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About

(/university/colleges/les/research-gallery/apoorva-bhatt.aspx) Dr. Bhatt is a Lecturer in Molecular Microbiology in the School of Biosciences. A prestigious Fellowship- a Career Development Award from the Medical Research Council-enabled him to set up his research group at the University of Birmingham in 2006. Dr.Bhatt's research interests include studying pathogenic mycobacteria and how they cause disease, with a particular focus on *Mycobacterium tuberculosis*, the causative agent of tuberculosis (TB). This includes using a genetic approach to identify pathways involved in the biosynthesis of virulence-related metabolites.

Qualifications

- PhD (Bacterial Genetics)
- BSc and MSc (Microbiology)

Biography

2011-Present: Lecturer in Molecular Microbiology

2006-2011: Medical Research Council Fellow (Career Development Award)

2002-2006: Research Associate, Howard Hughes Medical Institute, Albert Einstein College of Medicine

2000-2002: Research Associate, University of Cambridge

1996-2000: PhD, John Innes Centre, Norwich

Teaching

1. Undergradaute Lectures: BIO305 and BIO317
2. Undergraduate Practicals: BIO151, BIO262, BIO305
3. MSc Lectures: BIOM08, BIOM22
4. MSc Practicals: BIOM22
5. ERASMUS teaching exchange with the Université Joseph Fourier, Grenoble, France.
6. Final year undergraduate, MRes and MSc research projects

Postgraduate supervision

PhD studentships are awarded each year competitively within the School of Biosciences. Funding options are also available for international students including a studentship from the Darwin Trust of Edinburgh.

For a list of possible PhD projects offered by Dr Bhatt **http://www.findaphd.com/search/ProjectDetails.aspx?PJID=57573 (http://www.findaphd.com/search/ProjectDetails.aspx?PJID=57573) (http://www.findaphd.com/search/customlink.asp?inst=birm-Biol&supersurname=Bhatt)**

Research

Research Theme within School of Biosciences: Molecular Microbiology

Lipid Metabolites of mycobacteria: pathways to biosynthesis and role in virulence

Mycobacterium tuberculosis (MTB), the causative agent of tuberculosis remains the most successful human pathogen. Though considered to be under control only 20 years ago, a number of factors like the spread of HIV and the emergence of drug resistant MTB strains have led to the resurgence of this disease. There is thus a clear and urgent need to extend our understanding of the physiology and pathogenicity of MTB with the aim of developing new therapeutics and vaccines.

Complex lipids play an important role in the biology of the bacterium as a large proportion of the genome contains genes proposed to be involved in lipid biosynthesis. A distinct lipid rich outer envelope helps MTB counteract a number of inhospitable conditions *in vivo*, and many mycobacterial lipids display immunomodulatory activities when tested in models of infection. Mycobacterial lipids thus play an important role in virulence. Furthermore, some of these lipids have been shown to be essential for growth and the enzymes involved in the biosynthesis of these lipids represent potential drug targets. The pathways involved in lipid biosynthesis thus merit a detailed study.

A broad aim of my research is understand how mycobacterial lipids are made, and the impact they have on virulence. We use a genetic approach to address these questions by generating mutant strains that are defective in these pathways. Research in my laboratory is funded by a Career Development Award, and Research Grants from the Medical Research Council.

Publications

(1) Ly D., Kasmar A.G., Cheng T.Y., de Jong A., Huang S., Roy S., **Bhatt A.,** van Summeren R.P., Altman J.D., Jacobs W.R. Jr, Adams E.J., Minnaard A.J., Porcelli S.A. and Moody D.B. (2013) CD1c tetramers detect ex vivo T cell responses to processed phosphomycoketide antigens. *J Exp Med* 2013 210:729-741.

(2) Varela C., Rittmann D., Singh A., Krumbach K., Bhatt K., Eggeling L., Besra G.S. and **Bhatt A.** (2012) *MmpL* genes are associated with mycolic acid metabolism in mycobacteria and corynebacteria. *Chem Biol* 19:498-506.

