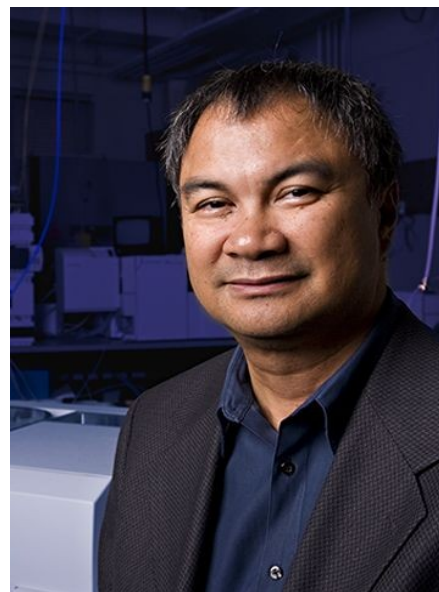


The Milky Way of a Star Scientist: Carlito B. Lebrilla

by Ronie J. Calugay*



Out of the myriads of complex bioactive molecules produced by mammals, milk is the universal source of nutrition for the newly born. Though human milk is generally steeped in essential nutrients in highly absorbable form, ironically it also contains a high concentration of seemingly useless substances which are undigestible and have no nutritional value to the infant. Such composition of a nutrition key to the development and survival, and hence the propagation of species, has boggled scientists for years.

Thanks to the childhood wonder and interest that fuelled the passion and expertise of Dr. Carlito B. Lebrilla on analytical tools for the study of biological molecules. Together with his colleagues at the University of California-Davis, they discovered that the role of the undigestible components of milk is to serve a unique love triangle: a mother-child-microbe relationship!

To the land of milk and honey

A pure-blooded Filipino with parents both from the island of Panay near Iloilo and Lambonao, Philippines, Dr. Lebrilla was born in the lush and beautiful island of Mindoro, in Central near San Jose. His interest as a child was in making devices and gadgets like traps for little animals, draw bridges from milk cartoons, crossbows from bamboo skewers, go-karts and the likes. Though his family left for the U.S. when he was seven, his interest did not leave him and greatly influenced his research. Today, as a full Professor and Chairman of the

Department of Chemistry of UC Davis, he builds and develops state-of-the-art instrumentation such as mass spectrometers for studying biological compounds.

Dr. Lebrilla was educated until the second grade in San Jose, Mindoro and continued his education in California where he graduated from the University of California, Irvine and obtained his PhD from the University of California, Berkeley. He was awarded an Alexander von Humboldt fellowship and a NATO-NSF postdoctoral fellowship in Berlin, Germany. His time in Germany was very formative and it showed him how the Germans approached research from a somewhat different perspective than the Americans. Having an Asian background, an American education, and a European research perspective made him realize that cultural backgrounds shape the way an individual approaches scientific problems.

Cream of the crop

Dr. Lebrilla is now one of the most prolific chemists in the world with 225 peer-reviewed publications and counting. He is on the editorial board of several important international journals and pioneered a number of mass spectrometry techniques specifically for oligosaccharide analysis in milk. To date, he has five patents in disease markers and food bioactive oligosaccharides in milk. His research team has so far identified 200 complex sugars now known as human milk oligosaccharides (HMOs) that act as prebiotic or food for beneficial bacteria or probiotics.

Before HMOs were identified, they were first discovered to be undigestible substances which constitute an astonishing 21% of the human milk! This is due to the lack of the human genome of the genes to break them down. But according to the studies of Dr. Lebrilla and his colleagues, Dr. Bruce German and Dr.

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David Mills of UC Davis, the gut probiotic bifido bacterium *Bifidobacterium longum* biovar *infantis* do possess the genes to digest the complex sugars. The bacteria feed on the complex sugars and they coat the lining of the infant intestines serving as barriers against pathogenic bacteria. The bacteria therefore provide the protective mechanism the mother and child can not accomplish but they provide the nutrients necessary for the bacteria to flourish, like guards fed and trained to protect a delicate fortress.

