

**PROF. DR. PAUL DALTON**

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**SUMMARY**

- Scopus H-Index: 44; Citations: 6,880 | Google Scholar H-Index: 51; citations: 9,505.
- Invented melt electrowriting as a distinct additive manufacturing (3D printing) technology.
- Unique combination of hands-on experience with 3D printing, experimental surgery, tissue engineering, implant manufacture and nanomaterials.
- Invented a hydrogel tube processing technology - a start-up company (matRegen) resulted.
- Five years within a research team taking an artificial cornea through animal surgeries – small to large – and to clinical trials, including clean room manufacturing experience for human implantation.

**EMPLOYMENT HISTORY**

**Functional Materials in Medicine and Dentistry, University Clinic Würzburg, Germany** **since 2014**

Tenured W2 Professor (*Biofabrication*),

Design of Scaffolds for Biomedical Applications, Melt Electrowriting as a 3D Printing Technology;

Würzburg BIOFAB International Master's Double Degree Coordinator;

**IHBI, Queensland University of Technology, Brisbane, Australia** **2009–2015**

Adjunct Associate Professor – Biofabrication; 3D Printing; Nanomedicine;

**Med-X Research Institute, Shanghai Jiao Tong University, China** **2008–2011**

Adjunct Special Senior Research Scientist – Experimental Spinal Cord Surgery;

**Nanoear Scientific Consortium (Integrated Project), Tampere, Finland** **2009**

Project Manager (*part-time*) – Nanotherapeutics for the Inner Ear;

**University of Southampton, United Kingdom** (*w Hugh Perry*) **2005–2008**

Research Scientist – Neuroimmunology; Experimental Spinal Cord Surgery; Melt Electrospinning;

**Post-doctoral Experience**

**German Wool Research Institute, RWTH Aachen, Germany** (*w Doris Klee/Martin Möller*) **2003–2005**

Nanofibers for Neural Applications; Porous Hydrogels; Melt Electrospinning;

**IBBME, University of Toronto, Canada** (*w Molly Shoichet*) **1999–2002**

Neural Tissue Engineering; Centrifugal Hydrogel Processing of Nerve Guides;

**Other Experience**

**Lions Eye Research Institute, Perth, Western Australia** (*w Traian Chirila*) **1993–1998**

Research Assistant - Clinical Trials of Artificial Cornea; Hydrogel Synthesis and Chemistry; Ocular Biomaterials;

**EDUCATION**

**Doctor of Philosophy (Applied Chemistry)** (*supervisor: Traian Chirila*) **1995–1998**

Thesis Title: Poly(vinyl alcohol) as a Potential Vitreous Substitute

Curtin University of Technology, Perth, Australia (Research performed at Lions Eye Research Institute)

**Bachelor of Applied Chemistry (Honours – 1<sup>st</sup> Class)** **1994**

Curtin University of Technology, Perth, Australia (Research thesis performed at Lions Eye Research Institute)

**Bachelor of Science (Multidisciplinary Science; Materials Science & Applied Chemistry)** **1989–1992**

Curtin University of Technology, Perth, Australia

**PERSONAL DETAILS**

Nationality:	Australian	Date of Birth:	9th February 1971
Place of Birth:	Perth, Australia	Languages:	Native English speaker; Intermediate German; Basic Mandarin;
Marital Status:	Married		

**PERSONAL FELLOWSHIPS**

<b>Alexander Von Humboldt Foundation</b>	Postdoctoral Fellowship, Sep 2003-Apr 2005
<b>International Campaign to Cure Paralysis (ICCP)</b>	Outstanding Young Investigator Award, 2005
<b>Wellcome Trust Foundation</b>	Advanced Training Fellowship, Aug 2006-Jul 2008
<b>Hofvijver Visiting Scientist</b>	University Medical Center Utrecht, Jun-Dec 2016
<b>ICORD Visiting Scientist</b>	Vancouver General Hospital, Vancouver, May-Jun 2020

**CURRENT FUNDING** (969k€ in total)

**Volkswagen Foundation** Coaxial 3D Printing of Actuating Electroactive Scaffolds for Muscle Regeneration. Project # 93 417, 2018-2020, **270k€** out of 663k€ award (lead).

