Researcher find fats galore in human plasma

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Human blood is famously fraught with fats; now researchers have a specific idea of just how numerous and diverse these lipids actually are. A national research team, led by scientists at the University of California, San Diego School of Medicine, has created the first "lipidome" of human plasma, identifying and quantifying almost 600 distinct fat species circulating in human blood.

"Everybody knows about blood lipids like cholesterol and triglycerides," said Edward A. Dennis, PhD, distinguished professor of pharmacology, chemistry and biochemistry at UC San Diego and principal investigator of LIPID MAPS, a national consortium studying the structure and function of lipids. "For the first time, we've identified and measured hundreds more and ultimately we might discover thousands. These numbers and their remarkable diversity illustrate that lipids have key, specific functions, most of which we do not yet recognize or understand. This lipidome is a first step towards being able to investigate correlations between specific fat molecules and disease and developing new treatments."

The findings will be published in the November issue of the Journal of Lipid Research.

In recent years, scientists have begun to appreciate the greater, more complex roles of lipids in human biology (among them the emergence of vitamin D). The utility of lipids in building cell membranes is well known, as is their function as repositories of stored energy. Less well-understood, however, is their role as signaling molecules.

"Fatty acids, which are common, are turning out to be very important communication conduits in some diseases," said co-author Oswald Quehenberger, PhD, professor of medicine at UC San Diego. "For example, adipocytes (fat cells) use specific fatty molecules to communicate with distant tissues, a process that's been linked to insulin resistance and diabetes and may also involve inflammatory networks."

Added Dennis: "Any condition in which inflammation is a component involves lipids. In fact, it's hard to think of a disease, including cancer, that doesn't involve lipids in some way."

The biggest challenge to mapping lipids is their abundance and diversity. Other basic molecules like sugars, amino acids and nucleic acids are limited to handfuls of types and variations. The upper limit of lipid species, from fatty acyls and glycerophospholipds to sterols and prenols, has yet to be determined. It may reach into the tens of thousands.

In the meantime, the new lipidome establishes benchmark levels for 588 lipid species, based on a new human plasma standard reference material (SRM) developed by the National Institute of Diabetes and Digestive and Kidney Diseases in collaboration with the National Institutes of Standards. The SRM was prepared by obtaining plasma samples from 100 individuals between 40 and 50 years of age, whose ethnicity and gender was representative of the U.S. population.

"I look at this lipidome as something like the human genome project," said Quehenberger. "First you have to do the sequencing. You have to know what genes – or in this case, fats – are there. Then you can begin to look at individual species, do association studies and discover how these molecules fit into systems, processes and diseases."

The lipidome is part of the larger, on-going LIPID MAPS project, which received a second five-year renewal grant in 2008 for almost $38

million. LIPID MAPS brings together researchers in a dozen research laboratories at nine universities, medical research institutes and life sciences companies. UC San Diego serves as lead institution and information clearinghouse.

Provided by University of California -- San Diego