

Professor Gerard Nash

Professor of Cardiovascular Rheology and Head of School of Clinical and Experimental Medicine

Cardiovascular and Respiratory Sciences

Contact details

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About

Gerard Nash originally trained as a physical scientist and is interested in understanding the processes of cell adhesion and migration, and the effects of blood flow on these processes, by application of well-defined, quantitative, in vitro models.

Gerard has published over 200 research papers in scientific journals as well as reviews and book chapters in the fields of blood flow, cell mechanics, and leukocyte adhesion and migration. He has received grants from British Heart Foundation, Wellcome Trust, BBSRC, MRC, EPSRC and Cancer Research UK.

Gerard Nash is a leading member of the NIHR SRMRC. Find out more about the work of the research centre on the **[SRMRC website \(http://www.srmrc.nihr.ac.uk/\)](http://www.srmrc.nihr.ac.uk/)**.

Qualifications

- Ph.D. Biophysics, University of London, 1979
- B.Sc. Physics (1st Class Honours), University of Manchester, 1975

Biography

After studying engineering and physics as an undergraduate, I opted to follow a research career in the biophysical sciences. My PhD was initially in instrumentation for automated cell characterisation but I quickly moved into cell mechanics and biorheology, and have subsequently gravitated towards studies of the cellular physiology of the cardiovascular system.

As a post-doc, my work at Guy's and at University of Southern California initially revolved around analysis of the physical properties of red cells, and later leukocytes, that influence their circulation. On returning to UK and St. George's Hospital Medical School, I applied these analytical approaches to defining biomechanical abnormalities associated with vascular disease.

On moving to Birmingham in 1989, my interest increasingly turned to the cellular adhesive properties of leukocytes and red cells. I established the Cardiovascular Rheology group, and developed novel flow-based culture and adhesion assays incorporating endothelial cells. We characterised for the first time the dynamic adhesive interactions of flowing malarial parasitised red cells. However, work on the mechanisms by which flowing neutrophils bind to 'vessel' walls came to take precedence, and we were the first to describe the ability of surface-adherent platelets to capture flowing neutrophils.

At the same time I developed an increasing interest in the role of endothelial cells in regulating neutrophil recruitment. Studies followed, e.g. defining the ability of endothelial cells exposed to hypoxia, cigarette smoke or cytokines to induce neutrophil recruitment, and defining the kinetics and molecular mechanisms of each stage of the capture, activation and migration process. More recently I have concentrated on the concept that the local physicochemical environment defines the responsiveness of endothelial cells to inflammatory stimuli, and also the subsequent fate of recruited leukocytes. This has involved development of models in which endothelial cells are conditioned by culture under different flow conditions or with different stromal cells. Initially we defined how these variables modified ability to capture and induce migration of leukocytes. We are currently extending this to include studies of migration through basement membrane into tissue constructs, and evaluation of how stromal cells may influence the fate of recruited leukocytes in inflamed tissue.

Much of the more recent work has been carried out in collaboration with Professors Ed Rainger and Chris Buckley and Dr. Helen McGettrick, studying processes linked to development of chronic inflammatory pathology, especially in atherosclerosis and rheumatoid arthritis. Recently we have worked on linking inflammatory responses with thrombosis and angiogenesis, and examining the potential for stem cells to modulate such responses. In this way we aim to develop an understanding of how these different responses are integrated and may be manipulated to facilitate tissue healing. This work is inter-disciplinary in nature, and e.g., acts as an interface between the Centre for Cardiovascular Sciences and the MRC Centre for Immune Regulation.

Teaching

- Lectures and small group teaching for cardiovascular and respiratory science to MBChB, BDS and Biomedical Sciences
- Lectures and labs for haematology for Biomedical Materials Science
- Lectures and labs in BMedSc Yr 3 options on Cardiovascular Science and Cellular Pathology
- Supervises laboratory projects for Yr 3 BmedSc
- Tutorials on cell recruitment from the circulation for MRes taught modules
- Personal mentor for MBChB

Postgraduate supervision

Gerard is a member of Wellcome Trust-, BBSRC- and MRC-funded doctoral training groups in immunology, tissue repair and regeneration, and stem cell biology. He is also on the steering committee of the EPSRC Doctoral Research Centre 'Physical Sciences of Imaging in the Biomedical Sciences, PSIBS'. He is interested in supervising doctoral research students in the following areas:

- Mechanisms of leukocyte recruitment from the blood and migration into the vessel wall, and the effects of the local haemodynamic and stromal micro-environments on these processes
- The role of disrupted leukocyte recruitment in vascular inflammatory disease

- Mechanisms by which stem cells move from the vascular compartment into tissue and subsequently modulate leukocyte recruitment.

If you are interesting in studying any of these subject areas please contact Gerard on the contact details above. 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

Research Themes

- Cardiovascular science and endothelial cell biology
- Leukocyte adhesion and migration
- Stem cell recruitment
- Vascular pathology linked to abnormal leukocyte recruitment.