**German Research Foundation** Ultra-Soft Matrix Composites for 3D Neuronal Culture. SFB TRR 225; project # 397987355, 2018-2021, **119k€** out of 539k€ award.

**German Research Foundation** Extending the Biofabrication Window with Segmented Copolymer Biopaper. SFB TRR 225; project # 397978837, 2018-2021, **119k€** out of 238€ award.

**German Research Foundation** Melt Electrospinning Writing of PLGA for Tissue Engineering Applications. DA 1034/4-1, project # 322483321, 2017-2020, **214k€**.

**German Research Foundation** Crosslinking of Melt Electrospun scaffolds for Hydrogel Fabrication. DA 1034/2-1, project # 310771104, 2017-2019, **104€** out of 220k€ award.

**Industrial Funding** 3D Printing Development of a Polymer 2016-2019, **115k€**.

**Industrial Funding** 3D printing of a value-added product 2019-ongoing, **20k€+** ongoing.

**PUBLICATIONS** (110 Published)

1. Kade J, Dalton PD. Polymers for melt electrowriting, *Adv Healthcare Mater* (accepted).
2. Bakirci E, Schaefer N, Dahri O, Hrynevich A, Strissel P, Strick R, Dalton PD, Villmann C. Melt Electrowritten In Vitro Radial Device to Study Cell Growth and Migration. *Adv Biosyst* (accepted).
3. Bolle ECL, Nicdao D, Dalton PD, Dargaville TR (2021) Production of Scaffolds Using Melt Electrospinning Writing and Cell Seeding. In: Rainer A., Moroni L. (eds) Computer-Aided Tissue Engineering. *Methods in Molecular Biology*, vol 2147. Humana, New York, NY.
4. Liashenko I, Hrynevich A, Dalton PD (2020) Designing outside the box: Unlocking the geometric freedom of melt electrowriting using microscale layer shifting. *Adv Mater*, 32, 2001874.
5. Dalton PD, Woodfield TBF, Mironov V, Groll J (2020). Advances in hybrid fabrication towards hierarchical tissue constructs. *Adv Sci*, 7, 1902953.
6. Janzen D, Bakirci E, Weiland A, Martin C, Dalton PD, Villmann C (2020) Cortical neurons form a functional neuronal network in a 3D printed reinforced matrix. *Adv Healthcare Mater*, 9, 1901630.
7. Tylek T, Blum C, Hrynevich A, Schlegelmilch K, Schilling T, Dalton PD, Groll J. (2020) Precisely defined fiber scaffolds with 40 µm porosity induce elongation driven M2-like polarization of human macrophages. *Biofabrication*, 12, 025007.
8. Nahm D, Weigl F, Schaefer N, Sancho A, Frank A, Groll J, Villmann C, Schmidt H-W, Dalton PD, Luxenhofer R. (2020) A versatile biomaterial ink platform for the melt electrowriting of chemically-crosslinked hydrogels. *Mater Horiz*, 7, 928-933.

