

## Professor Tim Dafforn PhD

Professor of Biotechnology  
College Director of Knowledge Transfer

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### About



[\(/university/colleges/les/research-gallery/tim-dafforn.aspx\)](/university/colleges/les/research-gallery/tim-dafforn.aspx) Professor Tim Dafforn has established himself as an expert in biophysical spectroscopy with a keen interest in synthetic biology. Professor Dafforn has developed a number of projects from inception through to commercial realization and is currently the director of knowledge transfer for the college of Life and Environmental Sciences at the University of Birmingham.

### Qualifications

BSc (Hons) Biochemistry(Cardiff University)

PhD ProteinEngineering (Bristol University)

### Biography

I began my science career studying protein engineering under Professor J. John Holbrook at the Bristol University. During these studies I developing 2 approaches to enzyme engineering based on forced evolution and rational design. I moved to a PDRA position in the laboratory of Professor Robin Carrell FRS in the Cambridge Institute of Medical Research. Working with Dr Arthur Lesk I studied the mechanism of action of a class of serine proteinase inhibitors (SERPINS) involved in innate immunity and blood clotting. During this time I defined a mechanistic and structural explanation which underlies a group of diseases known as serpinopathies. In 2003 I was awarded a prestigious MRC Career development fellowship to continue my work on the SERPINS, as part of this I worked with Professor Alison Rodger (Warwick) to establish Linear Dichroism as an important technique for the study of membrane proteins and protein fibres. More recently I have developed three research strands all enabled by linear dichroism. Firstly I have produced insights into the assemblies that underlie bacterial cell division. Secondly I have developed a novel method that trivializes the production of membrane proteins enabling advances in bioprocessing. Finally I have developed a platform bioassay that represents one of the first commercial applications of synthetic biology.

### Teaching

Impact has become a keyword in British science, my teaching aims to embed an impact ethos at the earliest stages of undergraduate and postgraduate training. I believe this can be achieved by first highlighting the wonders of the biological science and then showing how anyone can commercialize science for the common good.

### Research

Over the past 2 billion years life has been evolving to produce the wonderful biological diversity we see today. At the molecular level evolution has produced nano-molecular machines of wonderful complexity. My research is focused upon studying these wonders, understanding how they assemble and harnessing their function for good. Currently my studies have three streams of research:

1. Studying and understanding the complex molecular machinery that underlies bacterial cell division.
2. Developing novel nanoencapsulation methods that allow large scale production of membrane proteins.
3. Building nano-assemblies that can be used in detection systems

The last 2 of these projects have provided 7 patents that are currently the focus of two commercialisation projects.

### Other activities

I take a keen interest in wider aspects of science policy being a member of Senate at the University of Birmingham and a member of Council at the Biochemical Society. When not working I spend time watching my sons play rugby, rebuilding classic cars and sleeping.

### Publications

2014-2007

1. Berwick MR, Lewis DJ, Jones AW, Parslow RA, Dafforn TR, Cooper HJ, Wilkie J, Pikramenou Z, Britton MM, Peacock AF. De Novo Design of Ln(III) Coiled Coils for Imaging Applications. J Am Chem Soc. 2014 Jan 16.
2. Brown I, Dafforn TR, Fryer PJ, Cox PW Kinetic study of the thermal denaturation of a hyperthermostable extracellular  $\alpha$ -amylase from *Pyrococcus furiosus*. Biochim Biophys Acta. 2013 Dec;1834(12):2600-5.
3. Bonander N, Jamshad M, Oberthür D, Clare M, Barwell J, Hu K, Farquhar MJ, Stamatakis Z, Harris HJ, Dierks K, Dafforn TR, Betzel C, McKeating JA, Bill RM Production, purification and characterization of recombinant, full-length human claudin-1. PLoS One. 2013 May 21;8(5):e64517
4. Abdul-Wahab MF, Homma T, Wright M, Olerenshaw D, Dafforn TR, Nagata K, Miller AD.
5. The pH sensitivity of murine heat shock protein 47 (HSP47) binding to collagen is affected by mutations in the breach histidine cluster. J Biol Chem. 2013 Feb

