, either in vitro or in vivo (e.g., anti-tumour, anti-viral, antihyperlipidemic, prebiotic, anti-inflammatory, antioxidant). **The ANR project MIRROR_MIRROR aims to produce novel (sulfated) bioactive molecules, further enhancing the activities described above by discovering new enzymes able to modify sulfated galactans.** Before their examination in a pre-pilot study, a complete structural study of the oligosaccharides produced by the new enzymes is necessary to parallelize the bioactivities and the structural key points which induce these activities. **You will be hired as part of the ANR Mirror_Mirror project to conduct all structural characterizations, using tandem mass spectrometry.**

Our group has demonstrated the efficiency of highly-accelerated ions and high energetic photons as **alternative methods for ion activation, which can tackle the limitations of classical CID approach** for the structural elucidation of carbohydrates.¹⁻⁶ These methods promote informative fragmentations and minimize the losses of crucial labile functions such as sulfate groups, thereby allowing the fine characterization of complex sulfated oligosaccharide structures. However, they are not all available on high-resolution instruments. The aim is therefore to develop new instrumentation that will provide access to **high-energy fragmentation mechanisms on a high-resolution mass spectrometer, with a sensitivity and dynamic range that is compatible with biological samples** and can be coupled to a UHPLC system.

The mass spec analyses will be performed at INRAE-BIA-BIBS. You will be in charge of the **development of high-energy fragmentation methods** on highly sulfated species. Two instruments will be used for the project: a **Cyclic IMS** (Waters) equipped with an **ExD cell** (eMSion) which combines high-resolution ion mobility and electron induced dissociation; and an **Orbitrap (Q-Exactive) modified with a high-energy photon activation cell**. You will be in charge of method validation, interpretation of the data and generation of a highly confident multimodal database based on chromatography, ion mobility, exact mass measurement and tandem MS spectra.

You will present your findings at leading international conferences in mass spectrometry and/or glycosciences, and will publish in peer review journals.

Your work will be supervised by Dr David Ropartz. The anticipated start date is Jan. 1, 2025, but reasonable accommodations can be made for the right candidate.

Related publications of the group:

High-energy fragmentation through ion-ion or ion-photon interaction mechanisms

1. Ropartz, D.; Fanuel, M.; Ollivier, S.; Lissarrague, A.; Benkoulouche, M.; Mulard, L. A.; André, I.; Guieysse, D.; Rogniaux, H. Combination of High-Resolution Multistage Ion Mobility and Tandem MS with High Energy of Activation to Resolve the Structure of Complex Chemoenzymatically Synthesized Glycans. *Anal. Chem.* 2022, 94 (4), 2279
2. Ropartz, D.; Li, P.; Jackson, G. P.; Rogniaux, H. Negative Polarity Helium Charge Transfer Dissociation Tandem Mass Spectrometry: Radical-Initiated Fragmentation of Complex Polysulfated Anions. *Anal. Chem.* 2017, 89 (7), 3824
3. Ropartz, D.; Li, P.; Fanuel, M.; Giuliani, A.; Rogniaux, H.; Jackson, G. P. Charge Transfer Dissociation of Complex Oligosaccharides: Comparison with Collision-Induced Dissociation and Extreme Ultraviolet Dissociative Photoionization. *J. Am. Soc. Mass Spectrom.* 2016, 27 (10), 1614
4. Ropartz, et al. Charge Transfer Dissociation of Complex Oligosaccharides: Comparison with Collision-Induced Dissociation and Extreme Ultraviolet Dissociative Photoionization. *J. Am. Soc. Mass Spectrom.* 2016, 27 (10), 1614.
5. Ropartz, D.; Giuliani, A.; Fanuel, M.; Hervé, C.; Czjzek, M.; Rogniaux, H. Online Coupling of High-Resolution Chromatography with Extreme UV Photon Activation Tandem Mass Spectrometry: Application to the Structural Investigation of Complex Glycans by Dissociative Photoionization. *Anal. Chim. Acta* 2016, 933, 1
6. Ropartz, D.; Giuliani, A.; Hervé, C.; Geairon, A.; Jam, M.; Czjzek, M.; Rogniaux, H. High-Energy Photon Activation Tandem Mass Spectrometry Provides Unprecedented Insights into the Structure of Highly Sulfated Oligosaccharides Extracted from Macroalgal Cell Walls. *Anal. Chem.* 2015, 87 (2), 1042

DESIRED SKILLS AND QUALIFICATIONS

Required:

- A PhD degree in Chemistry, Physical-Chemistry or Biochemistry;
- Lab experience with mass spectrometry (HR-MS and MS/MS);
- A publishing record with at least one first-author publication;
- Proficiency in English;
- Capacity to quickly acquire new knowledge and master new skills;
- Interest in both hands-on research activities and data analysis;
- Ability to work independently and as a member of a research team;

Preferred:

- Lab experience with ion mobility hyphenated to MS
- Lab experience with liquid chromatography hyphenated to MS
- Knowledge of carbohydrates chemistry and their structural analysis

EMPLOYER

INRAE (www.inrae.fr)

INRAE is a world-leading institute for research on agriculture, food and the environment, with a responsibility to address the global challenges of our time, namely climate change, food insecurity and biodiversity loss. Through an integrated approach, INRAE is able to identify and develop solutions with multiple applications to achieve the agro-ecological, nutritional and energy transitions we need to make.

INRAE is committed to nurturing an inclusive culture and a welcoming atmosphere. The Institute has made the "Social and Environmental Responsibility" a collective priority, in line with its commitment to sustainable development. This strategy should lead the Institute's research and internal practices to converge with ambitious values of environmental responsibility, solidarity and equity.

CONDITIONS OF EMPLOYMENT

Contract: 18-month.

The pay is commensurate with experience and ranges from 2,370 to 2,920 EUR per month.

By joining us, you will benefit from:

- 30 + 15 days of annual leave (for full-time employees, meaning 38.5h/week);
- Support for parenthood;
- Skills development programmes;
- Social support, holiday and leisure services;
- Sport and cultural activities.

APPLICATION PROCEDURE

Interested candidates are invited to submit a cover letter, an up-to-date CV and the contact details of at least one reference to david.ropartz@inrae.fr

Deadline for application: November 1, 2024

Contract start date: January 1, 2025 (Adjustable depending on availability of the selected candidate)