

Structural basis of glycan diversity in biological systems



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ABSTRACT

Glycosylation is one of the most prevalent posttranslational modifications of proteins and lipids. It markedly influences their structure and function, and plays a central role in nearly every aspect of biology. A deeper understanding of glycosylation—and the ability to precisely and rationally modulate it—are essential for advancing our fundamental biological knowledge and for developing innovative therapeutics across a wide range of human diseases.

In this talk, I will present our recent findings and advances in three research areas:

- 1) Rationalizing glycoengineering strategies for immunotherapeutic antibodies;
- 2) Unveiling the role of gut microbiota glycan processing machinery in human health and disease;
- 3) Glycoprotein folding and quality-control mechanisms in human diseases.

In our research, we are using a truly multidisciplinary approach. To determine high-resolution structures, we employ X-ray crystallography and single particle cryo-electron microscopy. To obtain mechanistic insight, we combine structural studies with molecular biology, protein/membrane biochemistry/biophysics and AI-driven computational methods. These approaches are frequently integrated with collaborative efforts in genomics, transcriptomics, proteomics, cell biology, synthetic organic chemistry and NMR spectroscopy.

BIOSKETCH

Dr. Guerin is specialized in Structural Glycobiology, with a Pharm.D. from the University of Buenos Aires and a Ph.D. in Biochemistry and Molecular Biology obtained from the Leloir Institute, Buenos Aires, ARG. Following postdoctoral research at Institut Pasteur, Paris, FRA and MRL Colorado, USA, he has led the Structural Glycobiology Lab in the Basque Country and currently serves as CSIC Research Professor and Group Leader at IBMB, Barcelona, ESP.

The focus of the Guerin group is the structural and mechanistic study of enzymes mediating the synthesis, degradation, regulation and transport of glycans, with the aim of applying this knowledge to the biomedicine, bioengineering and biotechnology areas. Using a multidisciplinary approach, his lab employs X-ray crystallography and, in more recent years, single particle cryo-EM to determine high-resolution structures. These techniques are combined with molecular biology, protein and membrane biochemistry and biophysics to obtain mechanistic insights, often associated with collaborative transcriptomics, proteomics, genetics, cell biology, synthetic organic chemistry and NMR.

This successful research program is built on firm foundations, as it is grounded in solid experience in the study of enzymes/glycans and the capacity to manage a variety of highly complementary techniques. But also, in the spirit and organization of the research group, that prioritizes the well-being of their people and fosters a culture rooted in trust, collaboration and a positive, supportive atmosphere.

