

# DEPARTMENT OF HUMAN HEALTH & NUTRITIONAL SCIENCES

COLLEGE OF BIOLOGICAL SCIENCE



*Fighting Obesity  
and Diabetes with a  
Healthy Lifestyle*

*The Department of Human Health and Nutritional Sciences conducts innovative, world-class research exploring the biological aspects of human health. We aim to advance our understanding of aging and chronic disease, with an emphasis on the impact of sensory contributions, nutrition, physical activity, and biomechanics as powerful determinants of human health.*

UNIVERSITY  
of GUELPH

CHANGING LIVES  
IMPROVING LIFE

*Obesity is a complex condition affecting numerous tissues in the body, and can lead to serious complications including type 2 diabetes, heart disease, stroke, and cancer. Although preventable, the worldwide incidence of obesity and its associated diseases continue to rise, placing a significant burden on the healthcare system. Research in the Department of Human Health and Nutritional Sciences addresses this issue by examining the metabolic dysfunction associated with these conditions at molecular, cellular, and whole body levels, and how modifications in diet and exercise can be useful tools in the prevention and treatment of obesity and obesity-related diseases. Diverse areas of expertise allow us to uniquely approach research from multiple perspectives, resulting in significant collaboration among faculty members.*



## **David Wright, PhD**

### ***Lipids, Metabolism and Health***

Adipose tissue is more than just a storage depot. It is in fact an important and biologically active tissue that plays a key role in regulating whole body carbohydrate and fat metabolism, and its dysfunction has been linked to insulin resistance and type 2 diabetes. Exercise is a potent regulator of metabolism and whole-body health effects, and represents a potential treatment option to mediate adipose tissue dysfunction. My research examines how exercise, and related circulating factors, hormones and signaling pathways affect adipose tissue function. Our lab provides evidence for exercise as a mimetic of the beneficial effects of drugs in the treatment of insulin resistance and type 2 diabetes, and is working towards justifying exercise as an alternative treatment.

Castellani L, Root-McCaig J, Frendo-Cumbo S, Beaudoin MS, Wright DC. Exercise training protects against an acute inflammatory insult in mouse epididymal adipose tissue. *J Appl Physiol.* 2014; 116(10):1272-80.

Wan Z, Root-McCaig J, Castellani L, Kemp BE, Steinberg GR, Wright DC. Evidence for the role of AMPK in regulating PGC-1 alpha expression and mitochondrial proteins in mouse epididymal adipose tissue. *Obesity.* 2014; 22(3):730-80.

For more information, please visit [www.uoguelph.ca/hhns/People/DWright.html](http://www.uoguelph.ca/hhns/People/DWright.html)



## **Graham Holloway, PhD**

### ***Regulation of skeletal and cardiac muscle mitochondria in health and disease***

Alterations in mitochondrial function appear to play a significant role in the progression and/or development of diseases including type 2 diabetes, heart failure, diabetic cardiomyopathy, and various neuropathologies. The primary aim of my research program is to utilize exercise and nutritional approaches to understand the regulation of mitochondrial bioenergetics, and apply this knowledge to the establishment of novel prevention and treatment paradigms to combat diseases.

Beaudoin MS, Perry CC, Arkell A, Chabowski A, Simpson JA, Wright DC, Holloway GP. In the ZDF rat, impairments in mitochondrial palmitoyl-CoA respiratory kinetics that precede the development of cardiomyopathy are prevented by resveratrol supplementation. *J Physiol.* 2014; [Epub ahead of print].

Jain SS, Pagliarunga S, Vigna C, Ludzki A, Herbst EA, Lally JS, Schrauwen P, Hoeks J, Tupling AR, Bonen A, Holloway GP. High-fat induced mitochondrial biogenesis is regulated by mitochondrial derived reactive oxygen species activation of CaMKII. *Diabetes.* 2014; [Epub ahead of print].

For more information, please visit [www.uoguelph.ca/hhns/People/GHolloway.html](http://www.uoguelph.ca/hhns/People/GHolloway.html)



## **David Mutch, PhD**

### ***Diet for the prevention and treatment of chronic disease***

Obesity is a complex disease with many associated complications (e.g. inflammation, insulin resistance); however, in many cases these complications are preventable and treatable by changing one's lifestyle habits. Dietary fats are known to affect a person's health. For example, saturated and *trans* fats typically have negative effects on health, while monounsaturated and polyunsaturated fats tend to be more beneficial. Each of these groups of fats comprises several different fatty acids, and each fatty acid can affect a person's metabolism differently. I am interested in understanding the biological role of individual fatty acids and how regulatory enzymes can mediate their health effects.

Ralston JC, Badoud F, Cattrysse B, McNicholas PD, Mutch DM. Inhibition of stearoyl-CoA desaturase-1 in differentiating 3T3-L1 preadipocytes upregulates elongase 6 and downregulates genes affecting triacylglycerol synthesis. *Int J Obes (Lond).* 2014 [Epub ahead of print].

Perreault M, Roke K, Badawi A, Nielsen DE, Abdelmagid SA, El-Sohemy A, Ma DW, Mutch DM. Plasma levels of 14:0, 16:0, 16:1n-7, and 20:3n-6 are positively associated, but 18:0 and 18:2n-6 are inversely associated with markers of inflammation in young healthy adults. *Lipids.* 2014; 49(3):255-63.

