# University of Birmingham

# Dr Tim Overton BSc PhD

Lecturer

**School of Chemical Engineering (/schools/chemical-engineering/index.aspx)**

## Contact details

**Telephone (+44) (0) 121 414 5306 (tel:+44 0 121 414 5306)**

**Email t.w.overton@bham.ac.uk (mailto:t.w.overton@bham.ac.uk)**

School of Chemical Engineering
University of Birmingham
Edgbaston
Birmingham
B15 2TT
UK

## About

Dr Tim Overton is a biochemist and molecular microbiologist who is interested in applying molecular biology and single-cell techniques to understand and develop bioprocesses. He is active in microbial flow cytometry research and collaborates widely with bioprocess engineers, molecular microbiologists, cell biologists and environmental microbiologists to develop new methods of answering fundamental questions on a single-cell level.

His research also focuses on using bacteria to make useful products such as protein drugs and small molecules, and the bacterial responses to stress encountered in such processes. Current and recent research funding has come from the BBSRC, TSB and EU FP7. He is the director of the **MSc in Biochemical Engineering (/postgraduate/courses/taught/chemical-engineering/biochemical-engineering.aspx)**

## Qualifications

- PhD in Biochemistry, University of Birmingham, 2003
- BSc (Hons) in Biochemistry with Molecular and Cell Biology, University of Birmingham, 1999

## Biography

Prior to joining Chemical Engineering, Dr Overton was a postdoctoral researcher in the School of Biosciences at the University of Birmingham, studying gene regulation in both model organisms (*Escherichia coli*) and human pathogens (*Neisseria gonorrhoeae* and *E. coli O157*) in response to oxygen and reactive species using transcriptomic, proteomic and other molecular biology techniques. Using systems biology and other molecular approaches, he identified mechanisms for bacterial survival in adverse environments.

Research became focused on bioprocessing topics during a BBSRC-EPSRC Bioprocessing Research Industry Club (BRIC) grant in collaboration with GSK, studying the production of difficult recombinant proteins in *E. coli*. Dr Overton was initially postdoctoral researcher on this project, and moved to a Co-I role upon taking up his position in the School of Chemical Engineering.

Current research extends previous work on stress and recombinant protein production, and has developed in several new areas (detailed below).

Dr Overton is director of the **MSc in Biochemical Engineering (/postgraduate/courses/taught/chemical-engineering/biochemical-engineering.aspx)** and chairs the School MSc and EngD board of examiners. He is a member of the University Advisory Group on Biological Hazards and is School GMO safety officer and a member of the School safety committee.

## Teaching

- **MEng/BEng Chemical Engineering (/schools/chemical-engineering/undergraduate/degree-courses.aspx)**
- **MSc Biochemical Engineering (/postgraduate/courses/taught/chemical-engineering/biochemical-engineering.aspx)**
- **MSc Advanced Chemical Engineering (/postgraduate/courses/taught/chemical-engineering/advanced-chemical-engineering.aspx)**
- **EngD Formulation Engineering (/postgraduate/courses/combined/chemical-engineering/formulation-engineering-engd.aspx)**

Teaching topics include basic biology and molecular biology, systems and synthetic biology, genomic technologies, fermentation and cell culture and analysis of microbial physiology. Dr Overton also supervises fermentation practicals at laboratory and pilot scale (~100 litres).

## Postgraduate supervision

Dr Overton is interested in supervising research in the areas listed below in the Research section, and has the following PhD projects currently available:

- **The importance of oxygen in large-scale fermentations (pdf) (/Documents/college-eps/chemical/research-vacancies/projectoxygen.pdf)**
- **Monitoring bacterial physiology during recombinant protein production (pdf) (/Documents/college-eps/chemical/research-vacancies/projectbacterial.pdf)**

Informal enquiries from prospective PhD students are welcome.

## Research

**RESEARCH THEMES**

Applied molecular microbiology, Microbial flow cytometry, Recombinant protein production, Bacterial responses to stress.

