

Personal & Contact Information

Full name: Nicholas Jonathan Walters | Date & place of birth: 05/08/1985, London, UK | Nationality: British
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Brief Biography Nick Walters is a Postdoctoral Researcher at University of Tampere. His research focusses on developing modular 3D cell niches for studying the fundamental mechanotransductive processes by which cell-matrix interactions influence stem cell behaviour, in healthy and disease states. Ultimately, these may be used to gain control over stem cell differentiation and tissue formation, for regenerative medicine applications. Nick graduated from University College London in 2016 with a PhD in Biomaterials, following an MSc in Cell & Molecular Biology from Uppsala University. He previously worked as a technician in Prof. Molly Stevens' group at Imperial College London, following a BSc in Biochemistry from The University of Reading. Nick is heavily involved with TERMIS-EU (Tissue Engineering & Regenerative Medicine International Society European Chapter), as Co-Founder and Co-Chair of its Business Plan Competition and Pre-Accelerator Programme, a member of its Industry Committee, one of the key organisers of its 2016 conference and the youngest member of its 2016 & 2017 conference Scientific Advisory Committees. He is also the Scandinavian Society for Biomaterials Outreach Officer and will be the host of its 2019 conference, and the founder and host of a biannual symposium series on mechanotransduction and the cell niche. Nick is currently studying Finnish language full-time in order to gain citizenship, prior to returning to academia in September 2018.

Education

PhD Biomaterials, UCL Eastman Dental Institute, UK	09/2011–04/2016
MSc Cell & Molecular Biology, Uppsala University, Sweden	08/2009–08/2011
BSc (Hons) Biochemistry, University of Reading, UK & Uppsala University, Sweden	09/2003–07/2006

Employment

Postdoctoral Researcher, University of Tampere, Finland; PI: Miettinen S	04/2016–08/2017
Visiting Researcher, Uppsala University, Sweden; PI: Hilborn J	10/2015–11/2015
Researcher, University of Tampere, Finland; PI: Miettinen S	07/2015–01/2016
Project Researcher (80% FTE), Tampere University of Technology, Finland; PI: Kellomäki M	10/2014–06/2015
Tutor (freelance), www.PhDTutors.co.uk	07/2013–11/2014
Laboratory Administrator (20% FTE), Imperial College London, UK; PI: Stevens MM	06/2008–07/2009
Biomaterials Technician, Imperial College London, UK; PI: Stevens MM	11/2007–07/2009

Funding Total funding awarded to date as primary applicant: >€191,000

Research funding (primary applicant)

• Journal of Cell Science & The Company of Biologists Travelling Fellowship	£2,500	2015
• Jane & Aatos Erkko Foundation Personal Scholarship	€180,000	2015–2017

Symposium organisation (primary applicant)

• University of Tampere: Faculty of Medicine & Life Sciences Symposium Sponsorship	€1,500	2017
• Royal Society of Chemistry: Chemistry Biology Interface Division Small Grant for Scientific Activities	£2,000	2015

Conference travel funding (primary applicant)

• Institute of Materials, Minerals & Mining Andrew Carnegie Research Fund	4 x £250	2013–2016
• Royal Society of Chemistry: Chemistry Biology Interface Division Postdoctoral Researcher Travel Grant	£400	2016
• The Worshipful Company of Armourers & Brasiers Gauntlet Trust Travel Grant	£250, £700	2013, 2015
• UCL Eastman Graduate Student Conference Fund	£300	2012

Educational research funding (beneficiary)

• PhD Studentship, Engineering & Physical Sciences Research Council, EP/I022341/1; PI: Young AM	2011–2014
• MSc Research Project Stipend; PI: Larsson S	2011
• BSc Research Project Scholarship, European Union Socrates-Erasmus Programme; PI: Savva D	2005

Academic, Practical & Leadership Skills

Committee positions, institutional responsibilities, commissions of trust & event organisation

