University of Birmingham

Professor Owen Thomas

Professor of Biochemical Engineering
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About

Career History

- Professor and Director of Biochemical Engineering, School of Chemical Engineering, UoB (since April 2004)
- Associate Professor of Biotechnological Separation Processes, Center for Process Biotechnology, Technical University of Denmark, Lyngby, Denmark (Nov 1996 – Mar 2004)
- Visiting Professor, Institüt für Technische Chemie, Forschungszentrum Karlsruhe GmbH, Leopoldshafen, Germany (June 2000 – Sept 2000)
- Founding member and Director of Research and Development, GeneCare ApS, DK-2800 Lyngby, Denmark (Nov 1997 – Apr 1998)
- Senior Research Fellow and Honorary Lecturer, The Advanced Centre for Biochemical Engineering, UCL, London, UK (Oct 1990 – Nov 1996)
- Wellcome/MRC Postdoctoral Research Associate, Department of Biochemistry, University of Cambridge, UK (Jul 1987 – Oct 1990)

Qualifications

- Associate Member of the Institution of Chemical Engineers, Sept 2004
- PhD in Biotechnology, University of Wales, Cardiff, July 1987
- BSc (Hons) in Biochemistry, University of Wales, Cardiff, July 1983

Biography

- Owen Thomas (OT) joined the Department of Chemical Engineering at the University of Birmingham in April 2004, as Director of Biochemical Engineering. Prior to this he was an Associate Professor on the staff of the Center for Microbial Biotechnology at the Technical University of Denmark.

- OT's expertise is in bioseparation technology and bioprocess intensification. He is internationally recognised for innovative work on the development of new and/or improved bioprocess separation and analytical techniques. He is especially well known for his work on primary capture technology, notably for inventing the technique known as High-gradient magnetic fishing (HGMF), and continuing the advancement of this and other magnetic particle based separation techniques for large-scale application in the biopharmaceutical and nutriceutical sectors, and also for his contributions to the advancement of adsorbent design, Expanded Bed Adsorption (EBA) technology, and separation of plasmid DNA.

- Four of OT's inventions have been taken up by industry, notable among these being two for EBA. The patented rotating fluid distribution systems favoured and marketed by the two best-known suppliers of EBA equipment, GE Healthcare and UpFront Chromatography (now DSM), were invented in OT's laboratories.

- OT has published over 70 international peer reviewed journal papers, 3 book chapters, 6 patents and over 160 conference papers. Most of these concern development of new and/or improved bioprocess separation and analytical techniques. Topics studied include: challenging S/L separation problems; flocculation of cell homogenates; protein and nucleic acid precipitation; protein crystallisation; nanodisc extraction technology (SMALPs), adsorptive/chromatographic recovery of antibodies, antibody fragments and other proteins (native and recombinant; soluble, inclusion body and membrane derived); purification and refolding of inclusion body proteins, downstream processing of nanoplex species (pDNA, VLPs), next generation chromatography adsorbents (multilayered, 'smart') and operating systems (travelling cooling zone reactors) and primary capture technology (High-gradient magnetic fishing, continuous magnetic extraction, expanded bed adsorption).

- OT's research funding (£7 M to date) has come from the Danish (STVF, ATV, Novozymes Bioprocess Academy) and UK Research Councils (BRIC-BBSRC, BBSRC, EPSRC), European Framework multi-centre grants (IV, VI, VII, ERA-IB), Foreign government scholarships, Private foundations (Lundbeck, Loewen, Otto Moensted), industrial collaborative partnerships, visiting scientist programmes, and money earned from patents.

Teaching

Undergraduate Chemical Engineering Programme

- 3PF Processing for Formulation (10 credit module, 3rd year Semester 2)

Postgraduate Taught Courses

- Bioseparations 1 & 2 (Intensive 2 week 20 credit core module)
- Biodesign (10 credit optional module)

