Paul Anthony Dalby, FRSC, AMIChemE

Dept. Biochemical Engineering, University College London, Gower Street, London WC1E 6BT

EDUCATION AND CAREER

- 2016 - present **Deputy Head, Department of Biochemical Engineering (Research)**, UCL.
- 2016 - present **Co-Director** of EPSRC Future Targeted Healthcare Manufacturing Hub, UCL.
- 2013 - present **Professor at University College London,** Dept. Biochemical Engineering
- 2012 - 2022 **Director** of EPSRC Centre for Doctoral Training in Innovative Manufacturing, UCL.
- 2011 - 2016 **Co-Director** of EPSRC Centre for Innovative Manufacturing, UCL.
- 2009 - 2013 **Reader at University College London,** Dept. Biochemical Engineering
- 2007 - 2009 **Senior Lecturer at University College London,** Dept. Biochemical Engineering
- 2000 - 2007 **Lecturer at University College London,** Dept. Biochemical Engineering
- 1998 - 2000 **Postdoctoral fellowship at University of Pennsylvania,** School of Medicine
  Protein design and evolution with Prof. W. F. DeGrado (member of the National Academy)
  Projects: *Development of novel binding proteins*
  In vitro evolution of new catalytic function
  Collaboration with Ronald H. Hoess (Dupont)
  Carried out phage display, protein engineering, purification, formulation and characterisation by CD, fluorescence, enzymology, computer modeling and bioinformatics
- 1994 - 1998 **Ph.D. Cambridge University,** MRC Centre for Protein Engineering
  Protein folding and engineering with Prof. Sir A. R. Fersht, FRS
  Projects: *Folding pathway of Barnase*
  My work involved molecular biology, PCR, mutagenesis, expression and purification, organic synthesis, circular-dichroism, fluorescence and UV-Visible spectroscopy, calorimetry, stopped-flow kinetics, temperature-jump, pulsed quench-flow and NMR.
- 1991 - 1994 **B.A. (Hons)/ M.A. Natural Sciences (First class)**
  Gonville & Caius College, Cambridge University
  Studied Chemistry, Biochemistry, Physics, and Mathematics
  Project: *Synthesis of short antimicrobial peptides* (organic chemistry)

AWARDS

- 2010 **IChemE Innovation and Excellence Award in Bioprocessing** (for the BiCE team)
- 2010 **Royal Society of Chemistry Rita and John Cornforth Award** (for the BiCE team)
- 2008-2010 **Evonik European Science-to-Business Award for Industrial Biotechnology**
- 2001 **Second prize for young researcher at SCI: London's Chemistry meeting**
- 1994-1997 **Gonville & Caius College Dunlop Scholarship**
- 1993-1994 **Gonville & Caius College Senior Scholarship**
- 1993 **James Arthur Ramsay Prize in Chemistry & Biology**

PROFESSIONAL AFFILIATIONS

- 2022- **Scientific Advisory Board for UMabs, USA/China**.
- 2020- **EPSRC Strategic Advisory Team for Manufacturing the Future**.
- 2020- **EPSRC Healthcare Council-SAN-SAT Working Group**.
- 2020- **Scientific Advisory Board for Leukocare, Germany**.
- 2020- **Co-Founder of Roxijen Ltd**.
- 2018 **UKRI FLF Peer Review College Member**
- 2017- 2020 **External examiner** MSc Biological Engineering, University of Sheffield
- 2016- **EPSRC College member**
- 2015- **Elected Management Board Member** of BBSRC BioProNet
- 2015- **Editorial Board Member** of Scientific Reports (a Nature Journal)