**RESEARCH ACTIVITY**

Research activities are in several broad areas, all focusing on the use of information about the molecular microbiology and physiology of bacteria to develop processes that either utilise them as tools for the production of high-value products or eliminate them from foodstuffs. Stress responses and regulatory events in both types of process are linked, so synergy is achieved in investigating both areas simultaneously. Running through all research areas are the techniques of flow cytometry and molecular biology.

**Engineering biofilms for bioprocesses**

In collaboration with **Dr. Mark Simmons (/staff/profiles/chemical-engineering/simmons-mark.aspx)** (UoB) and **Dr. Rebecca Goss (http://www.uea.ac.uk/che/people/faculty/gossr)** (UEA, Norwich), this major BBSRC-funded project aims to generate and utilise engineered biofilms for biotransformation. Although usually a problem for the process industries, biofilms offer many advantages over planktonic cells. This project is developing tools, from the molecular to the process scale, in order to use biofilms as immobilised catalysts for fine chemical biotransformations.

**Biopolymer production – ISA-PACK**

Research funded by EU FP7 in collaboration with **Mike Jenkins (/staff/profiles/metallurgy/jenkins-mike.aspx)** in Materials and Metallurgy and **Gary Leeke (/staff/profiles/chemical-engineering/leeke-gary.aspx)** as well as other European partners is investigating biopolymer production using fermentation. More details about the aims of the project are available on the **ISA-PACK project website (http://www.isapack.eu)** .

**Recombinant protein production in *E. coli*: improving production and coupling to product capture**

As part of a cross-Europe EU FP7 project, the link between fermentation and product capture using novel magnetic particles (with Professor Owen Thomas ) is being investigated. New fermentation methods are being utilised to optimise feedstreams for biopharmaceutical capture and purification, including the design and development of a biopharmaceutical pilot line.

A BBSRC-funded PhD project focuses on optimising production of difficult recombinant proteins in *E. coli* using stress-minimisation methods. This develops research from a BBSRC/EPSRC BRIC grant.

**Bacterial stress responses to food processing**

Minimally processed foods such as fruit juices represent a particular challenge from a food safety viewpoint. A BBSRC-funded PhD student is investigating bacterial survival in such foodstuffs in order to understand survival mechanisms. This will lead to the ability to design food processing methods to counteract bacterial response mechanisms on a molecular level.

**Microbial flow cytometry techniques**

Flow cytometry is an extremely powerful technique for interrogating single cells within a population, and is used as an integral part of many of the projects above. In addition, collaborative research both within the University of Birmingham (the Schools of Biosciences and Chemical Engineering, the Medical School and the Centre for Systems Biology) and with other Universities seeks to extend the technique to answer research questions in the areas of molecular microbiology, cell biology, bioprocessing and environmental microbiology in both bacteria and yeast. These methods are made possible using the **latest equipment (http://www.genomics.bham.ac.uk/cytometry.htm)** , which was acquired through a BBSRC REI grant in 2007. Dr Overton is interested in developing new collaborations in this area.

## Other activities

- Editorial board member for Biotechnology Letters
- Refereeing for BMC Microbiology, FEMS Microbiology Letters, DNA Sequence, Powder Technology and the MRC and National Science Foundation
- Member of the European Federation of Biotechnology **Microbial Physiology (http://www.efb-central.org/index.php/microbialphysiology/)** Section board
- Co-organiser, Applied Synthetic Biology in Europe conference (February 2012, Barcelona)
- Peer review for FEBS Letters, Biotechnology Letters, BMC Microbiology, BMC Research Notes, FEMS Microbiology Letters, Powder Technology and DNA Sequence.
- Grant application review for BBSRC, MRC and the National Science Foundation

## Publications

**Google scholar: http://scholar.google.co.uk/citations?user=tF_eBKEAAAAJ (http://scholar.google.co.uk/citations?user=tF_eBKEAAAAJ)**