Postgraduate supervision

Current projects

- Process Analytical Technology informing the manufacture and formulation of biotherapeutic protein products (EngD – EPSRC/Pall Life Sciences)
- New magnetic particle based affinity separation systems (self-funded)
- Multifunctional chromatography materials: New designs and applications (EPRSC CDT in the EPSRC Centre for Innovative Manufacturing in Emergent Macromolecular Therapies)
- New manufacturing technology for *E. coli* expressed recombinant mini-antibodies (with T.W. Overton) (BBSRC/MIBTP)
- Next generation' chromatographic media for biopharmaceuticals manufacturing (EPRSC CDT in the EPSRC Centre for Innovative Manufacturing in Emergent Macromolecular Therapies)
- Development of novel methods for periplasmic release of biotherapeutic products (with T.R. Dafforn) (BBSRC/BRIC)
- Smart adsorptive materials and systems for recovery of high value protein products (EU Framework 7)
- Application of SMA lipid particles for production of hydrophobic proteins (with T.R. Dafforn) (BBSRC/TPS)

PhD opportunities

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Research

RESEARCH ACTIVITY

- Intensification of downstream process sequences for biopharmaceuticals – recombinant proteins, antibodies, plasmid DNA and other nanoparticulates, major histocompatibility complex class I (MHC-I) molecules, 'designer' carbohydrates and novel antibiotics
- Particle 'seeding' methods for separation of shear-sensitive biological solids
- Magnetic particle-based separations in downstream processing
- Re-design and scale-up of expanded bed adsorption chromatography
- Inclusion body processing and protein refolding
- Crystallization of industrial enzymes
- Synthesis of new support designs and nano-bio-structures and their application for separation, solid-phase analysis, synthesis and assembly of macromolecules

Other activities

International Conferences

- Co-organiser and/or scientific committee member and session chair of 23 international conferences (ESBES, ECB WCCE, BPP, SPICA, PREP, ECAB, ACS-BIOT) and 8 international 2 day ESBES-WGDSP workshops since 2000
- Elected Area Coordinator for 243rd Spring Meeting of the American Chemical Society Biotechnology (ACS-BIOT), San Diego, CA, USA, 2012
- Scientific committee member of *ECAB conference series,* since 2011
- Scientific committee member of *PREP conference series,*since 2008
- Scientific committee member of SPICA, 2008
- Scientific committee member of *BPP conference series,* 2005 – 2010
- Co-organiser & scientific committee member of *ESBES & ECB conference series,* since 2000
- Malcolm Lilly Award Committee Member for ESBES-7 and ESBES-8 conferences
- Vice-chairman of ESBES's Working Group on Downstream Processing (WGDSP), Sept 2008 – Oct 2011
- Chairman of ESBES's Working Group on Downstream Processing (WGDSP), Mar 2004 – Sept 2008
- Member of ESBES Board, since March 2004
- Member of the European Society of Biochemical Engineering Science, ESBES, since 1999

Editorial

- Editorial Board Member for *Biotechnology and Bioengineering,* Feb 2003 – Feb 2008
- Editorial Board Member of the *Journal of Chemical Technology and Biotechnology,* since Nov 2007
- Subject Editor for *Food and Bioproducts Processing*, since Feb 2013
- Recipient of IChemE Journals 'Top Reviewer Award 2013'

National level

- Management Team, BBSRC's BioProNet, Mar 2013 – date
- Member of Medicines and Health Products Agency (MHRA) Clinical Trials, Biologicals and Vaccines Expert Advisory Group (CTBVEAG) July 2010 – July 2014
- Organizing committee member, IChemE's Biochemical Engineering Special Interest Group (BESIG) Sept 2010 – dateOrganizing committee member, SCI's Separation Science and Technology Task Group, Aug 2009 – Feb 2015

Examiner

- Current External Examiner for four taught MSc courses:
  - University of Sheffield – 'Biological and Bioprocess Engineering' & 'Biochemical Engineering with Industrial Management'
  - Aston University – 'Health and Disease & 'Molecular Biotechnology'
- External PhD examiner at the University of Cambridge, Brunel University and Technical University of Denmark

Publications

Selected Publications

A more comprehensive list is available on **Google Scholar (http://scholar.google.co.uk/citations?user=6jhhdFoAAAAJ&hl=en)**

