University of Birmingham

Dr Andy Philp

Lecturer in Integrative Physiology

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About

Dr Andy Philp is an integrative physiologist, interested in the molecular regulation of skeletal muscle adaptation. The main focus of his work is to examine how diet and exercise interact to regulate skeletal muscle mitochondrial function, adaptive growth and insulin sensitivity in the context of human athletic performance and in metabolic diseases such as sarcopaenia, obesity and type 2 diabetes.

Qualifications

BSc (Hons) - Sport and Exercise Sciences (University of Brighton)
PhD - Exercise Physiology (University of Brighton)

Biography

Dr Andy Philp joined the School of Sport, Exercise and Rehabilitation Sciences in October 2012 to establish a world-leading research group studying the impact of diet and exercise on the molecular regulation of skeletal muscle adaptation.

In 2002, Andy obtained his Bachelor of Science degree in Sport and Exercise Sciences from the University of Brighton, UK. Upon completion, he continued his graduate training in the same department focusing on understanding the impact of exercise and nutrition on substrate balance during acute and chronic exercise in humans. Under the tutelage of Dr. Peter Watt, he acquired the skills and knowledge to utilize stable isotope tracers (^{13}C lactate and glucose) to determine substrate turnover during basal and exercise conditions.

With a drive to understand underpinning skeletal muscle adaptation, rather than describe physiological responses to exercise, following the completion of his Ph.D., Andy pursued expert training in cell biology at the University of Dundee, first in the MRC Protein Phosphorylation Unit working with Dr Kei Sakamoto, and later with Dr. Keith Baar in the Division of Molecular Physiology. His post-doctoral work, funded by the Engineering and Physical Sciences Research Council (EPSRC), utilized a 3-dimensional skeletal muscle cell culture model, pioneered by Dr. Baar, to study skeletal muscle responses to contraction and loading. Andy's input on this project led to two papers describing the development of novel machines (i.e., bioreactors) designed to deliver physiological stimuli to engineered muscle constructs. In 2009 Andy moved to the Department of Neurobiology, Physiology and Behavior at the University of California Davis (UCD). At UCD, Andy led research investigating how cellular energy status regulates skeletal muscle adaptations to exercise and inactivity. Specific focus was given to understanding the mechanisms by which substrate intermediates (fatty acids, glycogen) and by-products of contraction (NAD^+, cAMP, Ca^{2+}) regulate cellular metabolism, mitochondrial biogenesis and muscle growth. This body of work led to Andy receiving the 2012 UC Davis award for excellence in postdoctoral research.

The ultimate goal for Andy's research has always been to translate his basic studies at the cell level back into settings of human health and disease. Upon returning to the UK, Andy will work with colleagues in the School of Sport and Exercise Sciences, Centre for obesity research and the newly awarded MRC-ARUK centre for musculoskeletal aging (**http://www.birmingham.ac.uk/research/activity/mds/centres/mrc-musculoskeletal-ageing/index.aspx (http://www.birmingham.ac.uk/research/activity/mds/centres/mrc-musculoskeletal-ageing/index.aspx)**), to deliver a combination of basic and applied research with a broad translational approach to understanding metabolic diseases of aging.

Teaching

Dr Philp teaches on the 'Mechanisms of Adaptation to training' module, available to 3rd year undergraduate students studying the BSc Sport and Exercise Sciences degree.

Postgraduate supervision

Dr Philp is currently supervising two PhD students:

Zhe Song (2nd year PhD student funded by Chinese Government Scholarship)

Thomas Rowland (1st year PhD student funded by the BBSRC)

Dr Philp is currently recruiting for PhD studentships due to start in September 2013, for more information please visit (**http://www.findaphd.com/search/ProjectDetails.aspx?PJID=41041&LID=151 (http://www.findaphd.com/search/ProjectDetails.aspx?PJID=41041&LID=151)**)

Research

My current research focuses on how cellular energy status regulates skeletal muscle adaptations to exercise and inactivity. I am interested in the mechanisms by which substrate intermediates (fatty acids, glycogen) and by-products of contraction (NAD^+, cAMP, Ca^{2+}) regulate cellular metabolism, mitochondrial biogenesis and muscle growth. Recent work, in collaboration with Dr. Simon Schenk at the University of California San Diego (UCSD) (**http://muscle.ucsd.edu/NSMRC/home.shtml (http://muscle.ucsd.edu/NSMRC/home.shtml)**) has utilized conditional knock-out mouse models to study the role of the NAD^+-dependant protein deacetylase, sirtuin 1 (SIRT1), in the regulation of skeletal muscle insulin sensitivity in response to calorie restriction and mitochondrial biogenesis following endurance type exercise.

Current projects in the Philp laboratory are geared towards:

1) Determining the role of protein lysine acetylation in metabolic regulation of skeletal muscle.

2) Understanding the role of glycogen content in the adaptive responses to exercise.

3) Investigating the molecular regulation of exercise induced mitochondrial protein synthesis.

4) Identifying novel regulators of mitochondrial biogenesis in human skeletal muscle.

Students interested in studying these research areas are encouraged to contract Dr Philp via email (a.philp@bham.ac.uk).