### Selected journal articles


Chaudhari RD, Stenson JD, **Overton TW**, Thomas CR. (2012) Effect of Bud Scars on the Mechanical Properties of *Saccharomyces cerevisiae* Cell Walls. *Chemical Engineering Science* **84**: 188-196

Foulkes, JM, Winn, M, Perni, S, Simmons, MJH, **Overton, TW** & Goss, RJM. (2012) Biofilms and their Engineered Counterparts: a new Generation of Immobilised Biocatalysts. *Catalysis Science and Technology* DOI: 10.1039/C2CY20085F

Vizcaino-Caston, I, Wyre, C and Overton, TW. (2012) Fluorescent proteins in microbial biotechnology – new proteins and new applications. ***Biotechnology Letters* 34: 175-186. (http://www.ncbi.nlm.nih.gov/pubmed/21983972)**

Tsoligkas, AN, Bowen, J, Winn, M, Goss, RJM, **Overton, TW** and Simmons, MJH. (2012) Characterisation of spin coated engineered *Escherichia coli* biofilms using atomic force microscopy. ***Colloids and Surfaces B: Biointerfaces* (http://www.ncbi.nlm.nih.gov/pubmed/21955509)** 89: 152-160.

Whitehead, RN, Kemp, CL, **Overton, TW** and Webber, MA. (2011) Exposure of *Salmonella enterica* serovar Typhimurium to high level biocide challenge can select for multidrug resistant mutants in a single step. ***PLoS ONE* 6(7): e22833 doi:10.1371/journal.pone.0022833 (http://www.ncbi.nlm.nih.gov/pubmed/21829527)** .

Tsoligkas, AN, Winn, M, Bowen, J, **Overton, TW**, Simmons, MJH, and Goss, RJM. (2011) Engineering Biofilms for Biocatalysis. ***ChemBioChem 12: 1391-1395* (http://www.ncbi.nlm.nih.gov/pubmed/21608096)** .

Li, Y, Hopper, A, **Overton, T**, Squire, DJ, Cole, J, and Tovell ,N. (2010) Organisation of the electron transfer chain to oxygen in the obligate human pathogen, *Neisseria gonorrhoeae*: roles for cytochromes $c^4$ and $c^5$, but not cytochrome $c^2$, in oxygen reduction. ***Journal of Bacteriology 192: 2395-406 (http://www.ncbi.nlm.nih.gov/pubmed/20154126)*** .

Yanina Sevastsyanovich, Y, Alfasi, S, **Overton, T**, Hall, R, Jones, J, Hewitt, C, and Cole, J. (2009) Exploitation of GFP fusion proteins and stress avoidance as a generic strategy for the production of high-quality recombinant proteins.***FEMS Microbiology Letters* 299 86–94 (http://www.ncbi.nlm.nih.gov/pubmed/19686347)** .

**Overton, TW**, Justino MC, Li Y, Baptista JM, Melo AM, Cole JA, and Saraiva LM. (2008) Widespread distribution in pathogenic bacteria of di-iron proteins that repair oxidative and nitrosative damage to iron-sulfur centers.***Journal of Bacteriology 190 2004-132004-13 (http://www.ncbi.nlm.nih.gov/pubmed/18203837)*** .

**Overton, TW**, Whitehead, R, Li, Y, Griffiths, L and Cole, J. (2008) Sense and nonsense from whole genome microarray data in the analysis of microbial physiology. *Biotechnologia* **80**: 15-30

Filenko, N, Spiro, S, Browning, DF, Squire, D, **Overton, TW**, Cole, J and Constantinidou, C. (2007) The NsrR regulon of *Escherichia coli* K-12 includes genes encoding the hybrid cluster protein and the periplasmic, respiratory nitrite reductase. ***Journal of Bacteriology 189 4410-7. (http://www.ncbi.nlm.nih.gov/pubmed/17449618)***

Whitehead, RN, **Overton, TW,** Snyder LAS, McGowan, S, Smith, H, Cole, JA and Saunders, NJ. (2007) The small FNR regulon of *Neisseria gonorrhoeae*: comparison with the larger *E. coli* FNR regulon and interaction with the NarQ-NarP regulon. ***BMC Genomics 8:35 (http://www.ncbi.nlm.nih.gov/pubmed/17261178)*** .

