

Lipids, Physiology, and Disease

BY DANIEL M. RABEN AND MARY F. ROBERTS

Lipid Research has become an important component of studies in an expanding number of disciplines. This has ushered in a plethora of new techniques and knowledge in a variety of areas that cover physiology, biochemistry, biophysics, and cell biology. The Lipid Theme for the 2010 ASBMB Annual Meeting, "Lipid Interactions in Physiology and Disease," will highlight emerging concepts in these areas of lipid research.

It is well known that lipids and lipid metabolism play an important role in health and disease. Recently, we have started gaining a new, or perhaps renewed, appreciation for the notion that specific cells and sub-cellular compartments in which lipids and metabolizing enzymes reside are critical to their physiological roles. The first session of the 2010 Lipid Theme will cover emerging concepts in lipid physiology and pathophysiology. For example, regulating apoptosis is a central concept in a number of pathophysiological problems, and the mitochondrion is known to be intimately involved in this process. Valerian E. Kagan (University of Pittsburgh) will discuss new mechanisms and pathways through which cytochrome *c* catalyzes oxidation of cardiolipin, a mitochondria-specific phospholipid, and the role of this process in apoptosis. Lina M. Obeid (Medical University of South Carolina) will present some emerging concepts regarding the role of sphingolipids in cancer, and Lucio Cocco (University of Bologna) will present fascinating data regarding the potential role of nuclear localized phosphatidylinositol phospholipase C- β 1 in the progression and prognosis of myelodysplastic syndromes. These discussions will shed light on new and potentially important roles of lipids and lipid-metabolizing enzymes in health and disease.

With the recognition that lipid metabolism in specific cells and sub-cellular compartments needed further investigation came the need to develop new tools and strategies to study this metabolism. Richard W. Gross (Washington University in St. Louis) will discuss some novel approaches for studying lipids and lipid metabolism in membranes to illuminate their potential signaling roles. A particularly dif-

ficult yet extremely important question that troubles many lipid researchers pertains to the dynamics of specific lipid-protein interactions. Mary F. Roberts (Boston College) will discuss a potentially powerful approach to this question using high resolution field cycling NMR spectroscopy. To delve further into the analysis of lipids at the single molecule level, Akihiro Kusumi (Kyoto University) will outline some fascinating approaches to track lipids and lipid metabolism enzymes at the single molecule level. This promises to be a very informative tool for studying signaling lipids and the enzymes involved in their metabolism.

The third session will examine lipid movements and compartmentalization within cells. Gerrit van Meer (Utrecht University) will present a bird's eye view of this issue by discussing the general theme of where various membrane lipids are found and how they behave. Brian (Binks) W. Wattenberg (University of Louisville) will discuss new thoughts regarding how the localization of an important lipid metabolizing enzyme, sphingosine kinase-1, is important for its function. One lipid that receives much attention but is also misunderstood is cholesterol. A new way of thinking about the behavior of cholesterol in membranes and its relationship to cholesterol homeostasis will be presented by Yvonne Lange (Rush University Medical Center).

The fourth and final topic will focus on some current thoughts on the structure and regulation of lipid transporters and metabolizing enzymes. Lipid transporters are gaining increasing attention as they play important roles in lipid homeostasis as well as drug delivery and metabolism. Frances J. Sharom (University of Guelph) will present some new ideas on lipid transporters and membrane proteins that bind sterols. Understanding the enzymology and regulation of lipid-metabolizing enzymes is central to our



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ability to understand signaling lipids. Two lipid second messengers that are emerging as essential players in a number of physiological and pathophysiological processes are diacylglycerol and phosphatidic acid. The enzymes responsible for metabolizing these signaling lipids once generated are critical to regulating their levels. Daniel M. Raben (Johns Hopkins University School of Medicine) will outline new ideas regarding the regulation of a mammalian diacylglycerol kinase (DGK- θ), which converts diacylglycerol to phosphatidic acid. Phosphatidic acid is itself metabolized by specific enzymes. One class of such enzymes is phosphatidate phosphatases. George M. Carman (Rutgers University) will highlight recent discoveries regarding the structure, regulation, and physiology of these enzymes.

These presentations will be complemented by 12 short talks selected from submitted abstracts. The organizers have a strong interest in finding abstracts from young investigators, postdoctoral fellows, and graduate students to give them an opportunity to present their work to the lipid community. Please encourage these young folks to submit an abstract! We are hoping this meeting will stimulate ideas and increase enthusiasm for lipid research.

In addition to the symposia noted above, there will be a new award, the Avanti Young Investigator Award in Lipid Research, which will be presented at this meeting. This award will be given to a young investigator selected for their novel and innovative work in the area of lipid research. The awardee, who will be asked to present a lecture at one of the Lipid Theme sessions, will receive a plaque, \$2,000, and transportation support to the ASBMB meeting. For more information, go to www.asbmb.org/lipidcorner.

There will also be a workshop, "Lipidology—From Basics to Biofuels and Cancer Therapeutics," that is aimed at those who are interested in, but not necessarily expert practitioners of, lipidology. Small roundtable discussions guided by experts will accompany a general overview of different aspects relevant to working with lipids and membranes. If lipids didn't excite you before, they should after seeing how useful a little lipidology can be!

We look forward to what promises to be a very exciting and enlightening meeting. 

Daniel M. Raben is a professor of Biological Chemistry at Johns Hopkins University School of Medicine and can be reached at draben@jhmi.edu. Mary F. Roberts is a professor of Chemistry at Boston College and can be reached at mary.roberts@bc.edu.

Lipid Interactions in Physiology and Disease

SYMPOSIUM: EMERGING CONCEPTS IN THE PHYSIOLOGY AND PATHOLOGY OF LIPID METABOLISM

Nuclear Inositide Signaling: Role of PI-PLC β 1 in MDS and AML, *Lucio Cocco, University of Bologna*

Cardiolipin and Its Redox Interactions with Cytochrome c in Apoptosis, *Valerian E. Kagan, University of Pittsburgh*

Bioactive Sphingolipids in Inflammation and Cancer, *Lina M. Obeid, Medical University of South Carolina*

SYMPOSIUM: NOVEL APPROACHES FOR STUDYING LIPID SIGNALING, METABOLISM, AND MEMBRANES

Multidimensional Mass Spectrometry Using Shotgun Lipidomics to Identify Alterations in Lipid Signaling and Metabolism in Disease States, *Richard W. Gross, Washington University in St. Louis*

Signal Transduction by Lipid-anchored Molecules as Revealed by Single-molecule Tracking, *Akihiro Kusumi, Kyoto University*

High Resolution Field Cycling for Analysis of Lipid Dynamics in Membranes, *Mary F. Roberts, Boston College*

SYMPOSIUM: CELLULAR LIPID MOVEMENT AND COMPARTMENTALIZED METABOLISM

How Cells Sense and Set Their Cholesterol, *Yvonne Lange, Rush University Medical Center*

Sphingolipids on the Move, *Gerrit van Meer, Utrecht University*

Sphingosine Kinase-1 Localization Drives Differential Metabolism of Sphingosine-1-phosphate, *Brian (Binks) W. Wattenberg, University of Louisville*

SYMPOSIUM: STRUCTURE AND REGULATION OF LIPID TRANSPORTERS AND METABOLIZING ENZYMES

Regulation of Human and Yeast Phosphatidic Acid Phosphatase Enzymes, *George M. Carman, Rutgers University*

Regulation of DGK θ , *Daniel M. Raben, Johns Hopkins University School of Medicine*

Sterol Binding and Transfer by NPC1, *Frances J. Sharom, University of Guelph*