- 2014-2016   **Panel Member** of the Innovate UK IB Catalyst.
- 2013-   **Fellow of the Royal Society of Chemistry** (Member since 2005)
- 2013- 2016   Steering Group Member of the BBSRC Bioprocess Research Industry Club (BRIC)
- 2011- 2014   **Editor-in-Chief** of 'Current Biotechnology', since its launch (issue 1: Feb 2012)
- 2010- 2014   **Editor-in-Chief** of the 'Open Biotechnology Journal' (Editorial board member since 2007)
- 2011- 2014   BBSRC Research Grant Panel Committee D as core member
- 2010- 2011   BBSRC Research Grant Panel Committee C as pool member
- 2008-   **Chair** Royal Society of Chemistry - Biotechnology Group (Member since 2003)
- 2011- 2013   Editorial Board Member of 'Enzyme Engineering'
- 2006- 2008   Editorial Advisory Board for 'Recent Patents in Biotechnology'
- 2006- 2013   Member of the Protein Society
- 2003-   Associate Member of the Institute of Chemical Engineers
- 2001- 2005   Member of the American Chemical Society

FACULTY, UCL, MULTI-INSTITUTIONAL ROLES
- 2017 - 2021   Faculty REF Impact lead
- 2017 - 2021   Dept Biochemical Engineering REF lead
- 2016 -   Chair of the UCL SLMS Technology Innovation Network for Biologics
- 2016 -   Member of Faculty of Engineering Sciences Research Directors Committee
- 2015 - 2022   Member of UCL CDT Directors Committee
- 2012 - 2022   Director of EPSRC Multi-Institutional Centre for Doctoral Training
- 2008 -   Genetic Modification Safety Committee
- 2016 - 2017   Member of Faculty of Engineering Sciences Research Degrees Committee
- 2012 - 2014   Chair of BBSRC Multi-Institutional Doctoral Training Programme Recruitment Panel
- 2012 - 2014   BBSRC Multi-Institutional Doctoral Training Programme Management Board
- 2005 - 2008   Engineering Faculty Undergraduate Degree Committee

TEACHING ROLES
- 2017 -   **Course coordinator** MBI® in Antibody Targeted Therapy
- 2016 -   **Course coordinator** (Yr3), BENG0031. Chemistry for Biochemical Engineers
- 2014 -   BENG101P. Lectures (formulation, vaccines) Introduction to Biochemical Engineering
- 2013 -   **Course coordinator** (Yr2), BENG0013. Biochemistry for Biochemical Engineers
- 2007 -   MBI® in Design of Experiments for Bioprocess Optimisation. Case study lecture.
- 2000 -   G004/M002 Advanced Bioreactor Engineering - Lectures (MSc & Yr4)
- 2000 -   Research project supervision (Yr4, MSc, MRes & Biotechnology BSc)
- 2012 - 2018   BBSRC LIDO Doctoral Training Programme. Lecture- Biological design and engineering.
- 2003 - 2017   **Course coordinator** (Yr 4), BENGM005/6, 3010 Undergraduate research projects
- 2005 - 2017   **Course coordinator** and lecturer, MBI® in biocatalysis
- 2001 - 2014   BENG2006 Biocatalyst design lectures (Yr3 Biotechnology)
- 2005 - 2014   **Course coordinator** (Yr1), BENG1001 Introduction to Biochemical Engineering
- 2000 - 2013   G17 & BIOC2007 Biochemistry for Biochemical Engineers - Workshops (MSc & Yr2)
- 2006 - 2009   BIOC2008 Biochemistry for Biochemical Engineers - Workshops (Yr3)
- 2003 - 2008   BIOC1001 Biochemistry for Engineers - Industrial biocatalysis lectures (Yr1)
- 2000 - 2008   PhD/EngD training day coordinator
- 2002 - 2004   E129/E105/G23 - Affinity Chromatography for undergraduate and MSc
- 2001 - 2005   Biochemical Engineering in the 21st Century - **Coordinator** (Yr1)
- 2000 - 2005   MBI® in biocatalysis - Enzyme design lecture

TUTORING ROLES AT DEPT BIOCHEMICAL ENGINEERING, UCL
- 2016 -   **Chair of Departmental Research Committee**
- 2016 -   **Member of Departmental Finance Committee**

