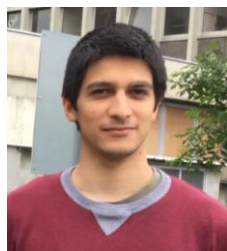


# Glycan Analysis by IR Spectroscopy Integrated into Mass Spectrometry

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Baptiste Schindler obtained his PhD in Physics at the University of Lyon in 2016. This concluded a strongly interdisciplinary academic training, which started in 2007 at the Pharmacy school of Nancy, followed by a Master degree in Analytical Sciences at the Chemistry Dpt. of the University of Lyon. During his PhD, Baptiste Schindler specialized in laser spectroscopy. By combining his skills in Infrared ion spectroscopy with his background in analytical chemistry, he developed an entirely new approach to tackle a major challenge in analytical sciences: carbohydrate sequencing. In 2017, with the support of CNRS and University of Lyon, he set up the IROGLYPH facility which provides expertise in carbohydrate analysis to research teams from academia and industry.

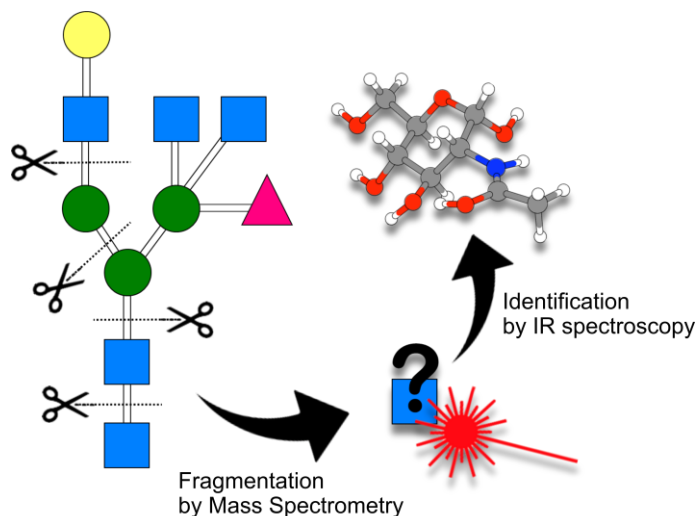
## Abstract:

Sequencing techniques have been established for proteins and DNA and have revolutionised modern biology but similar technique do not exist for glycans. In particular, top down analysis of glycans by mass spectrometry is often ambiguous due to the presence of various isomerisms. To fully characterize a glycan, one must describe:

1. The nature of the monosaccharide content
2. The regiochemistry of the glycosidic bond linking two carbohydrate moieties
3. The anomer stereochemistry ( $\alpha$  or  $\beta$ )
4. The structure of the monomeric ring (pyranose or furanose)
5. The identification of the position of commonly observed modifications such as sulfation or acetylation

While MS readily offers valuable information on the size distribution of glycans in a complex sample, a full characterization requires additional structural detail, which calls for hyphenated approaches. In our group at Institut Lumière Matière, we have built an instrument coupling Mass Spectrometry and Vibrational Spectroscopy (InfraRed Multiple Photon Dissociation), dedicated to the structural characterization of glycans. This instrument offers the structural resolution of spectroscopic techniques for mass-selected glycan ions and operates at typical MS conditions, i.e. it requires significantly less sample than traditional spectroscopy.

First, we have shown that the IR signature in the 3  $\mu\text{m}$  range obtained with our instrument is a powerful metric which is able to resolve simultaneously all these isomerisms. Then the



conservation of the molecular structure of a precursor ion within MS fragments has been revealed on disaccharides, opening the way to top-down, *de novo* MS analysis. Following this demonstration we have established a set of carbohydrate sequencing rules using a combination of Mass Spectrometry and IRMPD Spectroscopy. Finally, we have applied our approach to the determination of the sequence of different oligosaccharides.

**Figure.** Concept of top-down analysis of glycans using IR spectroscopy integrated into mass spectrometry

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