6. Pacheco-Gómez R, Cheng X, Hicks MR, Smith CJ, Roper DI, Addinall S, Rodger A, Dafforn TR.
7. Tetramerization of ZapA is required for FtsZ bundling. *Biochem J.* 2013 Feb 1;449(3):795-802.
8. Hicks, M.R., A. Rodger, Y.P. Lin, N.C. Jones, S.V. Hoffmann, and T.R. Dafforn, Rapid Injection linear dichroism for studying the kinetics of biological processes. **Analytical Chemistry**, 2012. In Press.
9. McNab, G.L., T.R. Dafforn, A. Wood, E. Sapey, and R.A. Stockley, A novel model and molecular therapy for Z alpha-1 antitrypsin deficiency. *Mammalian genome : official journal of the International Mammalian Genome Society*, 2012. 23(3-4): p. 241-9.
10. Pacheco-Gomez, R., J. Kraemer, S. Stokoe, H.J. England, C.W. Penn, E. Stanley, A. Rodger, J. Ward, M.R. Hicks, and T.R. Dafforn, Detection of Pathogenic Bacteria Using a Homogeneous Immunoassay Based on Shear Alignment of Virus Particles and Linear Dichroism. **Analytical Chemistry**, 2012. 84(1): p. 91-97.
11. Turner, D.J., I. Portman, T.R. Dafforn, A. Rodger, D.I. Roper, C.J. Smith, and M.S. Turner, The Mechanics of FtsZ Fibers. **Biophysical Journal**, 2012. 102(4): p. 731-8.
12. Jamshad, M., Y.P. Lin, T.J. Knowles, R.A. Parslow, C. Harris, M. Wheatley, D.R. Poyner, R.M. Bill, O.R.T. Thomas, M. Overduin, and T.R. Dafforn, Surfactant-free purification of membrane proteins with intact native membrane environment. **Biochemical Society Transactions**, 2011. 39: p. 813-818.
13. Kosmoliaptsis, V., T.R. Dafforn, A.N. Chaudhry, D.J. Halsall, J.A. Bradley, and C.J. Taylor, High Resolution Three-Dimensional Modelling of Hla Class I Structure and Surface Electrostatic Potential Reveals the Molecular Basis for Alloantibody Binding Epitopes. **Transplant International**, 2011. 24: p. 89-89.
14. Kosmoliaptsis, V., T.R. Dafforn, A.N. Chaudhry, D.J. Halsall, J.A. Bradley, and C.J. Taylor, High-resolution, three-dimensional modeling of human leukocyte antigen class I structure and surface electrostatic potential reveals the molecular basis for alloantibody binding epitopes. **Human Immunology**, 2011. 72(11): p. 1049-1059.
15. Pacheco-Gomez, R., D.I. Roper, T.R. Dafforn, and A. Rodger, The pH Dependence of Polymerization and Bundling by the Essential Bacterial Cytoskeletal Protein FtsZ. **Plos One**, 2011. 6(6).
16. Bromley, E.H.C., K.J. Channon, P.J.S. King, Z.N. Mahmoud, E.F. Banwell, M.F. Butler, M.P. Crump, T.R. Dafforn, M.R. Hicks, J.D. Hirst, A. Rodger, and D.N. Woolfson, Assembly Pathway of a Designed alpha-Helical Protein Fiber. **Biophysical Journal**, 2010. 98(8): p. 1668-1676.
17. Damianoglou, A., A. Rodger, C. Pridmore, T.R. Dafforn, J.A. Mosely, J.M. Sanderson, and M.R. Hicks, The Synergistic Action of Melittin and Phospholipase A2 with Lipid Membranes: Development of Linear Dichroism for Membrane-Insertion Kinetics. **Protein and Peptide Letters**, 2010. 17(11): p. 1351-1362.
18. Kosmoliaptsis, V., A.N. Chaudhry, L.D. Sharples, D.J. Halsall, T.R. Dafforn, J.A. Bradley, and C.J. Taylor, Structural and Physicochemical Computer Modelling of HLA Class II Predicts the Occurrence and Magnitude of Humoral Immune Responses to Alloantigen. **American Journal of Transplantation**, 2010. 10: p. 45-45.
19. Mardakheh, F.K., G. Auciello, T.R. Dafforn, J.Z. Rappoport, and J.K. Heath, Nbr1 Is a Novel Inhibitor of Ligand-Mediated Receptor Tyrosine Kinase Degradation. **Molecular and Cellular Biology**, 2010. 30(24): p. 5672-5685.
20. Marshall, K.E., M.R. Hicks, T.L. Williams, S.V. Hoffmann, A. Rodger, T.R. Dafforn, and L.C. Serpell, Characterizing the Assembly of the Sup35 Yeast Prion Fragment, GNNQQNY: Structural Changes Accompany a Fiber-to-Crystal Switch. **Biophysical Journal**, 2010. 98(2): p. 330-338.
21. Soufi, A., A. Sawasdichai, A. Shukla, P. Noy, T. Dafforn, C. Smith, P.S. Jayaraman, and K. Gaston, DNA compaction by the higher-order assembly of PRH/Hex homeodomain protein oligomers. **Nucleic Acids Research**, 2010. 38(21): p. 7513-7525.
22. Batt, S.M., L.E.H. Bingle, T.R. Dafforn, and C.M. Thomas, Bacterial Genome Partitioning: N-Terminal Domain of IncC Protein Encoded by Broad-Host-Range Plasmid RK2 Modulates Oligomerisation and DNA Binding. **Journal of Molecular Biology**, 2009. 385(5): p. 1361-1374.
23. Bulheller, B.M., A. Rodger, M.R. Hicks, T.R. Dafforn, L.C. Serpell, K.E. Marshall, E.H.C. Bromley, P.J.S. King, K.J. Channon, D.N. Woolfson, and J.D. Hirst, Flow Linear Dichroism of Some Prototypical Proteins. **Journal of the American Chemical Society**, 2009. 131(37): p. 13305-13314.