- 2010 - 2012   **Mentor to Darren Nesbeth, a new probationary lecturer in the Department**
- 2007 - 2009   **Mentor to Martina Micheletti, a new probationary lecturer in the Department**
- 2005 - 2014   **Chair of undergraduate departmental staff student consultative committee**
- 2005 - 2008   **Crook (UG) and Beaker (PG) Society Liaison**
- 2005 - 2008   **Departmental Tutor to Undergraduates**
- 2000 - 2007   **Tutor to 1st year undergraduates**
  Organised BE in 21st century seminars to help students see broader picture.
  Incorporated BE in 21st century seminars into E100 course to make examinable.
- 2000 - 2005   **Undergraduate Admissions tutor**
  Developed recruiting strategies, including Video/CD, mailshot via UCAS
  Increased total number of applications from 80 to 160 per year
- 2003 - 2005   **Convenor of undergraduate departmental staff student consultative committee**
- 2002 - 2005   **Undergraduate recruitment coordinator**

PUBLICATIONS: H-index 30 (WoK), 35 (Google Scholar)

Published (114) including 4 book chapters, and one book

1. Zhang C, Berg A, Joe CCD, Dalby PA, Douglas AD (2023) Lyophilization to enable distribution of simian adenovirus-vectored vaccines without refrigeration. *Nature Vaccines.* in press.

2. Zhang, H., Dalby, P.A. (2022) Stability convergence in antibody coformulations. *Molecular Pharmaceutics* 19 (11) 4098-4110.

3. Lee, W., Pradhan, S., Zhang, C., Venanzi, N., Li, W., Goldrick, S., Dalby, P.A. (2022) Directed evolution for soluble and active periplasmic expression of bovine enterokinase in Escherichia coli. *Scientific Reports*

4. Lee, W., Pradhan, S., Zhang, C., Venanzi, N., Li, W., Goldrick, S., Dalby, P.A. (2022) Directed evolution for soluble and active periplasmic expression of bovine enterokinase in Escherichia coli. *Research Square* (pre-print): doi.org/10.21203/rs.3.rs-1522473/v1

5. Xiaochen Lyu, Qichao Zhao, Julia Hui, Tiffany Wang, Mengyi Lin, Keying Wang, Jialing Zhang, Jiaqian Shentu, Paul A Dalby, Hongyu Zhang, Bo Liu (2022). The Global Landscape of Approved Antibody Therapies. *Antibody Therapeutics* 5(4) 233-257.

6. Li Y, Dalby PA (2022) Engineering of enzymes using non-natural amino acids. *Bioscience Reports* 42(8) BSR20220168.

7. Kellerman MAW, Almeida T, Rudd TR, Matejtschuk P, Dalby PA (2022) NMR Reveals Functionally Relevant Thermally-induced Structural Changes within the Native Ensemble of G-CSF. *Molecular Pharmaceutics* 19(9) 3242-3255.

8. Lalaurie CJ, Splevins A, Barata TS, Bunting KA, Higazi DR, Zloh M, Spiteri VA, Perkins SJ, Dalby PA (2022) Elucidation of critical pH-dependent structural changes in Botulinum Neurotoxin E. *Journal of Structural Biology* 214(3) 107876.

9. Yu HR, Ma S, Li YW, Dalby PA (2022) Hotspots making directed evolution easier. *Biotechnol. Adv.* 56, 107926.

10. Wood VE, Groves K, Wong LM, Kong L, Bird C, Wadhwa M, Quaglia M, Matejtschuk P, Dalby PA (2022) Protein engineering and HDX identifies structural regions of G-CSF critical to its stability and

11. Phattaraporn Morris, Ribia García-Arrazola, Leonardo Rios-Solis, Paul A. Dalby. (2021) Biophysical characterization of the inactivation of E. coli transketolase by aqueous co-solvents. *Scientific Reports.* 11(1), 23584.