Sweet revenge on infections and cancer

Dr. Lebrilla and his team have extended their studies on HMOs to clinical applications with funding by the National Institutes of Health as well as several industrial collaborations. The complex sugars may be used as a treatment for necrotizing enterocolitis, a condition where the intestinal tissues die, which is the second leading cause of death in premature babies or those born by caesarean.

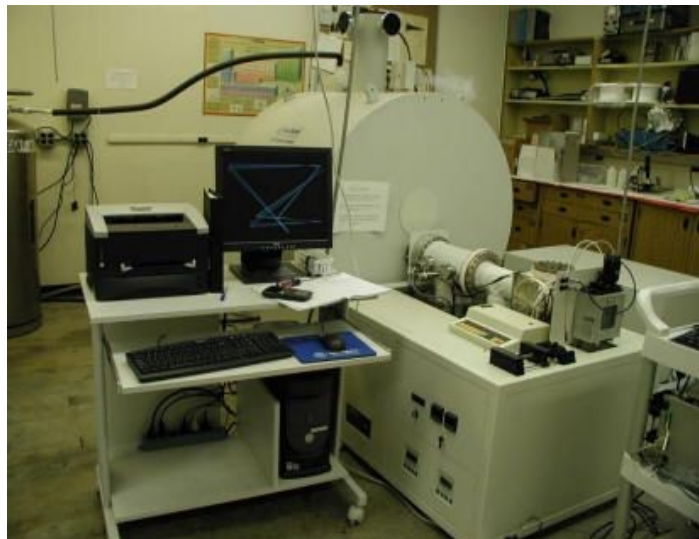
Dr. Lebrilla's team has also pioneered a number of mass spectrometry techniques specifically for analyzing glycosylation in proteins. Glycomics (the study of sugars) approach was pioneered by his lab to find relevant biomarkers of breast cancer. Because the glycosylation of proteins is known to change in tumor cells during the development of cancer cells, glycan profiles are obtained through collecting the cleaved oligosaccharides from glycosylated proteins shed by cancer cell lines and analyzed. The method is also used to analyze serum samples from patients with and without breast cancer. Preliminary results showed that the glycosylation profiles obtained from patients with cancer were distinct from individuals without cancer. This novel method provides early detection and more sensitivity to signatures of cancer.

Lofty goals

Dr. Lebrilla's commitment to hard work and excellence has tremendous contribution in the field of human health and nutrition. Milk as a crucial human nutrient is now seen in a new dimension as never seen before. The knowledge and importance of breast milk is brought to a much deeper level. His works on the early diagnosis of cancer will as well lead to tremendous biomedical applications around the world. Despite his countless achievements in biological chemistry, he feels that there is still much to do and his goal is to be always among the very best at the area he chooses.

Though based in the USA, he actively participates with the numerous activities in the Philippines of the U.S.-founded Filipino-American scientists organization, the Philippine-American Academy of Science and Engineering (PAASE) in promoting in the country the latest trends in science and technology. As to his perspective on Philippine science, his words of wisdom are:

'... there are differences in the way cultures approach science and they are all beneficial to some extent. It is therefore important that Philippines contributes more to science because the Filipino perspective can be quite unique and may solve specific problems that others cannot.' **PSL**



When little becomes much. Dr. Lebrilla's childhood wonder and hobby in the Philippines in making devices and gadgets out of bamboo and milk cartoons as toys served as seeds in doing what he does best, building and developing cutting-edge instrumentation such as mass spectrometers. His pioneering research is focused on developing high performance mass spectrometry and separation methods for understanding the structure-function relationships of oligosaccharides and protein glycosylation pertinent to nutrition and disease marker discovery.



Mastering Milk. Dr. Lebrilla (right) looks on as one of the graduate students of his research team in University of California, Davis works on the identification and analysis of the molecular components of one the most important nutrients of mammals – milk! The group is currently unravelling the glycomic and proteomic profiles of milk. They have recently characterized the free oligosaccharides in mammalian milk including human, bovine, porcine, murine, and several primate species.