- Cao, P. Müller, T.K.H., Ketterer, B., Ewert, S., Theodosiou, E., Thomas, O.R.T. and Franzreb, M. (2015) Integrated system for temperature-controlled fast protein liquid chromatography. II. Optimized adsorbents and 'single column continuous operation' *J. Chromatogr. A*, online 3 June 2015, doi: 10.1016/jchroma.2015.05.039.
- Hsu, C.-C., Thomas, O.R.T. and Overton, T.W. (2015) Periplasmic expression in and release of Fab fragments from *Escherichia coli* using stress minimization. *J. Chem. Technol. Biotechnol.*, online 21 March 2015, doi: 10.1002/jctb.4672.
- Jamshad, M., Grimard, V., Idini, I., Knowles, T.J., Dowle, M.R., Schofield, N. Sridhar, P., Lin, Y-P., Finka, R., Wheatley, M., Thomas, O.R.T., Palmer, R.E., Overduin, M., Govaerts, C., Ruysschaert, J-M., Edler, K.J., Dafforn, T.R. (2015) Structural analysis of a nanoparticle containing a lipid bilayer used for detergent-free extraction of membrane proteins. Nano Research 8(3):774-789; doi: 10.1007/s12274-014-0560-6.
- Fischer, I., Gärtner, Hsu, C-C., Müller, C., Overton, T.W., Thomas, O.R.T., Franzreb, M. (2013) 'Continuous protein purification using functionalized magnetic nanoparticles and aqueous micellar two-phase systems', *J. Chromatogr. A*, 1305: 7-16. DOI: 10.1016/j.chroma.2013.06.011
- Olszewski, P., Willett, T.C., Theodosiou, E., Thomas, O.R.T., Walsh, J. L. (2013) 'In situ modification of chromatography adsorbents using cold atmospheric pressure plasmas', *Appl. Phys. Lett.*, 102: 202104-1 – 20104-5. DOI: 10.1063/1.4807931.
- Müller, T.K.H., Cao, P., Ewert, S., Wohlgemuth, J., Liu, H., Willett, T.C., Theodosiou, E., Thomas, O.R.T., Franzreb, M. 'Integrated system for temperature-controlled FPLC comprising improved copolymer modified beaded agarose adsorbents and a travelling cooling zone reactor (TCZR) arrangement', *J. Chromatogr. A*, 1285: 97 – 109. DOI: 10.1016/j.chroma.2013.02.025.
- Brown, G.N., Müller, C., Theodosiou, E., Franzreb, M., Thomas, O.R.T. (2013) 'Multi-cycle Recovery of Lactoferrin and Lactoperoxidase from Crude Whey using Fimbriated High-Capacity Magnetic Cation Exchangers and a Novel 'Rotor-Stator' High-Gradient Magnetic Separator', Biotechnology and Bioengineering, 110(6): 1714 –1725. DOI: 10.1002/bit.24842.
- Jamshad, M., Lin, Y-P., Knowles, T.J. Parslow, R.A. Harris, C., Wheatley, M., Poyner, D.R., Bill, R.M., Thomas, O.R.T., Overduin, M. and Dafforn, T.R. (2011) 'Surfactant-free purification of membrane proteins with intact native membrane environment', *Biochem. Soc. Trans.,* 39(3): 813-818. DOI: 10.1042/BST0390813.
- Arpanaei, A., Jensen, B.W., Theodosiou, E. Kingshott, P., Hobley, T.J., Thomas, O.R.T. (2010) 'Surface modification of chromatography adsorbents by low temperature low pressure glow discharge plasma', *J. Chromatogr. A*, 1217(44): 6905-6916. DOI: 10.1016/j.chroma.2010.08.069.
- Becker, J.S, Thomas, O.R.T. and Franzreb, M. (2009) 'Protein separation with magnetic adsorbents in micellar aqueous two-phase systems', *Sep. Sci. Technol.,* 65(1): 46-53.
- Arpanaei, A., Heebøll-Nielsen, A., Hubbuch, J.J., Thomas, O.R.T. and Hobley, T.J. (2008) 'Critical evaluation and comparison of fluid distribution systems for industrial scale expanded bed adsorption chromatography column', *J. Chromatogr. A*, 1198-1199: 131-139. DOI: 10.1016/j.chroma.2008.05.44.
- Faber, C., Hobley, T.J.,Mollerup, J., Thomas, O.R.T. and Kaasgaard, S.G. (2008) 'Factors affecting the solubility of *Bacillus halmapalus* a-amylase', *Chem. Eng. Processing*, 47: 1007-117. DOI: 10.1016/j.cep.2007.02.015.