12. Vaud, S, Pearcy, N, Hanzevacki, M, Van Hagen, AMW, Abdelrazig, S, Safo, L, Ehsaan, M, Jonczyk, M, Millat, T, Craig, S, Spence, E, Fothergill, J, Bommareddy, RR, Colin, PY, Twycross, J, Dalby, PA, Minton, NP, Jager, CM, Kim, DH, Yu, JP, Maness, PC, Lynch, S, Eckert, CA, Conradie, A (Conradie, Alex) 2 Bryan, SJ (Bryan, Samantha J (2021) Engineering improved ethylene production: Leveraging systems biology and adaptive laboratory evolution. *Metabolic Engineering.* 67, 308-320.

13. Groves, Kate; Ashcroft, Alison; Cryar, Adam; Sula, Altin; Wallace, Bonnie Ann; Stocks, Bradley; Burns, Christopher; Cooper-Shepherd, Dale; De Lorenzi, Ersilia; Rodriguez, Elizabeth ; Zhang, Hongyu; Ault, James; Ferguson, Jackie; Phillips, Jonathan; Pacholarz, Kamila; Thalassinos, Konstantinos; Luckau, Luise; Ashton, Lorna; Durrant, Oliver; Barran, Perdita; Dalby, Paul; Vicedo, Pau; Colombo, Raffaella; Davis, Rachel; Parakra, Rinky; Upton, Rosie; Hill, Sarah; Wood, Victoria; Soloviev, Zoja; Quaglia, Milena (2021) A reference protocol to assess analytical performance of higher order structural analysis measurements: results from an inter-laboratory comparison. *Analytical Chem.* 93 (26), 9041-9048. doi.org/10.1021/acs.analchem.0c04625

14. Zhang H, Yang Y, Zhang C, Farid SS, Dalby PA (2021) Machine learning reveals hidden stability code in protein native fluorescence. *Computational and Structural Biotechnology Journal.* 19, 2750-2760.

15. Cheng Zhang, Nuria Codina, Jiazhi Tang, Haoran Yu, Nesrine Chakroun, Frank Kozielski, Paul A. Dalby. (2021) Comparison of the pH- and thermally-induced fluctuations of a therapeutic antibody Fab fragment by molecular dynamics simulation. *Computational and Structural Biotechnology Journal.* 19, 2726-2741.

16. Spiteri V, Doutch J, Rambo RP, Gor J, Dalby PA, Perkins SJ (2021) Solution structure of deglycosylated human IgG1 shows the role of C_H2 glycans in its conformation. *Biophysical Journal* 200, 1814-1834. doi.org/10.1016/j.bpj.2021.02.038

17. Hales JE, Aoudjane S, Aeppli G, Dalby PA (2021). Proof-of-concept analytical instrument for label-free optical deconvolution of protein species in a mixture. *Journal of Chromatography A* 1641, 461968.

18. Colin PY, Dalby PA (2020) Functional and computational identification of a rescue mutation near the active site of an mRNA methyltransferase**. *Scientific Reports* 10, (1) 21841

19. Zhang H, Dalby PA (2020) Stability enhancement in a mAB:Fab protein coformulation. *Scientific Reports* 10, 1-11. Doi.org/10.1038/s41598-020-77989-w

20. Wood VE, Groves K, Cryar A, Quaglia M, Matejtschuk P, Dalby PA (2020) HDX and in-silico docking reveal that excipients stabilise G-CSF via a combination of preferential exclusion and specific hotspot interactions. *Molecular Pharmaceutics* 17 (12) 4637-4651. doi.org/10.1021/acs.molpharmaceut.0c00877

21. Chauhan VM, Zhang H, Dalby PA, Aylott JW (2020) Advancements in the co-formulation of biologic therapeutics. *J Controlled Release* 327, 397-405.

