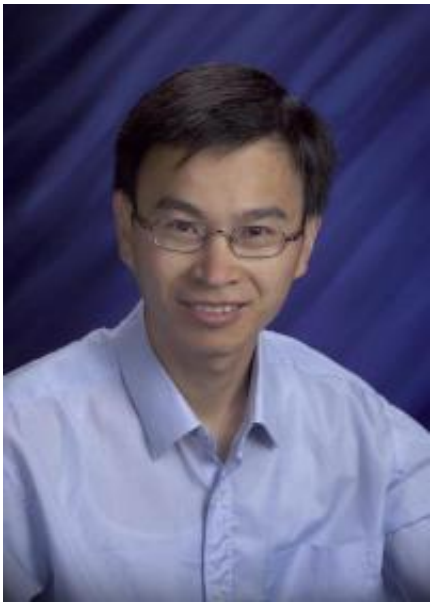
PNNL chemist earns NIH New Innovator Award

September 24 2009



The National Institutes of Health recognized PNNL's Wei-Jun Liu for innovative and creative research in proteomics, the study of an organism's cellular workhorses -- proteins. Credit: Pacific Northwest National Laboratory

An analytical chemist at the Department of Energy's Pacific Northwest National Laboratory has been recognized with a National Institutes of Health Director's New Innovator Award. The award will support Wei-Jun Qian's drive to make new research and clinical diagnostic tools that are dramatically more sensitive, reliable and faster than current technologies.

The award, which comes with a $1.5 million, five-year grant, recognizes researchers early in their careers. Qian has been studying proteomics -- or the proteins that make organisms work -- at PNNL only since 2002 but has already published more than 60 scientific papers. NIH selected projects that show creativity and are considered high-risk ventures but with the potential to make a significant impact.

"This is great news for Wei-Jun and highlights the significant instrument development capabilities at PNNL," said Doug Ray, director of Fundamental & Computational Sciences at PNNL. "Not many DOE researchers earn such a prestigious NIH award. For his first grant, this is a major achievement."

Qian earned this honor for his proposal to increase the ability of research tools to detect diagnostic molecules in blood or tissue enough so they can replace conventional tools. When patients enter clinics now, they donate up to an ounce or two of blood so that multiple tests can be done. Each test -- for cholesterol, liver health, or cancer markers -- is generally performed seperately. A slate of 20 tests is far more labor and time intensive than just one. Qian would like to develop a single test for 20 diseases.

Research laboratories such as those found in EMSL, DOE's molecular sciences laboratory on the PNNL campus, have instruments called mass spectrometers that can identify hundreds of proteins and other molecules floating in a drop of that ounce of blood. Although much faster, the instruments aren't sensitive and accurate enough to compare with the clinical lab tests done one at a time.

"We are aiming to increase the sensitivity of our instrument so that we can detect proteins whose concentrations in blood are very low, and at the same time accurately measure their concentration for hundreds of different proteins -- perhaps up to a thousand," said Qian. "We hope this

platform will lead to a paradigm change in how clinics do their testing."

Qian's plan will pull together tools that have been in development by the proteomics team at PNNL and EMSL for several years, but it will also require developing new technologies. The complete instrument identifies molecules in a sample such as blood by first separating them by size and shape and then measuring their mass as they flow past a detector.

Because different molecules can have the same mass, the technique breaks down molecules and identifies smaller pieces, which computer programs then recognize as belonging to certain molecules. Different molecules of the same mass will break into different pieces, much as the pieces of a 30-pound bike will be different from those of a 30-pound coffee table.

To improve the instruments' ability to detect rare molecules, Qian and his group have to increase the percentage of molecules in the sample that make it into the instrument at the beginning, as well as how many can be identified individually near the end. To improve the identification of individual molecules, Qian proposed that breaking down fragments into even more pieces will increase the resolving power of the detector.

"Eventually, the instrument will find a piece that is so unique we know which molecule it had to come from," Qian said.

Although such an instrument might replace current clinical tests someday, it will be equally valuable in the research laboratory, enabling scientists to screen many samples much faster than they are capable of now. This will cut down the time to find biomarkers -- proteins in the blood that indicate disease. For example, breast cancer researchers have identified almost 1000 proteins that show up or disappear, depending on the protein, when cancer is present. This technology could speed up the experiments needed to determine which of those are important for

diagnosing illness.

Source: DOE/Pacific Northwest National Laboratory