

CRBM external seminar BIOLuM

Thursday, October 10th 11:00 am Salle Marcel Dorée

Lipid droplets: a hub for regulating cell function and disease etiology

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Doug started research as an undergraduate at Iowa State University, where he majored in Animal Science and worked at the National Animal Disease Center. He then moved to Michigan State University, where he obtained an M.S. in Animal Science, studying nutrition during the periparturient period in dairy cows. Doug spent ~6 months in Denmark conducting dairy research at the Danish Institute of Agricultural Sciences. Doug then attended the University of Wisconsin-Madison, where he obtained a Ph.D. in Dairy/Nutritional Sciences, studying fatty acid trafficking in bovine hepatocytes and fatty liver development. Following his formal academic training, he accepted a postdoctoral fellowship in the laboratory of Dr. Rosalind Coleman in Nutritional Biochemistry at the University of North Carolina, where he studied acyl-CoA synthetases and their role in fatty acid partitioning and signaling. Following 3 years as a postdoc, Doug accepted an Assistant Professorship at the University of Minnesota, where he has been for the past 18 years.

Brief synopsis

The focus of our research laboratory is on fatty acid trafficking and signaling with an emphasis on lipid droplet biology. Specifically, we are attempting to define how diet and alterations in lipid metabolism, in general, or specific changes in lipid droplet biology influence the development and progression of metabolic diseases such as Type 2 Diabetes, non-alcoholic fatty liver disease, and cancer as well as aging / lifespan regulation. A major emphasis is placed on understanding the regulation of lipid droplet catabolism and how lipid droplets communicate within cells to influence signaling pathways and disease development. We employ a wide range of molecular and biochemical techniques and models (proteins, cells, rodents, and humans) to accomplish our research objectives. In this presentation, I will present recent unpublished data from our laboratory showing mechanisms through which lipid droplets affect key pathways underlying disease etiology. I will also integrate these cellular pathways with physiological processes known to regulating disease development and healthspan.

Selected publications

- Najt CP, Adhikari A, Heden TD, Gansemer ER, Rauckhorst AJ, Cui W, Markowski TW, Higgins L, Kerr EW, Boyum MD, Alvarez J, Brunko S, Mehra D, Puchner EM, Taylor EB, **Mashek DG**. Organelle interactions compartmentalize hepatic fatty acid trafficking and metabolism. *Cell Reports* 2023;42:112435.

- Shang L, Aughey E, Kim H, Heden TD, Wang L, Najt CP, Esch N, Brunko S, Abrahante JE, Macchietto M, Mashek MT, Fairbanks T, Promislow, Neufeld TP, **Mashek DG**. Systemic lipolysis promotes physiological fitness in Drosophila melanogaster. *Aging* 2022;14(16):6481-6506.

- Heden TD, Chow LS, Hughey CC, **Mashek DG**. Regulation and role of glycophagy in skeletal muscle energy metabolism. *Autophagy* 2022;18(5):1078-1089.Cui W, Sathyanarayan A, Lopresti M, Aghajan M, Chen D, **Mashek DG**. Lipophagy-derived fatty acids undergo extracellular efflux via lysosomal exocytosis. *Autophagy* 2021;17(3):690-705.

- Mashek DG. Hepatic lipid droplets: a balancing act between lipid storage and metabolic dysfunction in NAFLD. *Molecular Metabolism* 2021;50:101115.

- Najt CP, Khan SA, Heden TD, Witthuhn BA, Perez M, Mead LE, Franklin MP, Karanja KK, Graham MJ, Mashek MT, Bernlohr DA, Parker L, Chow LS, **Mashek DG**. Lipid droplet-derived monounsaturated fatty acids traffic via PLIN5 to allosterically activate SIRT1. *Molecular Cell* 2020;77(4):810-824.