Cardiovascular rheology seeks to understand the physiological regulation of leukocyte adhesion and migration through endothelium, and to define how disruption of these processes occurs in vascular inflammatory diseases. There is emphasis on realistic in vitro modelling of leukocyte-endothelial interaction, using flow-based models which mimic the circulation, and on the physical environmental factors that influence leukocyte recruitment. Linked studies relate to modulation of endothelial sensitivity by the stromal environment, and atheroma formation (with Profs. Ed Rainger and Chris Buckley and Dr. Helen McGettrick). We are also interested in links between inflammation, thrombosis and angiogenesis as integrated responses to tissue injury. Recently, we have incorporated studies of the recruitment of stem cells across endothelium, and of the ability of stem cells to modulate leukocyte recruitment. Collaborations exist with colleagues investigating inflammatory processes in rheumatoid arthritis, liver disease, traumatic injury, burns and post-surgical complications.

Other activities

- Project Grants Committee, British Heart Foundation (2008 - 2011)
- External Examiner, Dept. Bioengineering, Imperial College (2009 - 2012)
- Editorial Board, Clinical Haemorheology and Microcirculation (1991 -)
- Editorial Board, Biorheology (2001 -)
- Co-Chair, International Society on Haemostasis and Thrombosis, Scientific Standards Committee, Scientific Subcommittee on Biorheology (2001-2010)
- President, International Society for Clinical Hemorheology (2012-2015)

Publications

Glen K, Luu NT, Ross E, Buckley CD, Rainger GE, Egginton S and Nash GB (2012) **Modulation of functional responses of endothelial cells linked to angiogenesis and inflammation by shear stress: differential effects of the mechanotransducer CD31** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Modulation+of+functional+responses+of+endothelial+cells+linked+to+angiogenesis+and+inflammation+by+shear+stress%3A+differential+effects+of+the+mechanotransducer+CD31>) . *J Cell Physiol* 227(6):2710-21

Burton VJ, Butler LM, McGettrick HM, Stone PC, Jeffery HC, Savage CO, Rainger GE and Nash GB (2011) **Delay of migrating leukocytes by the basement membrane deposited by endothelial cells in long-term culture** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Delay+of+migrating+leukocytes+by+the+basement+membrane+deposited+by+endothelial+cells+in+long-term+culture>) . *Exp Cell Res* 317(3):276-92

Butler LM, Jeffery HC, Wheat RL, Rae PC, Townsend K, Alkharsah KR, Schulz TF, Nash GB, Blackburn DJ (2011) **Kaposi's sarcoma-associated herpesvirus infection of endothelial cells inhibits neutrophil recruitment through an interleukin-6 dependent mechanism: a new paradigm for viral immune evasion** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Kaposi%27s+sarcoma-associated+herpesvirus+infection+of+endothelial+cells+inhibits+neutrophil+recruitment+through+an+interleukin-6+dependent+mechanism%3A+a+new+paradigm+for+viral+immune+evasion>) . *J Virol* 85(14):7321-32

McGettrick HM, Buckley CD, Filer A, Rainger GE and Nash GB (2010) **Stromal cells differentially regulate neutrophil and lymphocyte recruitment through the endothelium** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Stromal+cells+differentially+regulate+neutrophil+and+lymphocyte+recruitment+through+the+endothelium>) . *Immunology* 131(3):357-70

McGettrick HM, Hunter K, Moss PA, Buckley CD, Rainger GE and Nash GB (2009) **Direct observations of the kinetics of migrating T cells suggest active retention by endothelial cells with continual bidirectional migration** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Direct+observations+of+the+kinetics+of+migrating+T+cells+suggest+active+retention+by+endothelial+cells+with+continual+bidirectional+migration>) . *Journal of Leukocyte Biology* 85(1):98-107

McGettrick HM, Smith E, Filer A, Kissane S, Salmon M, Buckley CD, Rainger GE and Nash GB (2009) **Fibroblasts from different sites may promote or inhibit recruitment of flowing lymphocytes by endothelial cells** (<http://www.ncbi.nlm.nih.gov/pubmed/19130557>) . *European Journal of Immunology* 39(1):113-25

Tull SP, Yates CM, Maskrey BH, O'Donnell VB, Madden J, Grimble RF, Calder PC, Nash GB and Rainger GE (2009) **Omega-3 Fatty acids and inflammation: novel interactions reveal a new step in neutrophil recruitment**. (http://www.ncbi.nlm.nih.gov/pubmed/19707265?ordinalpos=2&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum) . *PLoS Biology* 7(8):e1000177

Matharu NM, McGettrick HM, Salmon M, Kissane S, Vohra RK, Rainger GE and Nash GB (2008) **Inflammatory responses of endothelial cells experiencing reduction in flow after conditioning by shear stress** (<http://www.ncbi.nlm.nih.gov/pubmed/?term=Inflammatory+responses+of+endothelial+cells+experiencing+reduction+in+flow+after+conditioning+by+shear+stress>) . *Journal of Cellular Physiology* 216(3):732-41

Luu NT, Madden J, Calder PC, Grimble RF, Shearman CP, Chan T, Dastur N, Howell WM, Rainger GE and Nash GB (2007) **Dietary supplementation with fish oil modifies the ability of human monocytes to induce an inflammatory response** (http://www.ncbi.nlm.nih.gov/pubmed/18029497?ordinalpos=15&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DefaultReportPanel.Pubmed_RVDocSum) . *Journal of Nutrition* 137(12):2769-74