(3) Yamada H., **Bhatt A.,** Danev R., Fujiwara N., Maeda S., Mitarai S., Chikamatsu K., Aono A., Nitta K., Jacobs WR Jr. and Nagayama K. (2012) Non-acid-fastness in *Mycobacterium tuberculosis* Δ*kasB* mutant correlates with the cell envelope electron density. *Tuberculosis* 92:351-357.

(4) Sarkar D., Sidhu M., Singh A., Chen J., Lammas D.A., van der Sar A.M., Besra G.S. and **Bhatt A.** (2011) Identification of a glycosyltransferase from *Mycobacterium marinum* involved in the addition of a caryophyllose moiety in lipooligosaccharides. *J Bacteriol* 193:2336-2340.

(5) Alderwick L.J., Lloyd G.S., Ghadbane H., May J.W., **Bhatt A.**, Eggeling L., Fütterer K., and Besra G.S. (2011) The C-terminal domain of the Arabinosyltransferase *Mycobacterium tuberculosis* EmbC is a lectin-like carbohydrate binding module. *PLoS Pathog* 7(2):e1001299.

(6) Khan S., Nagarajan N.S., Parikh A., Samantaray S., Singh A., Kumar D., Roy R.P., **Bhatt A.** and Nandicoori V.K. (2010) Phosphorylation of enoyl-ACP reductase InhA impacts mycobacterial growth and survival. *J Biol Chem* 285: 37860-37871.

(7) Taylor R.C., Brown A.K., Singh A., **Bhatt A.** and Besra G.S. (2010) Characterization of a beta-hydroxybutyryl-CoA dehydrogenase from *Mycobacterium tuberculosis*. *Microbiol* 156: 1975-1982.

(8) Birch H.L., Alderwick L.J., Appelmelk B.J., Maaskant J., **Bhatt A.**, Singh A., Nigou J., Eggeling L., Geurtsen J. and Besra G.S. (2010) A truncated lipoglycan from mycobacteria with altered immunological properties. *Proc Natl Acad Sci* 107: 2634-2639.

(9) Chen J., Kriakov J., Singh A., Jacobs Jr. W.R., Besra G.S. and **Bhatt A.** (2009) Defects in glycopeptidolipid biosynthesis confer phage I3 resistance in *Mycobacterium smegmatis* *Microbiol* 155: 4050-4057.

(10) Brown A.K., Taylor R.C., **Bhatt A**., Fütterer K. and Besra G.S. (2009) Platensimycin activity against mycobacterial b-ketoacyl-ACP synthases. *PLoS ONE* 17: e6306.

(11) **Bhatt A.**, Brown A.K., Singh A., Minnkin D.E. and Besra G.S. (2008) Loss of a mycobacterial gene encoding a reductase leads to an altered cell wall containing b-oxo-mycolic acid analogs and accumulation of ketones. *Chem Biol* 15: 930-939.

(12) Bhatt A. and Jacobs Jr. W.R. (2008) Testing gene essentiality in mycobacteria using specialized transduction and inducible promoters. *Mycobacteria Protocols*, 2nd Ed, Humana Press. Ed. Tanya Parish and Amanda Brown.

(13) Bhowruth V., Alderwick L.J., Brown A.K., **Bhatt A**. and Besra G.S. (2008) Tuberculosis: a balanced diet of lipids and carbohydrates. *Biochem Soc Trans* 36: 555–565.

(14) Birch H.L., Alderwick L.J., **Bhatt A**., Rittman D., Krumbach K., Singh A., Yu B., Lowary T.L., Eggeling L. and Besra G.S. (2008) Biosynthesis of mycobacterial arabinogalactan: identification of a novel □(1→3) arabinofuranosyltransferase. *Mol Microbiol* 65: 1191-1206.