9. Blum C, Schlegelmilch K, Schilling T, Shridhar A, Rudert M, Jakob F, **Dalton PD**, Blunk T, Flynn LE, Groll J. (2019) Extracellular matrix-modified fiber scaffolds as a pro-adipogenic mesenchymal stromal cell delivery platform. *ACS Biomater Sci Eng*, **5**, 6655-6666.
10. Youssef A, Hrynevich A, Fladeland L, Balles A, Groll J, **Dalton PD**, Zabler S. The Impact of Melt Electrowritten Scaffold Design on Porosity Determined by X-ray Micro-tomography. *Tissue Eng Part C*, **25**, 367–378.
11. Robinson TM, Hutmacher DW, **Dalton PD**. (2019) The Next Frontier in Melt Electrospinning: Taming the Jet. *Adv Funct Mater*, **29**, 1904664.
12. Bertlein S, Hochleitner G, Schmitz M, Teßmar J, Raghunath M, **Dalton PD**, Groll J. (2019) Permanent hydrophilization and generic bioactivation of melt electrowritten scaffolds. *Adv Healthcare Mater*, **8**, 1801544.
13. Kotz F, Risch P, Arnold K, Sevim S, Luis JP, Quick A, Thiel M, Hrynevich A, **Dalton PD**, Helmer D, Rapp BE (2019) Sacrificial Template Replication: Fabrication of arbitrary three-dimensional suspended hollow microstructures in transparent fused silica glass. *Nat Comm*, **10**, 1439.
14. McMaster R, Höfner C, Hrynevich A, Blum C, Wiesner M, Wittmann K, Dargaville TR, Bauer-Kreisel P, Groll J, **Dalton PD**, Blunk T. Tailored Melt Electrowritten Scaffolds for Multicellular Spheroid Culture. *Adv Healthcare Mater*, **8**, 1801326.
15. Schäfer N, Jansen D, Bakirci E, Hrynevich A, **Dalton PD**, Villmann CV (2019) 3D electrophysiological measurements on cells embedded within fiber-reinforced Matrigel. *Adv Healthcare Mater*, **8**, 1801226.
16. Wunner FM, Bas O, Eggert S, Mieszczanek P, Maartens J, **Dalton PD**, Pardo EM, Hutmacher DW (2019) Printomics: The high-throughput parametric analysis of printing conditions applied to melt electrowritten medical grade poly( $\epsilon$ -caprolactone). *Biofabrication*, **11**, 025004.
17. Florczak S, Lorson T, Zheng T, Mrlik M, Hutmacher DW, Higgins M, Luxenhofer R, **Dalton PD** (2019) Melt electrowriting of electroactive poly(vinylidene difluoride). *Polym Int*, **68**, 735–745.
18. Fuchs A, Youssef A, Seher A, Hochleitner G, **Dalton PD**, Hartmann S, Brands R, Müller-Richter U, Linz C (2019) Medical-grade polycaprolactone scaffolds made by melt electrospinning writing for oral bone regeneration – a pilot study in vitro. *BMC Oral Health*, **19**, 28.
19. Wunner FM, Eggert S, Maartens J, Bas O, **Dalton PD**, Pardo EM, Hutmacher DW (2019) Design and Development of a 3D Printing High-Throughput Melt Electrospinning Writing Technology Platform. *3D Print Addit Manuf*, **6**, 82-90.
20. McColl E, Groll J, Jungst T, **Dalton PD** (2018) Design and fabrication of melt electrowritten tubes using intuitive software. *Materials and Design*, **155**, 46-58.
21. Hochleitner G, Chen F, Blum C, **Dalton PD**, Amsden B, Groll J. (2018) Melt electrowriting below the critical translation speed to fabricate crimped elastomer scaffolds with non-linear extension behaviour mimicking that of ligaments and tendons. *Acta Biomater*, **72**, 110-120.
22. Hrynevich A, Şen Elçi B, Haigh JN, McMaster R, Youssef A, Blum C, Blunk T, Hochleitner G, Groll J, **Dalton PD** (2018) Dimension-based design of melt electrowritten scaffolds. *Small*, **14**, 1800232.
23. Petcu E, Midha R, McColl E, Popa-Wagner A, Chirila TV, **Dalton PD**. (2018) 3D printing strategies for peripheral nerve regeneration. *Biofabrication*, **10**, 032001.
24. Wunner FM, Wille M-L, Noonan TG, Bas O, **Dalton PD**, Pardo EM, Hutmacher DW (2018) Melt electrospinning writing of highly ordered, large volume, scaffold architectures. *Adv Mater*, 1706570.
25. Hochleitner G, Fürsattel E, Giesa R, Groll J, Schmidt H-S, **Dalton PD** (2018) Melt electrowriting of thermoplastic elastomers. *Macromol Rapid Comm*, **39**, 1800055.
26. Castilho M, Hochleitner G, Wilson W, van Rietbergen B, **Dalton PD**, Groll J, Malda J, Ito K (2018) Mechanical behavior of a soft hydrogel reinforced with three-dimensional printed microfibre scaffolds. *Sci Rep*, **8**, 1245.
27. de Ruijter M, Hrynevich A, Haigh JN, Hochleitner G, Castilho M, Groll J, Malda J, **Dalton PD** (2018) Out-of-plane 3D-Printed Microfibers Improve the Shear Properties of Hydrogel Composites. *Small*, **14**, 1702773.
28. Wang S, **Dalton PD**, Dargaville TR (2018) Spatial Patterning of Hydrogels via 3D Covalent Transfer Stamping from a Fugitive Ink. *Macromol Rapid Comm*, **39**, 1700564.