Nilavongse, A, Brondijk, THC, **Overton, TW**, Richardson, DJ, Leach, E and Cole, JA (2006) The NapF protein of the *Escherichia coli* periplasmic nitrate reductase system: demonstration of a cytoplasmic location and interaction with the catalytic subunit, NapA. ***Microbiology 152 3227-3237 3227-3237 (http://www.ncbi.nlm.nih.gov/pubmed/17074894)*** .

**Overton, TW**, Whitehead, RN, Li, Y, Snyder, LAS, Saunders, NJ, Smith, H and Cole, JA. (2006) Coordinated regulation of the *Neisseria gonorrhoeae truncated denitrification pathway by the nitric oxide-sensitive repressor, NsrR, and nitrite-insensitive NarQ-NarP.* truncated denitrification pathway by the nitric oxide-sensitive repressor, NsrR, and nitrite-insensitive NarQ-NarP. ***Journal of Biological Chemistry 281 33115-33126. (http://www.ncbi.nlm.nih.gov/pubmed/16954205)***

Constantinidou, C, Hobman, JL, Griffiths, L, Patel, MD, Penn, CW, Cole, JA and **Overton, TW.** (2006) A reassessment of the FNR regulon and transcriptomic analysis of the effects of nitrate, nitrite, NarXL and NarQP as *Escherichia coli* K-12 adapts from aerobic to anaerobic growth. ***Journal of Biological Chemistry 281 4802-15. (http://www.ncbi.nlm.nih.gov/pubmed/16377617)***

Turner, SM, **Overton, T**, Moir, JW & Cole, JA (2005). Mutational and biochemical analysis of cytochrome c', a nitric oxide-binding lipoprotein important for adaptation of *Neisseria gonorrhoeae* to oxygen-limited growth. ***Biochemical Journal 388 545-53. (http://www.ncbi.nlm.nih.gov/pubmed/15689189)***

Spreadbury, CL, Pallen, MJ, **Overton, T**, Behr, MA, Mostowy, S, Spiro, S, Busby, SJ & Cole, JA. (2005) Point Mutations in the DNA- and cNMP-Binding Domains of the Homologue of the cAMP Receptor Protein (CRP) in *Mycobacterium bovis* BCG: Implications for the Inactivation of a Global Regulator and Strain Attenuation. ***Microbiology 151 547-446. (http://www.ncbi.nlm.nih.gov/pubmed/15699203)***

Grainger, D, **Overton, T**, Hobman, JL, Constaninidou, C, Tamai, E, Wade, JT, Struhl, K, Reppas, N, Church, G & Busby, SJW (2004). Genomic studies with *Escherichia coli* MelR protein: applications of chromatin immunoprecipitation and microarrays. ***Journal of Bacteriology 186 (20) 6938-43. (http://www.ncbi.nlm.nih.gov/pubmed/15466047)***

### Book Chapters

**Overton, TW**. (2012) Flow cytometry of Yeasts and Fungi. In Wilkinson, M (ed.) Microbial Flow Cytometry. Caister Academic Press, UK.

Clark, VL Isabella, VM, Barth, K and **Overton, TW**. (2010) Regulation and Function of the Neisserial Denitrification Pathway: Life with Limited Oxygen. In Genco, C and Wetzler, L (eds.) Neisseria: Molecular Mechanisms of Pathogenesis. Caister Academic Press, UK.

## Expertise

Industrial microbiology, bioprocessing and biochemical engineering; recombinant protein production, biofilms and their uses; flow cytometry and FACS.