

## Professor Prem Kumar

Head of the Institute of Clinical Sciences  
Professor of Physiological Science

Cardiovascular and Respiratory Sciences

### Contact details

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### About

Prem Kumar is a Professor of Physiological Science and Head of the Institute of Clinical Sciences. He is also the Director of Education for the College of Medical and Dental Sciences.

His research interests are in the field of chemoreception, with a particular emphasis on carotid body and chemotransduction mechanisms in health and disease and in the reflex responses to hypoxia and changes in blood glucose concentrations and he has published a number of research papers and reviews in these areas.

Professor Kumar has served on a number of Journal Editorial Boards, including the Journal of Physiology, Respiratory Physiology & Neurobiology and the Journal of Applied Physiology. In addition, he is a member of the Executive Committee of the Physiological Society and Chair of the Publications Committee. He is also a member of the International Committee of the American Physiological Society.

Professor Kumar is an enthusiastic teacher and holds key positions in the delivery and administration of undergraduate and postgraduate medical training at Birmingham as well as performing duties as an External Examiner at other UK and International Universities.

### Qualifications

- D.Phil (Oxon) 1986
- B.Sc (Hons) Physiology (Leeds) 1982

### Biography

Prem Kumar graduated as a Physiologist from the University of Leeds in 1982 and went on to complete a D.Phil (Ph.D) at the University of Oxford, working with Drs Bob Torrance and Piers Nye, where he became interested in understanding how the body senses and responds to changes in its blood chemical composition. He followed this with a brief postdoctoral position at the University of Reading where, under the leadership of Professor Mark Hanson, he extended his interests into an understanding of the development of chemoreception during fetal and neonatal life. This led to a Lectureship appointment at the University of Birmingham in 1990, where he moved via a Senior Lectureship, Readership position and now holds a Chair. A 5-year Lister Institute Fellowship was awarded to him between 1995-2000 and during this period he worked to develop an in vitro carotid body preparation that has allowed him to examine transduction processes that would not have been possible to study in vivo. He has been invited to speak at a number of national and international meetings, including the Nobel Conference on Oxygen Biology at the Karolinska Institute in Stockholm, as well as at major meetings in Brazil, China, Japan and North America.

He is proud to be a physiologist and has worked in a number of key positions within the Physiological Society of UK and Ireland to help promote the subject. In addition to serving as a Council and Executive Member of the Society, he has also held the Chair position of the Meetings Committee, where he took a lead role in the development of the Society's strategy for Conference organisation and delivery and in the organising of a number of International Meetings and the Publications Committee.

He has worked for a number of Journals in Editorial positions – holding roles as Reviewing Editor and Deputy Editor-in Chief for The Journal of Physiology as well as Editorial positions for Respiratory Physiology and Neurobiology and International Consulting Editor for the Journal of Applied Physiology.

He holds key roles in the administration of Education in the College of Medical and Dental Sciences and in the 5-year medical (MBChB) course and the 3-year Biomedical Science programme at the University of Birmingham, working with colleagues to ensure its appropriate delivery and assessment.

### Teaching

- Module Lead: Introduction to Respiratory Medicine – Yr 1 MBChB [Medicine and Surgery MBChB \(/undergraduate/courses/med/medicine.aspx\)](#)
- Module Lead: Cardiorespiratory System II: 3<sup>rd</sup> Year Biomedical Science [Biomedical Science BSc \(/undergraduate/courses/med/biomedical-science.aspx\)](#)
- SGT tutor – Biomedical Science, MBChB

### Postgraduate supervision

Prem has successfully supervised a number of Ph.D students and is interested in supervising further doctoral research students in the following broad area:

- Hypoxia sensing and cardiorespiratory control in health and disease – to include a range of approaches from single cell to whole animal; from electrophysiology to reflex measurement.  
Full and appropriate training will be given.

If you are interested in studying this subject area, please contact Prem on the contact details above, or for any general doctoral research enquiries, please email:

For a full list of available Doctoral Research opportunities, please visit our [Doctoral Research programme listings. \(http://www.bham.findaphd.com/?es=y&apl=y&aplt=&show\)](http://www.bham.findaphd.com/?es=y&apl=y&aplt=&show)

## Research

Professor Prem Kumar's research interests are in the area of cardiorespiratory physiology with a particular emphasis on chemotransduction mechanisms and the postnatal development of chemoreceptor sensitivity. The general approach he has adopted in the laboratory is to utilise a number of models ranging from *in vivo* to molecular-based from which hypotheses can be tested through various levels of organisation.