24. Cao, X.W., U. Coskun, M. Rossle, S.B. Buschhorn, M. Grzybek, T.R. Dafforn, M. Lenoir, M. Overduin, and K. Simons, Golgi protein FAPP2 tubulates membranes. **Proceedings of the National Academy of Sciences of the United States of America**, 2009. 106(50): p. 21121-21125.
25. Ennaceur, S.M., M.R. Hicks, C.J. Pridmore, T.R. Dafforn, A. Rodger, and J.M. Sanderson, Peptide Adsorption to Lipid Bilayers: Slow Processes Revealed by Linear Dichroism Spectroscopy. **Biophysical Journal**, 2009. 96(4): p. 1399-1407.
26. Hicks, M.R., T.R. Dafforn, A. Damianoglou, P. Wormell, A. Rodger, and S.V. Hoffmann, Synchrotron radiation linear dichroism spectroscopy of the antibiotic peptide gramicidin in lipid membranes. **Analyst**, 2009. 134(8): p. 1623-1628.
27. Kami, K., M. Chidgey, T. Dafforn, and M. Overduin, The Desmoglein-Specific Cytoplasmic Region Is Intrinsically Disordered in Solution and Interacts with Multiple Desmosomal Protein Partners. **Journal of Molecular Biology**, 2009. 386(2): p. 531-543.
28. Knowles, T.J., R. Finka, C. Smith, Y.P. Lin, T. Dafforn, and M. Overduin, Membrane Proteins Solubilized Intact in Lipid Containing Nanoparticles Bounded by Styrene Maleic Acid Copolymer. **Journal of the American Chemical Society**, 2009. 131(22): p. 7484+.
29. Kosmoliaptsis, V., A.N. Chaudhry, L.D. Sharples, D. Halsall, T. Dafforn, J.A. Bradley, and C.J. Taylor, Analysis of HLA Alloantigen Immunogenicity Based on the Physicochemical Properties of Polymorphic Amino Acids Enables Prediction of the Magnitude of Humoral Immune Responses. **American Journal of Transplantation**, 2009. 9: p. 303-303.
30. Kosmoliaptsis, V., A.N. Chaudhry, L.D. Sharples, D.J. Halsall, T.R. Dafforn, J.A. Bradley, and C.J. Taylor, Hla Class-I Alloantigen Immunogenicity Can Be Predicted by Tertiary Structure and Electrostatic Charge Disparity. **Transplant International**, 2009. 22: p. 69-69.
31. Kosmoliaptsis, V., A.N. Chaudhry, L.D. Sharples, D.J. Halsall, T.R. Dafforn, J.A. Bradley, and C.J. Taylor, Predicting HLA Class I Alloantigen Immunogenicity From the Number and Physicochemical Properties of Amino Acid Polymorphisms. **Transplantation**, 2009. 88(6): p. 791-798.
32. Lawson, A.J., E.A. Walker, S.A. White, T.R. Dafforn, P.M. Stewart, and J.P. Ride, Mutations of key hydrophobic surface residues of 11 beta-hydroxysteroid dehydrogenase type 1 increase solubility and monodispersity in a bacterial expression system. **Protein Science**, 2009. 18(7): p. 1552-1563.
33. Nicholls, S., K.P. Piper, F. Mohammed, T.R. Dafforn, S. Tenzer, M. Salim, P. Mahendra, C. Craddock, P. van Endert, H. Schild, M. Cobbold, V.H. Engelhard, P.A.H. Moss, and B.E. Willcox, Secondary anchor polymorphism in the HA-1 minor histocompatibility antigen critically affects MHC stability and TCR recognition. **Proceedings of the National Academy of Sciences of the United States of America**, 2009. 106(10): p. 3889-3894.
34. Conner, M., M.R. Hicks, T. Dafforn, T.J. Knowles, C. Ludwig, S. Staddon, M. Overduin, U.L. Guenther, J. Thome, M. Wheatley, D.R. Poyner, and A.C. Conner, Functional and biophysical analysis of the C-terminus of the CGRP-receptor; A family B GPCR. **Biochemistry**, 2008. 47(32): p. 8434-8444.
35. Dicko, C., M.R. Hicks, T.R. Dafforn, F. Vollrath, A. Rodger, and S.V. Hoffmann, Breaking the 200 nm Limit for Routine Flow Linear Dichroism Measurements Using UV Synchrotron Radiation. **Biophysical Journal**, 2008. 95(12): p. 5974-5977.
36. Goodman, R.S., V. Kosmoliaptsis, T.R. Dafforn, J.A. Bradley, and C.J. Taylor, Structural implications of platelet endothelial cell adhesion molecule-1 (PECAM-1) polymorphisms. **International Journal of Immunogenetics**, 2008. 35(6): p. 487-487.
37. Hicks, M.R., A. Damianoglou, A. Rodger, and T.R. Dafforn, Folding and Membrane Insertion of the Pore-Forming Peptide Gramicidin Occur as a Concerted Process. **Journal of Molecular Biology**, 2008. 383(2): p. 358-366.
38. Jamshad, M., S. Rajesh, Z. Stamatakis, J.A. McKeating, T. Dafforn, M. Overduin, and R.M. Bill, Structural characterization of recombinant human CD81 produced in *Pichia pastoris*. **Protein Expression and Purification**, 2008. 57(2): p. 206-216.
39. Kosmoliaptsis, V., A. Chaudhry, D. Halsall, T. Dafforn, J.A. Bradley, and C.J. Taylor, The position and physicochemical properties of amino acid sequence polymorphisms allow prediction of HLA class I alloantigen immunogenicity. **International Journal of Immunogenetics**, 2008. 35(6): p. 486-486.
40. Kosmoliaptsis, V., R.S. Goodman, T.R. Dafforn, J.A. Bradley, and C.J. Taylor, Structural implications of platelet endothelial cell adhesion molecule-1