Society committees & boards

• TERMIS-EU (Tissue Engineering & Regenerative Medicine International Society European Chapter) Industry Committee Member	09/2016–present
• ScSB (Scandinavian Society for Biomaterials) Outreach Officer	06/2016–present
• TERMIS-EU Business Plan Competition & TERMIS Pre-Accelerator Programme Co-Founder, Co-Chair, Treasurer, Academic Advisor & Committee Member	11/2015–present
• International English Speakers' Association of Finland: Ambassador, Tampere region (social activities)	03/2017–present



Conference committees

- ScSB 2019 Conference Host, Finland, spring/summer 2019 03/2017–06/2019
- TERMIS-EU 2017 Conference Scientific Advisory Committee, Davos, Switzerland, 2017 Jun 26–30 06/2016–06/2017
- TERMIS-EU 2016 Conference Scientific Advisory Committee & Local Organising Committee, Uppsala, Sweden, 2016 Jun 28 – Jul 1: Fund-Raising Chair (€86,000 in 5 months), Poster Session Chair & Students & Young Investigators Section Local Representative 11/2015–07/2016

Symposium organisation and chairpersonship

- Organiser & Co-Chair: “Cell-matrix interactions: innovative 3D hydrogel models for studying and directing stem cell fate”. 2017 Jun 28; TERMIS-EU 2017 Conference, Davos, Switzerland
- Organiser & Host: “Symposium on artificial cell niches for studying mechanotransductive processes”. 2017 Jun 15–16; University of Tampere, Finland.
- Co-Chair: “MSCs in TERM”. 2016 Jun 30; TERMIS-EU 2016 Conference, Uppsala, Sweden
- Organiser & Co-Host: “The use of polymers to study and direct stem cell fate in three-dimensions”. 2015 Oct 29–30; Uppsala University, Sweden

Institutional responsibilities

- MSCA-ITN Grant Application Coordinator. 2015; University of Tampere, Finland
- Postgraduate Student Representative, Athena SWAN Gender Equality Committee. 2012–2014; UCL Eastman Dental Institute, UK

Supervision & mentorship Primary supervision • Paulamäki J, 09/2016–03/2017, MSc thesis, “Modular stem cells niches for studying cell-matrix interactions in three dimensions”, Tampere University of Technology, co-supervisor Oommen OP. • Vento H, 02/2016–07/2017, MSc thesis, “PEG-based degradable hydrogels for studying cellular behaviours”, Tampere University of Technology, co-supervisor Kellomäki M. Co-supervision • Kemppe H, 04–12/2017, MSc thesis, “Gold cross-linked, collagen, gelatin A, gelatin B and fibronectin-containing hyaluronic acid hydrogels for hBMSC tissue engineering applications”, Tampere University of Technology, primary supervisor Oommen OP. Mentorship • Gupta, D, since 07/2016, University of Nottingham. • Chahal AS, since 06/2016, University of Oslo. • Yu TT, since 10/2015, King’s College London. Unofficial supervision • Yu TT, 09/2015–04/2019, PhD thesis, King’s College London, primary supervisor Gentleman E. • Dakkouri L, 03/2013–07/2015, D Dent thesis, University College London, primary supervisor Young AM. • Conti MS, 11/2012–08/2013, MSc thesis, University College London, primary supervisor Evans J.

Peer-review Journals • Acta Biomaterialia (Elsevier B.V.), 2016–present; • Journal of Biomaterials Applications (Sage Publications Inc.), 2013–present; • Journal of Tissue Engineering (Sage Publications Inc.), 2013–present; • Scientific Reports (Nature Publishing Group), 2016–present. Conferences • EMBEC/NBC 2017; • TERMIS-EU 2016 & 2017.

