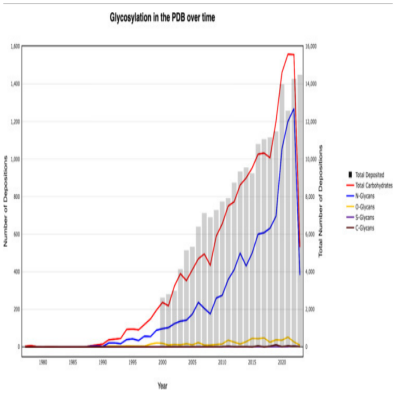

Ten Years of Integrative Carbohydrate Structure Validation with Privateer

Description

The article outlines the history, capabilities, and significance of **Privateer**, a specialized carbohydrate validation software used in structural biology.

The determination of the atomic structures of **glycoproteins** is uniquely challenging, even though the glycans themselves are only moderate in size. **Privateer** was originally created to mine monosaccharides and their structural contexts from the Protein Data Bank (PDB). Over the past decade, it has evolved into a ubiquitous tool in carbohydrate model building. It automatically detects errors in sugar **stereochemistry, regiochemistry, ring conformation** (pyranoside and furanoside), **composition, and overall glycan conformation**. The software supports both **X-ray crystallography** and **cryo-electron microscopy (cryo-EM)** data. It interacts directly with refinement software to restrain sugar rings into their lowest-energy (most stable) conformations.

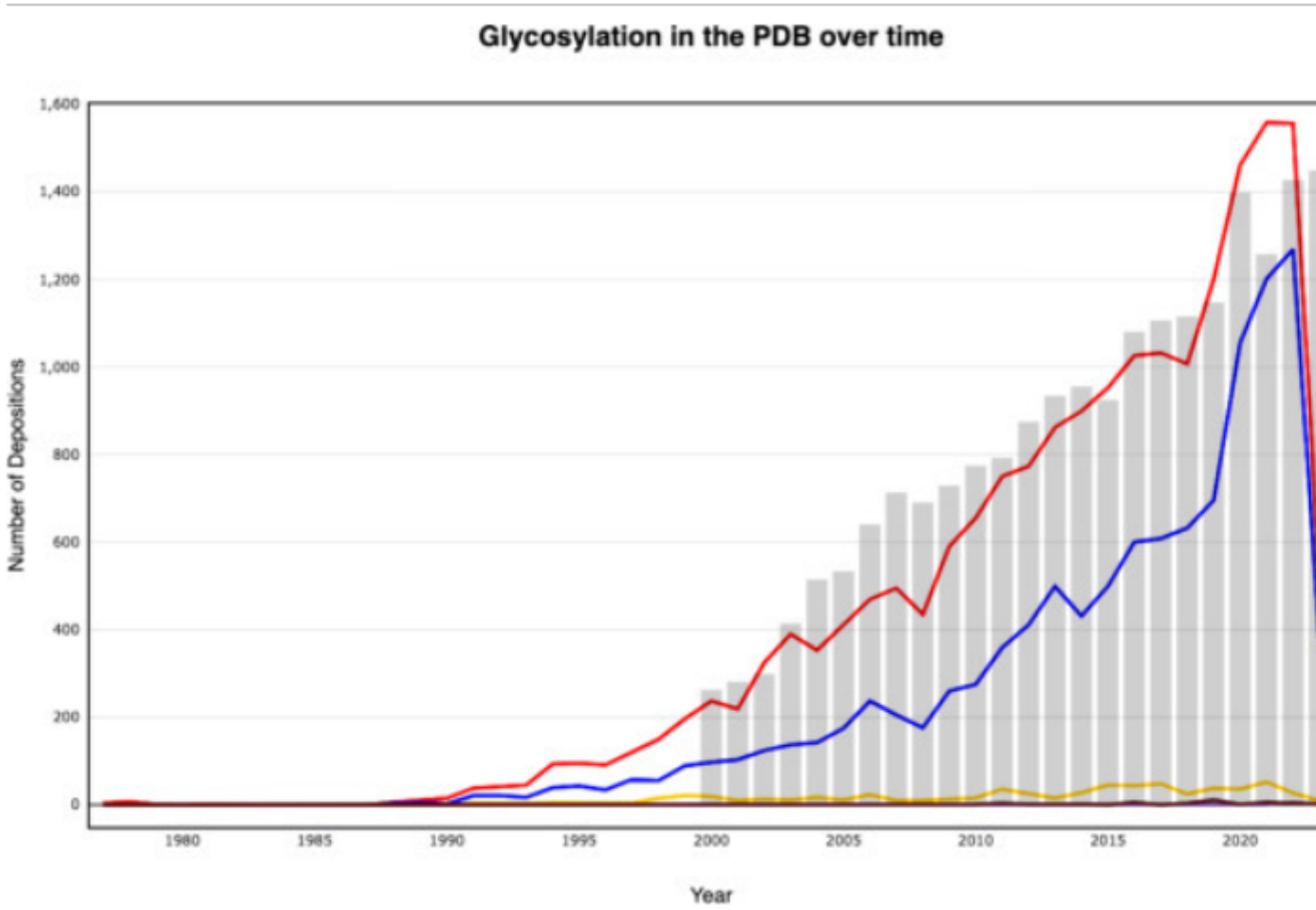

Figure 1: Distribution of carbohydrate-containing structure deposition in the Protein Data Bank over time. Grey bars (right axis) show the total number of structures deposited annually. Lines track structure deposition counts for specific carbohydrate categories (left axis): *N*-glycans, *O*-glycans, *C*-glycans, *S*-glycans and ligands. The analysis indicates around 10% of yearly deposits are sugar-containing structures. The apparent decline in deposited structures for 2025 likely reflects structures that are still undergoing deposition review or on hold awaiting publication. Data were extracted from the *Privateer Database* *(Dialpuri, Bagdonas, Schofield, Pham, Holland, and Agirre 2024)*

Category

1. News