29. Wunner FM, Onur B, Saidy, NT, **Dalton PD**, Pardo EM, Hutmacher DW (2017) Melt Electrospinning Writing of Three-dimensional Poly( $\epsilon$ -caprolactone) Scaffolds with Controllable Morphologies for Tissue Engineering Applications. *J Vis Exp*, **130**, e56289.
30. **Dalton PD** (2017) Melt Electrowriting with Additive Manufacturing Principles. *Curr Opin Biomed Eng*, **2**, 49–57.
31. Lühmann TC., Meinel L, Groll J, **Dalton PD** (2017) Electrospun Fibers for Drug Delivery. In: *Comprehensive Biomaterials II*. Ducheyne P, Grainger DW, Healy KE, Hutmacher DW, and Kirkpatrick, C.J. (Eds), Oxford: Elsevier. Vol. 4, 527–548.
32. Haigh JN, Dargaville TD, **Dalton PD**. (2017) Additive Manufacturing with Polypropylene Microfibers. *Mat Sci Eng C*, **77**, 883–887.
33. Muerza-Cascante ML, Shokoomand A, Khosrotehrani K, Haylock D, **Dalton PD**, Hutmacher DW, Lössner D. (2017) Endosteal-like extracellular matrix expression on melt electrospun written scaffolds, *Acta Biomater*, **52**, 145-158.
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35. Youssef A, Hollister S, **Dalton PD**. (2017) Additive manufacturing of polymer melts for implantable devices and scaffolds. *Biofabrication*, **9**, 012002.
36. Hochleitner G, Youssef A, Hrynevich A, Haigh J, Jüngst T, Groll J, **Dalton PD** (2016) Fibre Pulsing During Melt Electrospinning Writing. *Bionanomaterials*, **17**, 159–171.
37. Brown TD, **Dalton PD**, Hutmacher DW (2016) Melt Electrospinning Today- An Opportune Time for an Emerging Polymer Process. *Prog Polym Sci*, **56**, 116–166.
38. Weigand A, Boos AM, Tasbihi K, Beier JP, **Dalton PD**, Schrauder M, Horch RE, Beckmann MW, Strissel PL, Strick R. (2016) Selective isolation and characterization of primary cells from control breast and tumors reveal plasticity of adipose derived stem cells. *Breast Cancer Res Treat*, **18**:32.
39. Chen F; Hochleitner G, Woodfield T, Groll J, **Dalton PD**, Amsden B (2016) Additive Manufacturing of a Photo-Cross-Linkable Polymer via Direct Melt Electrospinning Writing for Producing High Strength Structures. *Biomacromolecules*, **17**, 208–214.
40. Groll J, Boland T, Burdick J, Blunk T, Choo D-W, **Dalton PD**, Derby B, Forgacs G, Li Q, Mironov VA, Moroni L, Nakamura M, Shu W, Takeuchi S, Vozzi G, Woodfield TBF, Xu T, Yoo JJ, Malda J (2016) Biofabrication: Reappraising the definition in an evolving field. *Biofabrication*, **8**, 013001.
41. Haigh JN, Chuang Y-M, Farrugia B, Hoogenboom R, **Dalton PD**, Dargaville TR. (2016) Hierarchically Structured Porous Poly(2-oxazoline) Hydrogels. *Macromol Rapid Comm*, **37**, 93–99.
42. Führmann T, Mousumi G, Otero A, Goss B, Dargaville TR, Pearse DD, **Dalton PD**. (2015) Peptide-functionalized polymeric nanoparticles for active targeting of damaged tissue in animals with experimental autoimmune encephalomyelitis. *Neurosci Lett*, **602**, 126–132.
43. Hochleitner G, Jüngst T, Brown TD, Hahn K, Moseke C, **Dalton PD**, Groll J (2015) Additive Manufacturing with Sub-Micron Melt Electrospun Filaments. *Biofabrication*. **7**, 035002.
44. Jüngst T, Muerza-Cascante ML, Brown TD, Standfest M, Hutmacher DW, Groll J, **Dalton PD**. (2015) Melt Electrospinning onto Cylinders: Effects of Rotational Velocity and Collector Diameter on the Morphology of Tubular Structures. *Polym Int*, **64**, 1086–1095.
45. Visser J, Melchels FPW, Jeon JE, van Bussel EM, Kimpton LS, Byrne HM, Dhert WJA, **Dalton PD**, Hutmacher DW, Malda J. (2015) Strengthening hydrogels using three-dimensionally printed microfibers. *Nat Comm*, **6**, 6933.
46. **Dalton PD**, Muerza-Cascante ML, Hutmacher DW. (2015) Tissue Engineering Scaffold Design and Fabrication via Melt Electrospinning. In *Electrospinning: Principles, Practice and Possibilities*. GR Mitchell, RCS Publishing, ISBN: 978-1-84973-556-8, pp 100-120.
47. Muerza-Cascante ML, Haylock D, Hutmacher DW, **Dalton PD**. (2015) Melt Electrospinning and Its Technologization in Tissue Engineering. *Tissue Eng B Rev*. **21**, 187-202.

