The Blood Proteoform Atlas:
A reference map of proteoforms in human blood cells

Rafael D. Melani[1], Vincent R. Gerbasi[1], Lissa C. Anderson[2], *et al.*

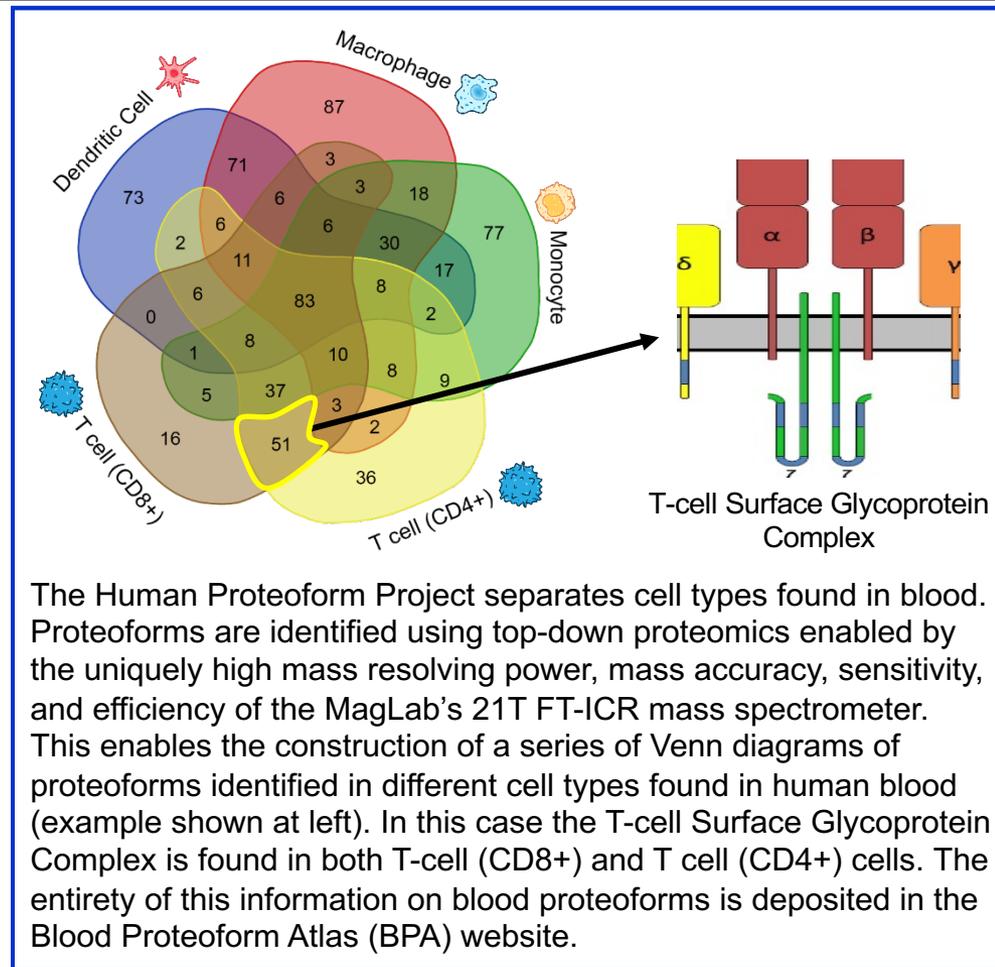1. **Northwestern University; 2. National High Magnetic Field Laboratory**

Nearly all our cells contain the same DNA blueprint, yet humans are a complex amalgamation of ~200 different cell types of various functions. Mass spectrometry-based protein analysis (proteomics) has cemented the linkage between protein biology and cellular phenotype. However, previous efforts to compositionally map proteins (PTN) across different cell and tissue types do not capture posttranscriptional and posttranslational processing. These dictate the distinct molecular ***proteoforms*** active in cells.

Melani *et al.* compiled a **Blood Proteoform Atlas**, a clarified map of ~30,000 unique proteoforms (PFR) as they appear in 21 different blood cell types. *The **MagLab's 21 tesla FT-ICR mass spectrometer** contributed nearly a third of the atlas' proteoforms while comprising ~15% of the total instrument time devoted to what is now the largest "**top-down**" proteomics study ever conducted. This patient-specific, cell type-specific, and proteoform-specific data enabled the discovery of 24 biomarkers for liver transplant rejection*.

*This advancement marks the beginning of a new era for more precise study of proteins in specific cells— **the Human Proteoform Project***. As the atlas grows, discoveries about fundamental biology, disease, aging and new therapeutics will accelerate.

The Human Proteoform Project separates cell types found in blood. Proteoforms are identified using top-down proteomics enabled by the uniquely high mass resolving power, mass accuracy, sensitivity, and efficiency of the MagLab's 21T FT-ICR mass spectrometer. This enables the construction of a series of Venn diagrams of proteoforms identified in different cell types found in human blood (example shown at left). In this case the T-cell Surface Glycoprotein Complex is found in both T-cell (CD8+) and T cell (CD4+) cells. The entirety of this information on blood proteoforms is deposited in the Blood Proteoform Atlas (BPA) website.