For more information, please visit [www.uoguelph.ca/hhns/People/DMutch.html](http://www.uoguelph.ca/hhns/People/DMutch.html)



## **Lindsay Robinson, PhD**

### ***Inflammatory mediators in metabolism***

Cytokines are proteins released from various cells in the body, including those within adipose tissue and skeletal muscle, and play an important role in regulating metabolic processes. My research program focuses on understanding the physiological roles and regulation of cytokines and other inflammatory mediators in mediating metabolic processes in the body, with a particular interest in the mechanisms by which dietary factors, such as fatty acids, can modulate various inflammatory mediators that are implicated in insulin resistance, a key characteristic of obesity-associated diseases such as type 2 diabetes.

Tishinsky JM, De Boer AA, Dyck DJ, Robinson LE. Modulation of visceral fat adipokine secretion by dietary fatty acids and ensuing changes in skeletal muscle inflammation. *Appl Physiol Nutr Metab.* 2014; 39(1):28-37.

Tishinsky JM, Gulli R, Mullen K, Dyck DJ, Robinson LE. Fish oil prevents high saturated fat diet-induced impairments in adiponectin and insulin response in rodent skeletal muscle. *Am J Physiol Regul Integr Comp Physiol.* 2012; 302(5):R598-605.

For more information, please visit [www.uoguelph.ca/hhns/People/LRobinson.html](http://www.uoguelph.ca/hhns/People/LRobinson.html)



## **Lawrence L. Spriet, PhD**

### ***Regulation of fat and carbohydrate metabolism at rest and during exercise***

The pathways involved in the production of energy from fat and carbohydrates are complex, and due to the changing energy needs of skeletal muscle at rest and during exercise, are highly regulated processes. The aim of my research is to unravel the independent and integrative regulation of carbohydrate and fat metabolism in response to the changing energy demands of skeletal muscle, in addition to how nutritional supplements and ergogenic aids can alter these processes.

Spriet LL. New insights into the interaction of carbohydrate and fat metabolism during exercise. *Sports Med.* 2014; 44 Suppl 1:87-96.

Spriet LL. The Metabolic Systems: Lipid Metabolism. In: *Advanced Exercise Physiology*, 2<sup>nd</sup> Ed. Farrell, PA, Joyner, MJ, Caiozzo, VJ (eds). Philadelphia: Lippincott, Williams and Wilkins; pp 392-407, 2012.

For more information, please visit [www.uoguelph.ca/hhns/People/LSpriet.html](http://www.uoguelph.ca/hhns/People/LSpriet.html)



## **Marica Bakovic, PhD**

### ***Phospholipids, Metabolism and Health***

Phospholipids are the major constituents of cell membranes and their function is altered in multiple chronic diseases, including cardiovascular disease, diabetes, obesity and cancer. My laboratory investigates genomic, biochemical, and nutritional regulation of membrane phospholipid metabolism. We study the gene regulation in the cell culture and animal models, and focus on liver, intestinal and heart function in obesity and diabetes.

Fullerton MD, Hakimuddin F, Bonen A, and Bakovic M (2009) The development of a metabolic disease phenotype in CTP: phosphoethanolamine cytidyltransferase deficient mice. *J Biol Chem*, 284:25704-25713.

Pavlovic Z, Zhu L, Pereira L, Singh RK, Cornell RB, and Bakovic M (2014) Isoform-specific and protein kinase C-mediated regulation of CTP:phosphoethanolamine cytidyltransferase phosphorylation. *J Biol Chem*, 289:9053-9064.

For more information, please visit [www.uoguelph.ca/hhns/People/MBakovic.html](http://www.uoguelph.ca/hhns/People/MBakovic.html)



## **David Dyck, PhD**

### ***Hormonal regulation of muscle metabolism in health, obesity, and diabetes***

Hormones are important regulatory proteins in metabolism, and are released from several tissues, including skeletal muscle. My research program has focused on how these hormones, specifically leptin and adiponectin, regulate skeletal muscle lipid and carbohydrate metabolism, and how this is altered in situations of metabolic dysfunction such as high fat feeding or obesity. I am also interested in how the effects of these hormones on muscle may be modulated by the interaction of diet and exercise.

Richie IW, MacDonald T, Wright DC, Dyck DJ. Adiponectin is sufficient, but not required, for exercise-induced increases in the expression of skeletal muscle mitochondrial enzymes. *J Physiol.* 2014; [Epub ahead of print].

Gulli RA, Tishinsky JM, Macdonald T, Robinson LE, Wright DC, Dyck DJ. Exercise restores insulin, but not adiponectin, response in skeletal muscle of high-fat fed rodents. *Am J Physiol Regul Integr Comp Physiol.* 2012; 303(10):R1062-70.

For more information, please visit [www.uoguelph.ca/hhns/People/DDyck.html](http://www.uoguelph.ca/hhns/People/DDyck.html)



The needs of the Department of Human Health and Nutritional Sciences are constantly evolving as we strive to produce top-level research in the health sciences. We are continually seeking collaborative partners who share our passion for human health and the promotion of a healthy lifestyle for the maintenance of health, aging, and the treatment of chronic disease.

Opportunities include:

- Contractual research partnerships
- Graduate Student Support  
PhD Student – \$19,300/year (4 years)  
MSc Student – \$15,300/year (2 years)
- Support in the form of research grants and awards

For more information about our research and how you can collaborate with the Department of Human Health and Nutritional Sciences, please visit [www.uoguelph.ca/hhns](http://www.uoguelph.ca/hhns), or contact the department Liaison Officer by phone (519-824-4120 ext. 54104) or email ([hhnsliaisonofficer@uoguelph.ca](mailto:hhnsliaisonofficer@uoguelph.ca)).



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