Other activities

Awards:

UC Davis Award for Excellence in Postdoctoral Research (2012)

American Physiological Society Research Recognition Award (2009)

Physiological Society Research Fellowship Award (2007)

Conference/Invited Talks:

Symposium organizer: aSIRTing Control on Cellular Metabolism: Role of the Sirtuins in Health and Disease, ACSM Annual Meeting, San Francisco (2012)

Diverse Metabolic Regulation by the Sirtuin Family of Protein Deacetylases, ACSM Annual Meeting, San Francisco (2012)

Metabolic Regulation of Exercise at and Above the Maximal Lactate Steady State (MLSS), ACSM Annual Meeting, San Francisco (2012)

Centre for Healthy Aging, University of Copenhagen, Denmark (2012)

National Skeletal Muscle Research Center, University of California, San Diego (2010)

International Biochemistry of Exercise Conference, Student Research Day, University of Guelph, Canada (2009)

GSK Sports Nutrition Symposium - European Congress of Sport Science, Oslo, Norway (2009)

PGC1α as a master regulator of mitochondrial metabolism – UK Sport and GB Cycling (2009)

Functional roles for the PGC1α related co-activator PRC in skeletal muscle – The Physiological Society Themed meeting (2009)

Molecular Nutrition Master Class – UK Sport and Team Great Britain (2009)

Publications

(1) **Philp, A.** and Baar, K. (2012) Fine-tuning metabolism – how products of contraction regulate skeletal muscle adaptation. *Am J Physiol Endocrinol Metab.* Jun 1;302(11):E1313-4. PMID: 22436694

(2) McCurdy, C.E. Schenk, S. Holliday, M.J. **Philp, A**. Houck, J.A. Patsouris, D. MacLean, P.S. Majka, S.M. Klemm, D.J. and Friedman, J.E. (2012) Attenuated PIK3R1 Expression Prevents Insulin Resistance and Adipose Tissue Macrophage Accumulation in Diet-Induced Obese Mice. *Diabetes* Oct;61(10):2495-505. PMID: 22698915

(3) **Philp, A.** Hargreaves, M. and Baar, K. (2012) More than a store: Regulatory roles for glycogen in skeletal muscle adaptation to exercise. *Am J Physiol Endocrinol Metab.* Jun 1;302(11):E1343-51. PMID: 22395109

(4) Park, S-J. Ahmed, F. **Philp, A.** Baar, K. Williams, T. Luo, H. Ke, H. Rehmann, H. Taussig, R. Kim, M.K. Beaven, M.A. Manganiello, V. Chung, J.H. (2012). Resveratrol ameliorates aging-related metabolic phenotypes by inhibiting cAMP phosphodiesterases. *Cell.* Feb 3;148(3):421-33. PMID: 22304913

(5) Schenk, S. McCurdy, C.E. **Philp, A**. Chen, MZ. Holliday, MJ. Bandyopadhyay, GK. Osborn, O. Baar, K. Olefsky, JM. (2011). SIRT1 mediates enhanced skeletal muscle insulin sensitivity in calorie-restricted mice. *J Clin Invest*. Nov;121(11):4281-8. PMID: 21985785

(6) **Philp, A**. Belew, M.Y. Evans, A. Pham, D. Sivia, I. Chen, A. Schenk, S. Baar, K. (2011) The PGC-1α related co-activator (PRC) promotes mitochondrial and myogenic adaptations in C2C12 myotubes. *Am. J. Physiol. Regul. Integr. Comp. Physiol.* Oct;301(4):R864-72. Epub 2011 Jul 27. PMID: 21795630

(7) **Philp, A**. Chen, A. Lan, D. Meyer, G.A. Murphy, A.N. Knapp, A.E. Olfert, I.M. McCurdy, C.E. Marcotte, G.R. Hogan, M.C. Baar, K. Schenk, S. (2011) Sirtuin 1 (SIRT1) deacetylase activity is not required for mitochondrial biogenesis or peroxisome proliferator activated receptor-γ coactivator-1α (PGC-1α) deacetylation following endurance exercise. *J. Biol. Chem.* Sep 2;286(35):30561-70. PMID: 21757760

(8) Breen, L. **Philp, A**. Witard, O.C. Jackman, S.R. Selby, A. Smith, K. Baar, K. Tipton, K.D. (2011) The influence of carbohydrate-protein co-ingestion following endurance exercise on myofibrillar and mitochondrial protein synthesis. *J. Physiol.* Aug 15;589(Pt 16):4011-25. Epub 2011 Jul 11. PMID: 21746787

(9) **Philp, A**. Hamilton, D.L. Baar, K. (2011) Signals mediating skeletal muscle remodeling by resistance exercise: PI3-kinase independent activation of mTORC1. *J. Appl. Physiol*. 110(2): 561-8. PMID: 21071597

(10) Preston, R.S. **Philp, A**. Cleasens, T. Dunlop, E.A. Gijezen, L. Harper, K.T. Brinkhuizen, T. Davies, D.M. Land, S.S. Baar, K. van Steensel, M. Tee, A.R. (2010) Absence of the Birt-Hodd-17. Dube gene product is associated with increased hypoxia inducible factor transcriptional activity and a loss of metabolic flexibility. *Oncogene*. 30(10): 1159-73. PMID: 21057536

(11) **Philp, A**. Perez-Schindler, J. Green, C. Hamilton, D.L. Baar, K. (2010) Pyruvate suppresses PGC1a expression and substrate utilisation despite increased respiratory chain content in C2C12 myotubes. *Am. J. Physiol. Cell. Physiol.* 299(2): C240-50. PMID: 20410436