48. Dalton PD, Harvey AR, Oudega M, Plant GW (2015) Chapter 17: Tissue Engineering of the Nervous System, in *Tissue Engineering*. 2<sup>nd</sup> Edition, De Boer & Van Blitterswijk, Academic Press. ISBN 9780124201453, pp 583-625.
49. Hutmacher DW, Woodfield T, Dalton PD (2015) Chapter 10: Scaffold Design and Fabrication. In *Tissue Engineering*. 2<sup>nd</sup> Edition, De Boer & Van Blitterswijk, Academic Press. ISBN 9780124201453, pp 311-346.
50. Brown TD, Edin F, Detta N, Skelton AD, Hutmacher DW, Dalton PD. (2014) Melt electrospinning of poly( $\epsilon$ -caprolactone) scaffolds: phenomenological observations associated with collection and direct writing. *Mater Sci Eng C*, **45**, 698–708.
51. Thibaudeau L, Taubenberger AV, Holzapfel BM, Quent VM, Führmann T, Hesami P, Brown TD, Dalton PD, Power CA, Hollier B, Hutmacher DW. (2014) A tissue engineered humanized xenograft model of human breast cancer metastasis to bone, *Dis Mod Mech*, **7**, 299–309.
52. Li HY, Führmann T, Zhou Y, Dalton PD. (2013) Host reaction to poly(2-hydroxyethyl methacrylate) scaffolds in a small spinal cord injury model. *J Mat Sci Mater Med*, **24**, 2001-2011.
53. Volpatto F, Führmann T, Migliaresi C, Hutmacher DW, Dalton PD. (2013) Using extracellular matrix for regenerative medicine in the spinal cord. *Biomaterials*, **34**, 4945-55.
54. Farrugia B, Brown TD, Hutmacher DW, Upton Z, Dalton PD, Dargaville TR. (2013) Dermal fibroblast infiltration of poly( $\epsilon$ -caprolactone) scaffolds fabricated by melt electrospinning in a direct writing mode. *Biofabrication*, **5**, 025001.
55. Shulte VA, Alves DF, Dalton PD, Möller M, Lensen MC, Mela P (2013) Microengineered PEG hydrogels: 3D scaffolds for guided cell growth, *Macromol Biosci*, **13**, 562–572.
56. Dalton PD, Vaquette C, Farrugia B, Dargaville TR, Brown TD, Hutmacher DW. (2013) Electrospinning and Additive manufacturing: converging technologies. *Biomater Sci*, **1**, 171.
57. Garland P, Broom LJ, Quraishe S, Dalton PD, Newman TA, Perry VH. (2012) Soluble axoplasm enriched from injured CNS axons reveals the early modulation of the actin cytoskeleton. *PLoS ONE*, **7**, e47552.
58. Brown TD, Vaquette C, Hutmacher DW, Dalton PD (2012) Electrospinning for Regenerative Medicine. In Dumitriu, S. and Popa, V. (Eds.), *Polymeric Biomaterials: Structure and Function*, Vol. 1, pp 539-592. Boca Raton, FL: CRC Press.
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### PATENTS