- Faber C., Hobley, T.J., Mollerup, J., Thomas, O.R.T. and Kaasgaard, S.G. (2007) 'Study of the solubility of a modified *Bacillus licheniformis* a-amylase around the isoelectric point', *J. Chem. Eng. Data*, 52: 707-713.
- Ebner, N., Gomes, C.S., Hobley, T.J., Thomas, O.R.T. and Franzreb, M. (2007) 'Filter capacity predictions for the capture of superparamagnetic microparticles by high-gradient magnetic separation (HGMS)' *IEEE Trans. Magnetics*, 43(5): 1941-1949.
- Bak, H., Kyhse-Andersen, J. and Thomas, O.R.T. (2007) 'High-throughput immunoturbidimetric assays for in-process determination of polyclonal antibody concentration and functionality in crude samples', *J. Chromatogr. B,* 848, 142-150.
- Bak, H, Thomas, O.R.T. and Abildskov, J. (2007)'Lumped parameter model to predict initial breakthrough profiles from preparative chromatographic capture of polyclonal rabbit antibodies from clarified antiserum', *J. Chromatogr. B,* 848, 131-141.
- Bak, H. and Thomas, O.R.T. (2007) 'Evaluation of commercial chromatographic adsorbents for the direct capture of polyclonal rabbit antibodies from clarified antiserum', *J. Chromatogr. B,* 848, 116-130.
- Franzreb, M., Siemann-Herzberg, M., Hobley, T.J., and Thomas, O.R.T. (2006) 'Product recovery by high-gradient magnetic fishing (HGMF).' In *Process Scale Bioseparations for the Biopharmaceutical Industry*, eds. A.A. Shukla, M.R. Etzel, S. Gadam, Taylor and Francis – CRC press (ISBN: 1574445170, publication date: 12/07/2006).
- Franzreb, M., Siemann-Herzberg, M., Hobley, T.J. and Thomas, O.R.T. (2006) 'Protein purification using magnetic adsorbent particles', *Appl. Microb. Biotechnol.*, 70: 505-516.
- Guillaumie, F., Justesen, S.F.L., Mutenda, K.E., Roepstorff, P., Jensen, K.J. and Thomas, O.R.T. (2006) 'Fractionation, solid-phase immobilization and chemical degradation of long pectin oligogalacturonides. Initial steps towards sequencing of oligosaccharides,' *Carbohydr. Res*., 341(1): 118-129.
- Ferré, H., Ruffet, E., Nielsen, L-L.B, Holst Nissen, M., Hobley, T.J., Thomas, O.R.T. and Buus, S. (2005) 'A novel system for continuous protein refolding and on-line capture by expanded bed adsorption,' *Protein Science*, 14: 2141-2153.
- Meyer, A., Hansen, D.B., Gomes, C.S.G., Hobley, T.J., Thomas, O.R.T. and Franzreb, M. (2005) 'Demonstration of a strategy for product purification by high-gradient magnetic fishing: Recovery of superoxide dismutase from unconditioned whey,' *Biotechnol. Progr.*, 21, 244-254.
- Regenberg, B., Krühne, U., Beyer, M., Pedersen, L.H, Simón, M., Thomas, O.R.T., Nielsen, J. and Ahl, T. (2004) 'Use of laminar flow patterning for miniaturised biochemical assays,' *Lab-on-a-Chip,* 4: 654-657.
- Heebøll-Nielsen, A., Justesen, S.F.L. and Thomas, O.R.T. (2004) 'Fractionation of whey proteins with high-capacity superparamagnetic ion-exchangers,' *J. Biotechnol.*, 113: 247-262.
- Heebøll-Nielsen, A., Justesen, S.F.L. Hobley, T.J. and Thomas, O.R.T. (2004) 'Superparamagnetic cation-exchange adsorbents for bioproduct recovery from crude process liquors by high-gradient magnetic fishing,' *Sep. Sci. Technol.,* 39(12): 2891-2914.
- Heebøll-Nielsen, A., Dalkiær, M., Hubbuch, J.J. and Thomas, O.R.T. (2004) 'Superparamagnetic adsorbents for high-gradient magnetic fishing of lectins out of legume extracts.' *Biotechnol. Bioeng.,* 87(3): 311-323

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