

## NORTHWESTERN PROTEOMICS

### MAPPING THE HUMAN PROTEOME

Proteomics is poised to become the next genomics by 2030. At the head of the field is [Northwestern Proteomics](#), the premier center for proteomics under the leadership of Neil Kelleher, PhD, a leading advocate for [the Human Proteoform Project \(HPfP\)](#), a global initiative to map all forms of proteins (proteoforms) in the human body.

The HPfP will lead to earlier detection of disease, better diagnostics, and faster development of new drugs to treat people living with cancer, heart disease, neurodegenerative disorders, and many other conditions.

### DRIVING INNOVATION AND THE ECONOMY

The HPfP is a natural next step to the Human Genome Project (HGP) and will mirror its impact on healthcare and life sciences, return on investment, and the economy. This ten-year initiative will place the US at the forefront of the next great biological frontier and open new avenues for research and discovery. It will spur major advances in human health and create jobs in the life sciences industry, including biotech, pharma, agriculture, forestry, and veterinary science.

From big pharma to biomedical startups, investment in proteomics science is expected to generate explosive growth in biomedical innovation and economic gains for the US and industry.

### PRECISION PROTEOMICS FOR PRECISION MEDICINE

Proteins play a central role in maintaining and regulating human health. When proteins confront a challenging environment, disease and illness can result. Scientists are increasingly looking to proteoforms, the exact molecular forms of proteins, as the strongest link between our genes and disease. Determination of the precise composition and function of each proteoform within the human body enables scientists to identify the true culprits behind disease and develop better targets to eliminate them.

Northwestern Proteomics is the leading lab in the world for studying proteins using a ‘top-down’ approach that analyzes intact proteoforms to fully understand their critical role in human health and disease.

Under Kelleher’s leadership public and private support for the HPfP has grown. As the director of the Chemistry of Life Processes Institute and president of the Consortium for Top-Down Proteomics, Kelleher has authored breakthrough studies and coordinated efforts to secure federal funding for the HPfP over the next decade.



**CLP Director**  
**Neil L. Kelleher, PhD**

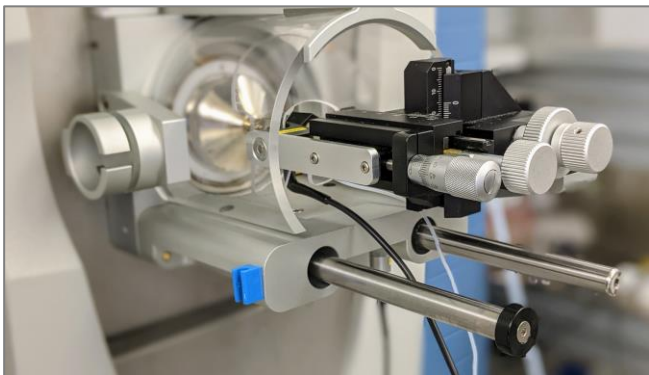
Walter & Mary E Glass Professor of Molecular Biosciences, Professor of Chemistry, and Professor of Medicine, and Director of Northwestern Proteomics

## THE HUMAN PROTEOFORM ATLAS

Proteins in their myriad forms are the fundamental working elements of our cells and tissues. Although a single cell contains hundreds of thousands of different proteoforms, existing analytical methods detect fewer than 10,000.

Northwestern Proteomics is remedying this knowledge gap through the development of the *Human Proteoform Atlas*, a database that provides an open-source, central location for scientists to browse proteoforms and contribute datasets. The platform combines both new and existing technology and high throughput methods to create a comprehensive record of every proteoform found in cells, fluids, and organs in the human body. As the Atlas expands, scientists will understand the diversity of protein signatures in health and disease, which will enable earlier and more precise identification of all human disease.

Critical insights derived from the Atlas will also accelerate the development of more targeted and effective therapies and are required to achieve personalized medicine.



## TECHNOLOGY DEVELOPMENT

Scientists have made significant progress in proteoform discovery, however, to achieve the ambitious objectives of the HPfP to transform human health within the next decade, a concerted effort to accelerate development of instruments and methods is needed. Advances in current technologies for complete proteoform analysis, as well as the development of highly automated, scalable, and cost-effective proteomics platforms of the future will hasten life-saving discoveries for this generation and for generations to come.

## DEMONSTRATING THE VALUE OF PROTEOFORM DATA

A recent collaboration between Kelleher and Josh Levitsky, MD, a hepatologist in the Feinberg School of Medicine, resulted in the development of the *Blood Proteoform Atlas*. This proof-of-concept recently published in the top journal, *Science*, identified proteins associated with liver transplant rejection providing physicians with early-stage markers needed to fine-tune immunosuppression to prevent rejection.



## REGIONAL POWERHOUSE, NATIONAL INITIATIVE

Within the next three years, CLP will lead a regional effort to develop proof-of-concept studies in **cancer, cardiovascular disease, immunology and neurodegenerative disease** that demonstrate the tremendous potential of the HPfP.

This regional effort will include the build-out of Chicago-area collaborative workspaces with administrative oversight by CLP. The labs will support research collaborations already underway between Northwestern Proteomics and more than 100 Northwestern labs on the Chicago and Evanston campuses, as well as 40 university investigators from across the Midwest.

To support Northwestern Proteomics,  
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