UVic knowlEDGE

Protein power

Proteomics is revolutionizing the life sciences, and a UVic research centre is leading the way

by Valerie Shore

Not feeling well? Imagine the day when your doctor takes a sample of your blood or urine, runs it through a hand-held device, and quickly confirms your ailment, the best way to treat it, and even what other medical conditions you may be susceptible to in the future.

Sound like science fiction? It is for now, but it soon won't be, predicts Dr. Bob Olafson, director of the UVic-Genome BC proteomics centre. "The development of new diagnostic and therapeutic tools is growing in leaps and bounds. Proteomics is the wave of the future."

Proteomics is the study of proteins—their location, structure and function. Just as every living thing has a complete set of DNA known as its genome, we all carry a full complement of proteins known as the proteome—the enzymes, antibodies and structural molecules that are the building blocks of our cells.

"All genes carry information for making proteins, which are the functional entities in all living things," explains Olafson. "By and large, our minute-by-minute, second-to-second existence depends on proteins."

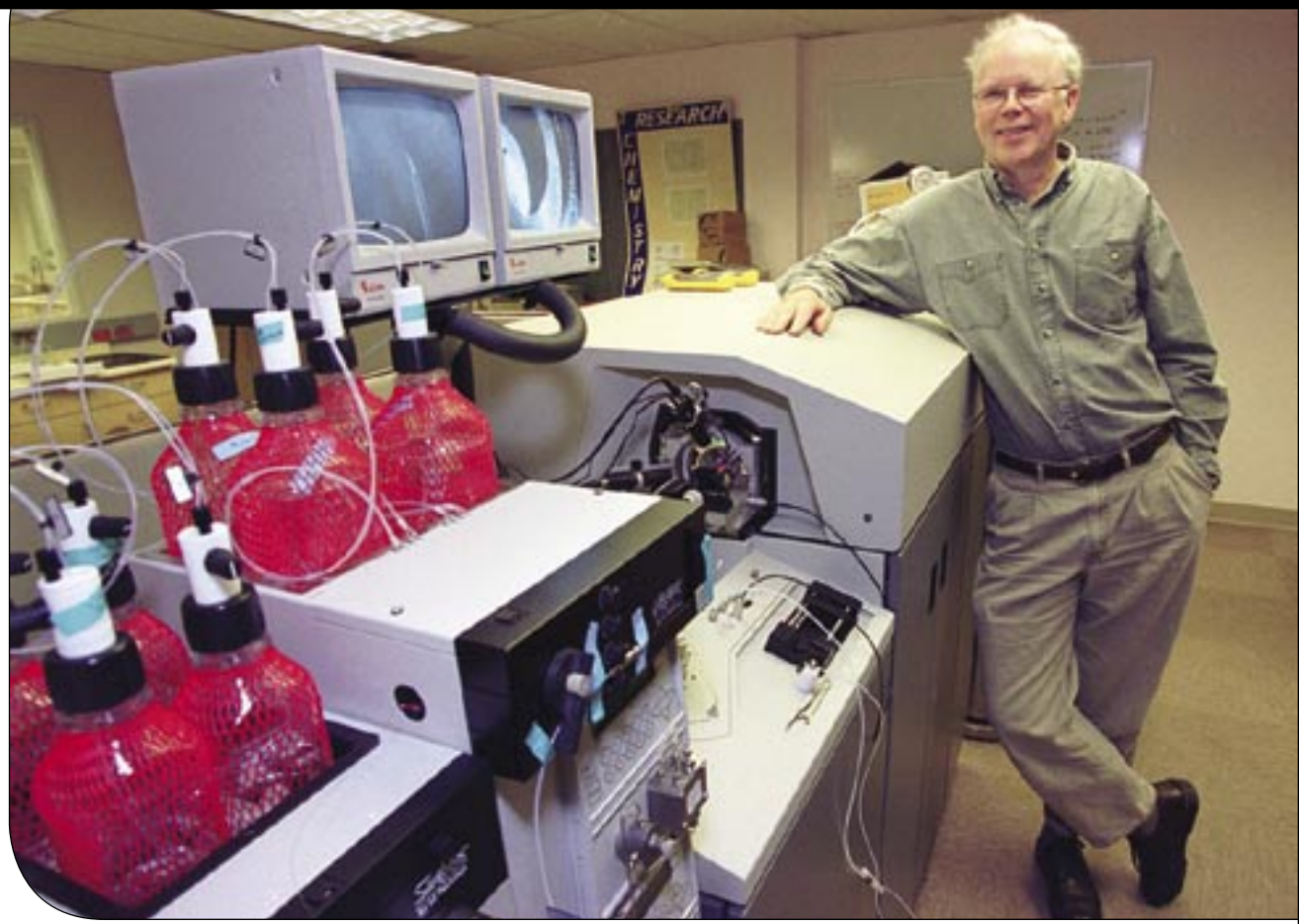
The field of proteomics is in many ways bigger than genomics. Since all the hoopla over mapping the human genome several years ago, scientists around the world have been busily defining the genome of many other organisms, including plants, fish, mice, bacteria, and viruses such as SARS. Now it's time to mine that information.

"Sequencing genes is like making a big dictionary," says Olafson. "We have all the words and we can spell them, but we don't know what they mean or how they go together."

The puzzle is complicated by the number of "words" involved. Where there might be 40,000 genes in an organism, there can be hundreds of thousands of proteins. Some are needed for routine cell functions. Others are critical for complex processes such as cell division. The role of many others is unknown.

This is where proteomics comes in. To link important proteins with their corresponding genes, proteins are chopped into chunks—or peptides—and instruments known as mass spectrometers measure their molecular weight. A computer then tries to match that information to a DNA sequence database.

"Once a match is found, we can obtain the entire structure of the protein from the DNA sequence and often its function," says Olafson.



Olafson and a mass spectrometer.

Proteins are of interest to researchers in just about every area of biochemical investigation. "The ramifications of proteomics are everywhere—medicine, pharmaceuticals, forestry, fisheries, agriculture, environmental research, you name it," says Olafson. "It's going to have a huge impact on our understanding of living systems."

Of special interest are proteins that regulate the immune system because they often underly conditions such as cancer, arthritis, Alzheimer's or multiple sclerosis.

"Understanding immuno-regulation, especially when it goes wrong, will give us insights into how we can fix these and other diseases," says Olafson. "The potential of proteomics is enormous."

PROTEOMICS ON THE MOVE

UVic continues to be a national leader in proteomics research.

The university's protein centre was created in 1982 and is the longest-running facility of its kind in Canada. It currently serves the advanced protein chemistry needs of more than 60 research labs across the country on a fee-for-service basis.

The centre houses state-of-the-art protein separation, analysis and synthesis technologies, along with several mass spectrometers—sophisticated instruments that can identify a protein, or part of a protein, by its molecular weight. "They're extremely sensitive," says centre director Dr. Bob Olafson. "For example, we can easily identify and measure the proteins in a fingerprint."

Two years ago, the centre's mandate was expanded to provide proteomics support for large-scale research programs funded by Genome BC in the areas of forestry, fisheries, environmental research, and cancer.

This fall, the centre moves from cramped quarters on the UVic campus into a 5,000-sq. ft. space within the Vancouver Island Technology Park (VITP). The move is a partnership with UVic, Genome BC and MDS Metro Laboratory Services, which is relocating its Victoria analytical facilities into VITP. The centre will work with MDS Metro to develop new analytical tools for medical diagnostics.