polymorphisms. **Transplantation**, 2008. 86(3): p. 484-485.

41. McCrudden, M.T.C., T.R. Dafforn, D.F. Houston, P.T. Turkington, and D.J. Timson, Functional domains of the human epididymal protease inhibitor, eppin. **Febs Journal**, 2008. 275(8): p. 1742-1750.
42. Nicholls, S., K.P. Piper, F. Mohammed, T.R. Dafforn, S. Tenzer, M. Salim, P. Mahendra, C. Craddock, P. van Endert, H. Schild, M. Cobbold, V.H. Engelhard, and B.E. Willcox, Immunological targeting of the cancer phosphoproteome. **Immunology**, 2008. 125: p. 51-52.
43. Oates, J., M. Hicks, T.R. Dafforn, D. DiMaio, and A.M. Dixon, In vitro dimerization of the bovine papillomavirus E5 protein transmembrane domain. **Biochemistry**, 2008. 47(34): p. 8985-8992.
44. Sullivan, A.L., T. Dafforn, P.S. Hiemstra, and R.A. Stockley, Neutrophil elastase reduces secretion of secretory leukoprotease inhibitor (SLPI) by lung epithelial cells: role of charge of the proteinase-inhibitor complex. **Respiratory Research**, 2008. 9.
45. Bhakta, T., S.J. Whitehead, J.S. Snaith, T.R. Dafforn, J. Wilkie, S. Rajesh, S.A. White, and J.B. Jackson, Structures of the dl(2)dIII(1) complex of proton-translocating transhydrogenase with bound, inactive analogues of NADH and NADPH reveal active site geometries. **Biochemistry**, 2007. 46(11): p. 3304-3318.
46. Brissett, N.C., R.S. Pitcher, R. Juarez, A.J. Picher, A.J. Green, T.R. Dafforn, G.C. Fox, L. Blanco, and A.J. Doherty, Structure of a NHEJ polymerase-mediated DNA synaptic complex. **Science**, 2007. 318(5849): p. 456-459.
47. Dafforn, T.R., So how do you know you have a macromolecular complex? **Acta Crystallographica Section D-Biological Crystallography**, 2007. 63: p. 17-25.
48. Obiozo, U.M., T.H.C. Brondijk, A.J. White, G. van Boxel, T.R. Dafforn, S.A. White, and J.B. Jackson, Substitution of tyrosine 146 in the dl component of proton-translocating transhydrogenase leads to reversible dissociation of the active dimer into inactive monomers. **Journal of Biological Chemistry**, 2007. 282(50): p. 36434-36443.
49. Small, E., R. Marrington, A. Rodger, D.J. Scott, K. Sloan, D. Roper, T.R. Dafforn, and S.G. Addinall, FtsZ polymer-bundling by the Escherichia coli ZapA orthologue, YgfE, involves a conformational change in bound GTP. **Journal of Molecular Biology**, 2007. 369(1): p. 210-221.

