Supramolecular assemblies and mass spectrometry for detecting biomarkers
Huan He (Thayumanavan Group) and Mahalia Serrano (Vachet Group)

Biomarkers are often peptides and proteins that are used as diagnostic indicators to assess the risk or presence of diseases. Being able to reliably and sensitively detect these biomarkers could pave way for the early diagnosis of diseases such as cancer. However, biomarkers are often present in very low concentrations in complex biological samples such as serum, and the presence of more abundant compounds make their detection difficult. Our approach is to use supramolecular assemblies made from amphiphilic homopolymers to selectively enrich biomarkers of interest, followed by mass spectrometric analysis as a means of sensitive detection.

We have created amphiphilic homopolymers that bear both hydrophilic and hydrophobic groups and self-assemble into nanocontainers. These nanocontainers are designed with hydrophilic groups that impart selectivity to the enrichment process, whereby only peptides or proteins having the appropriate properties (e.g. charge) are enriched. This means that we can selectively sequester and enrich peptides and proteins of interest from complex samples and subsequently detect them by mass spectrometry. Our preliminary work indicates that breast cancer biomarkers can be detected at concentrations as low as 80 parts-per-trillion in human serum, making this approach applicable to clinically relevant concentrations.