(15) Mishra A.K., Alderwick L.J., Rittman D., Wang C., **Bhatt A**., Jacobs Jr. W.R., Takayama K., Eggeling L. and Besra G.S. (2008) Identification of a novel a(1→6) mannopyranosyltransferase MptB from *Corynebacterium glutamicum* by deletion of a conserved gene, *NCgl1505* affords a lipomannan- and lipoarabinomannan-deficient mutant. *Mol Microbiol* 68: 1595-1613.

(16) Dover L.G., **Bhatt A**., Bhowruth V., Willcox B.E. and Besra G.S. (2008) New drugs and vaccines for drug-resistant *Mycobacterium tuberculosis* infections. *Expert Rev Vaccines* 7: 481-497

(17) **Bhatt A.**/Brown A.K‡., Singh A., Saparia E., Evans A.F. and Besra G.S. (2007) Identification of the dehydratase component of the mycobacterial mycolic acid synthesizing fatty acid synthase-II complex. *Microbiol* 153: 4166-4173.[‡ Equal authorship].

(18) Brown A.K., Papaemmanouil A., Bhowruth V., **Bhatt A.**, Dover L.G. and Besra G.S. (2007) Flavonoid inhibitors as novel antimycobacterial agents targeting Rv0636, a putative dehydratase enzyme involved in *Mycobacterium tuberculosis* fatty acid synthase II. *Microbiol* 153: 3314-3322.

(19) **Bhatt A.**, Molle V., Besra G.S., Jacobs Jr. W.R. and Kremer L. (2007) The *Mycobacterium tuberculosis* FAS-II condensing enzymes: their role in mycolic acid biosynthesis, acid fastness, pathogenesis and in drug development. *Mol Microbiol*64: 1442-1454.

(20) **Bhatt A.**, Fujiwara N., Bhatt K., Gurcha S.S., Kremer L., Chen B., Chan J., Porcelli S., Kobayashi K., Besra G.S. and Jacobs Jr. W.R. (2007) Deletion of *kasB* in *Mycobacterium tuberculosis* causes loss of acid-fastness and subclinical latent tuberculosis in immunocompetent mice. *Proc Natl Acad Sci (USA)* 104: 5157-5162.

(21) Bhatt K., Gurcha S.S., **Bhatt A.**, Besra G.S. and Jacobs Jr. W.R. (2007) Two polyketide-synthase-associated acyltransferases are required for sulfolipid biosynthesis in *Mycobacterium tuberculosis*. *Microbiol* 153: 513-520.

(22) Ojha A., Anand M., **Bhatt A**., Kremer L., Jacobs Jr. W.R. and Hatfull G.F. (2005) GroEL1: A dedicated chaperone involved in mycolic acid biosynthesis during biofilm formation in mycobacteria. *Cell* 123: 861-873.

(23) **Bhatt A.**, Kremer L., Dai A.Z., Sacchettini J.C. and Jacobs Jr. W.R. (2005) Conditional depletion of KasA, a key enzyme of mycolic acid biosynthesis, leads to mycobacterial cell lysis. *J Bacteriol* 187: 7596-7606.

(24) **Bhatt A.**, Stark C.B.W., Harvey B.M., Gallimore A.R., Spencer J.B., Staunton J. and Leadlay P.F. (2005) Accumulation of an *E*,*E*,*E*,-Triene by a polyether-producing polyketide synthase when oxidative cyclization is wholly blocked. *Angew Chem* 44: 7075-7078.

(25) Matsunaga I., **Bhatt A**., Young D.C., Cheng T-Y., Besra G.S., Briken V., Porcelli S.A., Jacobs Jr. W.R. and Moody D.B. (2004) *Mycobacterium tuberculosis pks12* produces a novel polyketide presented by CD1c to T Cells. *J Exp Med* 200: 1559-1569.

(26) **Bhatt A.** and Jacobs Jr. W.R. (2003) Conjugal rites of mycobacteria. *Nat Genet* 34: 3-4.

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(30) **Bhatt A.** and Kieser T. (1999) Transposition of IS*117* of *Streptomyces coelicolor* A3(2) in *Mycobacterium smegmatis*. *Microbiol* 145: 1201-1207.