Major research presently undertaken involves:

1. Glucose sensing by peripheral chemoreceptors – are these receptors more than 'just' oxygen sensors? Could they play a role in sensing systemic metabolism and hence act to match ventilation to metabolism? Might this function be impaired in certain disease states eg diabetes, heart failure, COPD?
2. Role of ATP in mediating vasomotion. Could vasomotion – or its lack – be implicated in the aetiology of pre-eclampsia? Might ATP release from blood or cells of the umbilicus / placenta be involved in its control?
3. Catecholaminergic mediation of exercise hyperpnea. Ventilation increase in hypoxia without change in blood gas tensions. This suggests that either the chemical sensing of blood is not involved or that the carotid body sensitivity to other stimuli acts to augment discharge during exercise. This study is also examining a possible link between catecholamines and ventilatory impairment in chronic heart failure.
4. Apnea and the control of breathing. The intermittent hypoxia of recurrent sleep apnoea appears to be able to induce a form of long-term facilitation in carotid body function (perhaps via ROS) and this augmented chemodischarge could underlie the increased sympathetic drive that leads to hypertension in these patients. This study utilises models of intermittent hypoxia.

## Other activities

1998 - 2006 Editor, Journal of Physiology

1999 - 2001 Ethical Editor, Journal of Physiology

2001 - 2003 Senior Editor, Journal of Physiology

2003 - 2006 Deputy Editor-in-Chief, The Journal of Physiology

2003 - 2011 Editor, Respiratory Physiology and Neurobiology

2008 - 2011 International Consulting Editor, Journal of Applied Physiology

2005 - 2013 IUPS UK Executive planning Committee

2006 - 2010 Chair, Meeting Committee – The Physiological Society

2006 - 2010 Member of Executive Committee – The Physiological Society

2006 - 2007 Council Member – The Physiological Society

2012 – 2015 Member, American Physiological Society International Committee

2014-2017 Chair, Publications Committee, Physiological Society

2013-2016 Committee Member, Annual Physiological Society Hypoxic Interest Group

## Publications

LimTo WK, Kumar P, Marshall JM (2015). **Hypoxia is an effective stimulus for vascular release of ATP from human umbilical vein endothelial cells** (<http://www.sciencedirect.com/science/article/pii/S0143400415008966>). *Placenta* 36:759-766

Holmes AP Turner PJ, Carter P, Leadbeater W, Ray CJ, Hauton D, Buckler KJ and Kumar P (2014) Glycogen supports the sensory neuronal activity of the carotid body during glucose deprivation. *The Journal of Physiology* 592(20):4493-4506 (2015)

Nunes AR, Holmes AP, Sample V, Kumar P, Cann MJ, Monteiro EC, Zhang J and Gauda EB (2013) **Bicarbonate-sensitive soluble and transmembrane adenylyl cyclases in peripheral chemoreceptors** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Bicarbonate-sensitive+soluble+and+transmembrane+adenylyl+cyclases+in+peripheral+chemoreceptors>). *Respir Physiol Neurobiol* 188(2):83-93

Hauton D, Holmes A, Ziff O and Kumar P (2013) **The impact of acute and chronic catecholamines on respiratory responses to hypoxic stress in the rat** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=The+impact+of+acute+and+chronic+catecholamines+on+respiratory+responses+to+hypoxic+stress+in+the+rat>). *Pflugers Arch* 465(2):209-19

Evans AM, Peers C, Wyatt CN, Kumar P and Hardie DG (2012) **Ion Channel Regulation by the LKB1-AMPK Signalling Pathway: The Key to Carotid Body Activation by Hypoxia and Metabolic Homeostasis at the Whole Body Level** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=ion+Channel+Regulation+by+the+LKB1-AMPK+Signalling+Pathway:+The+Key+to+Carotid+Body+Activation+by+Hypoxia+and+Metabolic+Homeostasis+at+the+Whole+Body+Level>). *Arterial Chemoreception: Advances in Experimental Medicine and Biology* 758:81-90

Kumar P and Prabhakar NP (2012) **Peripheral Chemoreceptors: Function and Plasticity of the Carotid Body** (<http://www.ncbi.nlm.nih.gov/pubmed/23728973>). *Compr Physiol* 2(1):141-219

Holmes AP, Hauton D and Kumar P (2012) **The Interaction Between Low Glucose and Hypoxia in the in vitro, Rat Carotid Body** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=The+Interaction+Between+Low+Glucose+and+Hypoxia+in+the+in+vitro,+Rat+Carotid+Body>). *Adv Exp Med Biol* 758:123-7

Griffin HS, Kumar P, Pugh K and Balanos GM (2012) **Long-term facilitation of ventilation following acute continuous hypoxia in awake humans during sustained hypercapnia** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Long-term+facilitation+of+ventilation+following+acute+continuous+hypoxia+in+awake+humans+during+sustained+hypercapnia>). *J Physiol* 590(Pt 20):5151-65

