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About

Kai is a senior research fellow in the MRC Centre for Immune Regulation. His main interest is the differentiation of lymphocytes during antibody responses. He published over 60 research papers, and received major grants from the European Union, Pfizer, and the MRC/BBSRC

Qualifications

- PhD Biochemistry/Immunology 1994
- Dipl.-Biol. Biology 1990

Biography

Kai qualified in 1990 with a Dipl.-Biol. in Virology/Immunology at the University of Hohenheim, Germany. He then moved to the Forschungszentrum Borstel, Germany to do a PhD on the regulation of the germinal centre reaction by cytokines, and was awarded a PhD in 1994.

In 1994 he started as a research fellow at the Department of Immunology, University of Birmingham and since then has studied the cellular interactions and differentiation processes that lymphocytes undergo while antibody responses develop.

Teaching

Teaching Programmes

- **BMedSci** (/undergraduate/courses/med/biomedical-science.aspx)
- **MBChB** (/undergraduate/courses/med/medicine.aspx) Immunology & Infection
- MRes in Biomedical Research
- Intercalated BMedSc in Clinical Sciences
- MPharm Pharmacy
- MSc Immunology and Immunotherapy

Postgraduate supervision

Kai is interested in supervising doctoral research students in the following areas:

- The role of antibody in the selection of germinal centre B cells
- Effects of ageing on the antibody affinity maturation
- Signals leading to differentiation of plasma cells
- Regulation of B cell migration by chemokines

If you are interesting in studying any of these subject areas please contact Kai on the contact details above, or for any general doctoral research enquiries, please email: **dr@contacts.bham.ac.uk** (mailto:dr@contacts.bham.ac.uk) or call +44 (0)121 414 5005.

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) .

Research

RESEARCH THEMES

Immunology

RESEARCH ACTIVITY

Selection of B cells in germinal centres

Most antibody responses involve affinity maturation. This process occurs in germinal centres (GCs), microanatomical structures in lymphoid tissues where B lymphocytes

mutate and mature their immunoglobulin V-genes. Affinity maturation is thought to be achieved by Darwinian evolution with repeated cycles of Ig hypermutation followed by B cell interaction with the antigen that is on follicular dendritic cells. This is then followed by stimulation from follicular T helper cells. We are studying how antigen, antibodies, T cells and other accessory cells in germinal centre interact with B cells and provide stimulation or barriers that lead to selection of higher affinity B cells. Main focus of this work is to understand the action of vaccines, and to understand processes that become defunctional during ageing.

Regulation of immunoglobulin class switching and plasma cell differentiation

B cells not only mutate their antibody genes after contact with antigen, they also rearrange these genes to produce antibody switch variants with same specificity, but different function. This process is called immunoglobulin class switching and happens in B cells at different stages and in different microanatomical compartments during an antibody response. The end product of B cell differentiation is the plasma cell – a cellular factory specialised in producing large amounts of antibody. Similar microenvironments and signals to the ones that induce immunoglobulin class switching also regulate plasma cell differentiation.

We are trying to understand the molecular signals that lead to these processes and the cellular interactions that provide signals for immunoglobulin class switching or plasma cell differentiation.

T helper lymphocyte differentiation

T helper cells are the main cells that interact with B cells and regulate antibody responses, having a role not only in the initiation of B cell differentiation, but also for long term immunological memory. We are interested in the differentiation of specialized subsets of T cells regulating B cell differentiation, and in the development and distribution of memory T cells throughout different microanatomical compartments.

Publications

Figge, M. T., A. Garin, M. Gunzer, M. Kosco-Vilbois, K.-M. Toellner, M. Meyer-Hermann
Deriving a germinal center lymphocyte migration model from two-photon data
Journal of Experimental Medicine, 2008, 205, 3019-3029

Marshall, J. L., Y. Zhang, L. Pallan, M.-C. Hsu, M. Khan, A. Cunningham, I. C. M. MacLennan, K.-M. Toellner Early B blasts acquire a capacity for Ig class switch recombination that is lost as they become plasmablasts
European Journal of Immunology, 2011, 41, 3506-3512.

Meyer-Hermann, M., E. Mohr, N. Pelletier, Y. Zhang, G. D. Victora, K.-M. Toellner. A novel theory of germinal center B cell selection, division, and exit
Cell Reports, 2012, 26, 162-174.

Zhang Y., M. Meyer-Hermann, L. George, M. T. Figge, M. Khan, M. Goodall, S. P. Young, A. Reynolds, F. Falciani, A. Waisman, C. A. Notley, M. R. Ehrenstein, M. Kosco-Vilbois, K.-M. Toellner. Germinal centre B cells govern their own fate via antibody feedback
Journal of Experimental Medicine, 2013, 210, 457-464

Stamm, C., J. Barthelmann, N. Kunz, K.-M. Toellner, J. Westermann, K. Kalies. Dose-dependent Induction of Murine Th1/Th2 Responses to Sheep Red Blood Cells Occurs in Two Steps: Antigen Presentation during Second Encounter Is Decisive
PLOS One, 2013, 8(6): e67746.

Caganova, M., C. Carrisi, F. Mainoldi, L. George, F. Alberghini, M. Ponzoni, T. Nojima, C. Doglioni, D. Kitamura, K.-M. Toellner, I. Su, S. Casola. Regulation of the germinal center B-cell program by the histone H3 lysine-27 methyltransferase Ezh2
Journal of Clinical Investigation, 2013, 123, 5009-5022

Toellner, K.-M. Cognate interactions: extrafollicular IL-4 drives germinal centre reactions, a new role for an old cytokine
European Journal of Immunology, 2014, 44, 1917-1920

Zhuang, X., F. Ahmed, Y. Zhang, J. C. Steele, N. M. Steven, V. L. Heath, K.-M. Toellner, R. Bicknell. Vaccination against the tumour endothelial marker Robo4 inhibits angiogenesis and tumour growth
Angiogenesis, 2015, 18(1):83-95