- 1) WIPO/PCT WO 2018/071967 Tuch B, Dargaville TR, Mridha A, **Dalton PD**, Vaithilingham V. "Cell associated scaffolds for the delivery of agents" 2018.
- 2) European Patent WO 2004/071736 **Dalton PD**, Shoichet MS, Levesque SG, Freier T, Chung W. "Method of producing structures using centrifugal forces." 2004.
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- 4) US Patent 6787090 **Dalton PD** and Shoichet MS. "Method of producing structures using centrifugal forces." 2004.
- 5) European Patent WO/2001/085417 **Dalton PD** and Shoichet MS. "Method of producing structures using centrifugal forces." 2001.

### SELECTED CONFERENCE PRESENTATIONS

(Complete List available on Request)

- **Dalton PD**. Melt electrowriting: Bridging the divide between FDM Printing and Electrospinning. International Society for Biofabrication, Würzburg, Germany, October 2018 (keynote).
- **Dalton PD**. Convergence of melt electrospinning writing with tissue engineering & regenerative medicine. Biopolymer Conference (BiPoCo), Balatonfüred, Hungary, September 2018 (plenary).
- **Dalton PD**. Multimodal and Multiphasic Printing for Biofabrication. BiofabUSA Spring Summit, Manchester, New Hampshire, USA, June 2018 (invited).
- **Dalton PD**. Incorporating Melt Electrowriting into Tissue Engineering and Regenerative Medicine in the 21st Century, Australasian Society for Biomaterials and Tissue Engineering, Perth, Australia, Mar 2018 (keynote).
- **Dalton PD**. Melt Electrospinning Writing as a New Additive Biomanufacturing Technology. World Biomaterials Congress, Montreal, Canada, May 2016 (keynote).
- **Dalton PD**. The New Kid on the Block: Melt Electrospinning Writing as a 3D Printing Technology, 3D Bioprinting Symposium, Dublin, May 2014 (invited)
- **Dalton PD**. 3D Printing using Melt Electrospinning. *Electrospinning, Principles, Possibilities and Practice 2013*, London, UK, December 2013 (invited).
- **Dalton PD**. Three-dimensional Writing of Polymeric Filaments for Tissue Engineering. *EMBC IEEE Meeting*, Osaka, Japan, July 2013 (keynote).
- **Dalton PD**, Klinkhammer K, Schnell E, Mey J, Klee D, Brook G, Möller M. Electrospun nanofiber substrates for neuronal and glial guidance. *Regenerate 2007 – TERMIS North American Meeting*, Toronto, June 2007.
- **Dalton PD**, Hydrogel nerve guides for fully transected spinal cords. British Tissue Engineering Network – Tissue Engineering for Nerve Regeneration. London, June 2006 (co-organizer of meeting w John Priestley).
- **Dalton PD**, Tsai E, Midha R, Shoichet MS, Tator CH: Regenerative Matrices for Neural Tissue Engineering. 2<sup>nd</sup> Neuroglia Meeting, Amsterdam, The Netherlands, May 2005 (invited speaker).

END OF ABBREVIATED CURRICULUM VITAE