

*Meeting Report***The 4th Prof. Eric A. Newsholme Research Symposium—“Immunometabolism”, Merton College, Oxford, 29th August 2019****Philip Newsholme**

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Eric Arthur Newsholme was an innovative metabolic researcher, recognized for his ground-breaking work in the area of regulation of metabolism. He was born on 19 May 1935 in Liverpool, England, and passed away on 17 March 2011 in South Devon, UK. He read Natural Sciences at Magdalen College, University of Cambridge, and completed his PhD in Biochemistry at Cambridge under the supervision of Sir Philip Randle. Eric published over 300 scientific articles and authored three textbooks. He made scientific contributions and impact to three important research areas: mechanisms of metabolic regulation, metabolic changes in response to physical exercise, and identifying the various metabolic requirements of leukocytes [1,2]. The books *Regulation in Metabolism* (by E. A. Newsholme and C. Start, in 1973) [3] and *Biochemistry for the Medical Sciences* (by E. A. Newsholme and A. R. Leech, in 1983) [4] updated to *Functional Biochemistry in Health and Disease* (in 2010) [5] highlighted the beauty and the relevance of metabolism for students and health professionals alike.

The Symposium in Merton College, Oxford, held on 29th August 2019 and organized by Prof. Philip Newsholme and Prof. Rui Curi, involved presentations from experts in Immunometabolism and metabolism more generally (Figure 1), to highlight the important contributions made by Eric Newsholme in the 1970s and 1980s. A brief description is provided below of the topics covered by the speakers:

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The first presentation was provided by Prof. Philip Newsholme (Curtin University, Australia) who linked ground breaking experiments in the laboratories of Eric Newsholme and Siamon Gordon in the 1980s with recent discoveries, emphasizing the importance of metabolism to immune function.

Prof. Siamon Gordon (Oxford University) then described the importance of macrophage metabolism to the many functions of this highly adaptable cell type, which is found distributed in all tissues and organs of the body.

Prof. Luke O' Neill (Trinity College Dublin, Ireland), revealed the technology and approaches behind the discovery of novel metabolites

generated in macrophages, that regulate essential functions such as cytokine release.

Dr. Paula Longhi (QM, University of London) then discussed the importance of metabolism to maturation and function of the dendritic cell, a key regulator of immune responses.

Dr. Jazz Sethi (University of Southampton) provided a fascinating presentation on Immunometabolic signaling and tissue remodeling.

Prof. Victor Zammit (University of Warwick) presented a metabolic overview of the complexities of hepatic triglyceride synthesis and secretion and the implications for metabolic health and disease.

Prof. Marilia Seelaender and Dr. Jose Cesar Rosa Neto (both of University Sao Paulo, Brazil) presented work on the importance of metabolism to inflammation in cancer and the effect of fatty acid supplementation on immunometabolic responses in animal models.

Prof. Augusto Guimares (Nutral, Fortaleza, Brazil) presented on the importance of clinical nutrition to health outcomes and provided information on the various products produced by his company, Nutral.

Prof. David Jenkins (University of Toronto, Canada), presented information on the importance of key principles of metabolic regulation to the glucose fatty acid cycle, the glycemic index and cardiovascular disease.

Dr. Caroline Pond (Honorary Senior Research Fellow, Department of Zoology, Oxford, Emeritus Professor, The Open University) described her investigation of the previously neglected topics of natural obesity and determinants of the anatomical distribution of adipose tissue, starting with road-killed wild animals. Largely as a hobby, she examined more than 400 specimens. In 2018, she donated the entire collection to Oxford Zoology Department for use in medical, biological and wildlife research such as molecular phylogeny, genomics and stable isotope analysis, and housed at the Wildlife Conservation & Research Unit (WildCRU) in Tubney. Comprehensive catalogue and terms of use at: <https://www.wildcru.org/the-pond-collection/>.

Prof. Rui Curi, (Interdisciplinary Post-graduate Program in Health Sciences, Cruzeiro do Sul University, Sao Paulo, Brazil and Butantan Institute, Sao Paulo, Brazil) emphasized that glutamine is the most abundant free amino acid in the human blood and intracellular pools. Mammals can synthesize glutamine in skeletal muscle, liver, and lung but during injury, trauma, burns, sepsis, and diseased states, the cellular requirement for glutamine outstrips its supply and glutamine become essential; a “conditionally” essential amino acid. In the 1980s, Eric Newsholme’s laboratory published pioneering studies regarding glutamine metabolism in leukocytes. Eric’s laboratory was the first to establish that lymphocytes and macrophages utilize glutamine at a high

rate in addition to glucose, being essential for the functions of these cells. Rui Curi and colleagues reported that glutamine is also utilized by neutrophils contributing to reactive oxygen species production and apoptosis of these cells. Due to the high utilization of glutamine by leukocytes and its importance for cell function, Eric Newsholme postulated that skeletal muscle, the primary source of this amino acid in the body, is directly involved in the immune and inflammatory responses. Marked skeletal muscle mass wasting occurs in conditions of increased leukocyte glutamine requirement. Prof. Curi presented a fascinating lecture on the interconnectivity of amino acid and glutamine metabolism in muscle and leukocytes.

The symposium speakers and additionally Prof. Gerhard Wegener and his wife Monica, and Newsholme family members (wife Pauline, daughter Glenda, Son Philip, and Grandsons Rory and Aodhan) enjoyed a wonderful and entertaining dinner at Wolfson College, Oxford, on the evening of 29th August.



Figure 1. Photograph of the participants at the 4th Eric A Newsholme Research Symposium, Merton College, Oxford.

Prof. Philip Newsholme
Editor-in-Chief

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