22. Wilkinson HC, Dalby PA (2020) Fine-tuning the activity and stability of an evolved enzyme active-site through non-canonical amino-acids. *FEBS J* 288, 1935-1955. DOI: 10.1111/febs.15560

23. Yu H, Dalby PA (2020) A beginner's guide to molecular dynamics simulations and the identification of cross-correlation networks for enzyme engineering. *Methods Enzymology.* 643, 15-49.

24. Wilkinson HC, Dalby PA (2020) The Two-Species Model of transketolase explains donor substrate-binding, inhibition and heat-activation. *Scientific Reports* 10, 4148.

25. Yu H, Hernandez-Lopez RI, Steadman D, Mendez-Sanchez D, Higson S, Cazares-Korner A, Sheppard TD, Ward JM, Hailes HC, Dalby PA (2020) Engineering transketolase to accept both unnatural donor and acceptor substrates and produce α-hydroxyketones. *Febs J.* 287, 1758-1776. DOI: 10.1111/febs.15108

26. Wilkinson HC, Dalby PA (2019) Novel insights into transketolase activation by cofactor binding identifies two native species subpopulations. *Scientific Reports* 9, 16116.

27. Hales JE, Matmon G, Dalby PA, Ward JM, Aeppli G. (2019) Virus lasers for biological detection. *Nature Communications* 10:3594. DOI: 10.1038/s41467-019-11604-z

28. Nuria Codina, Cheng Zhang, Nesrine Chakroun, and Paul A. Dalby. (2019) Insights into the stability of a therapeutic antibody Fab fragment by molecular dynamics and its stabilization by computational design. *BioArXiv.*

29. Nuria Codina, David Hilton, Cheng Zhang, Nesrine Chakroun, Shahina S Ahmad, Stephen J Perkins, Paul A Dalby. (2019) An expanded conformation of an antibody Fab region by X-ray scattering, molecular dynamics and smFRET identifies an aggregation mechanism. *Journal of Molecular Biology* 431(7):1409-1425. doi: 10.1016/j.jmb.2019.02.009

30. Mathew J. Robinson, Paul Matejtschuk, Colin Longstaff, Paul A. Dalby. (2019) Selective stabilisation and destabilisation of protein domains in tissue-type plasminogen activator using formulation excipients. *Molecular Pharmaceutics.* 16(2): 744-755. DOI: 10.1021/acs.molpharmaceut.8b01024

31. Yu, H, Dalby, PA. (2018) Exploiting correlated molecular-dynamics networks to counteract enzyme activity-stability trade-off. *Proc. Natl. Acad. Sci. USA* 115 (52) E12192-E12200.

32. Yu, H, Dalby, PA. (2018) Coupled molecular dynamics mediate long and short-range epistasis between mutations that affect stability and aggregation kinetics. *Proc. Natl. Acad. Sci. USA* 115 (47) E11043-E11052.

33. Pandya A, Howard MJ, Zloh M, Dalby PA. (2018) An evaluation of the potential of NMR spectroscopy and computational modelling methods to inform biopharmaceutical formulations. *Pharmaceutics* 10 (4), 165. DOI: 10.3390/pharmaceutics10040165

34. Zhang C, Samad M, Yu H, Chakroun N, Hilton D, Dalby PA. (2018) Computational-design to reduce conformational flexibility and aggregation rates of an antibody Fab fragment. *Molecular Pharmaceutics.* 15 (8), 3079-3092. DOI: 10.1021/acs.molpharmaceut.8b00186

35. Robinson MJ, Matejtschuk P, Bristow AF, Dalby PA. (2018) T_m-values and unfolded fraction can predict aggregation rates for GCSF variant formulations, but not under predominantly native conditions. *Molecular Pharmaceutics.* 15 (1), 256-267. DOI: 10.1021/acs.molpharmaceut.7b00876

36. Cardenas-Fernandez M, Bawn M, Hamley-Bennett C, Bharat PKV, Subrizi F, Suhaili N, Ward D, Bourdin

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