Scientific society membership • Biochemical Society, 2015–present; • BSCB (British Society for Cell Biology), 2015–present; • IET (The Institution of Engineering & Technology), MIET, 2015–present; • IADR (International Association of Dental Research), 2012; • IOM³ (Institute for Materials, Minerals & Mining), MIMMM, 2013–present; • RSB (Royal Society of Biology), MRSB, 2015–present; • RSC (Royal Society of Chemistry), MRSC, 2015–present; • ScSB (Scandinavian Society for Biomaterials), 2016–present; • Science is Vital, 2015–present; • SSB+RM (Swiss Society for Biomaterials & Regenerative Medicine), 2013; • TERMIS (Tissue Engineering & Regenerative Medicine International Society), 2013–present; • WISE (Campaign to Promote Women in Science, Technology & Engineering), 2015–present.

Collaborations • Current principal collaborators: Gentleman E & Yu TT, King’s College London; Miettinen S & Hytönen V, University of Tampere; Hilborn J, Uppsala University; Oommen OP & Kellomäki M, Tampere University of Technology, 2015–present; Bozec L, University College London. • Other current collaborators: Vuornos, K & Ojansivu M, University of Tampere; Koivisto J, Tampere University of Technology (2016–present). • Former collaborators: Knowles JC, Foroutan F & Syed O, University College London, UK, 2014–2015. • Fostered collaborations between: Gentleman E & Varghese OP, Uppsala University, Sweden, 2011–present; Gentleman E & Bozec L, 2012–present.

Laboratory techniques • Design/characterisation/biological evaluation of complex, multifunctional tissue scaffold biomaterials. • Polymer chemistry. • Materials synthesis, e.g. dental/orthopaedic composites, calcium phosphate bone cements, synthetic/natural hydrogels. • High performance liquid chromatography. • Mammalian cell/tissue culture. • Bacterial culture. • Viral culture. • Adipose/bone marrow stromal cell isolation. • Histoimmunochemical and other biological and immunosorbent assays, including for measuring biocompatibility, protein expression, mineral deposition and quantification of protein release. • PCR & qRT-PCR. • Confocal microscopy. • Scanning electron microscopy. • Energy-dispersive X-ray spectroscopy. • Fourier transform infrared spectroscopy. • Raman spectroscopy. • Biaxial flexural, compressive & cyclic mechanical testing for assessing material strength/modulus/resilience/toughness/fatigue. • Rheological testing. • Atomic force microscopy. • Adherence to standard protocols, e.g. ISO, BSI, ASTM. • Involvement in product development/patenting/CE marking/commercialisation of biomaterial product.

Language & communication skills • Proficient in scientific writing and presentation. • Native English speaker. • French GCSE Grade A. • Italian GCSE Grade B. • Swedish Level B2 (upper intermediate), UCL Language Centre & Uppsala Folkuniversitet. • Finnish Level A2 (elementary), UCL School of Slavonic & Eastern European Studies & University of Tampere. • Mac & PC literate. Proficient in Microsoft Office, Adobe Creative Suite (Photoshop, Lightroom, Illustrator, InDesign, Dreamweaver), HTML, CSS, & scientific imaging software (ImageJ, Huygens Essential, Zeiss Zen). • Currently studying online course “Introduction to Programming with MATLAB”, Vanderbilt University.

Publications

† joint first authorship | * corresponding author | ‡ presenting author

Metrics (Google Scholar): total citations: 87 | mean citations per article: 17.4 | g-index: 5 | h-index: 4 | i10-index: 3 | m-index: 1.33

Publications (peer-reviewed)

5. Walters NJ, Xia W, Salih V, Ashley PF & Young AM*. Poly(propylene glycol) and urethane dimethacrylates improve conversion of dental composites and reveal complexity of cytocompatibility testing. *Dental Materials* 2016;32:264–77, [doi:10.1016/j.dental.2015.11.017](https://doi.org/10.1016/j.dental.2015.11.017). (10 citations)
4. Foroutan F, Walters NJ, Owens GJ, Kim H-W, De Leeuw N & Knowles JC*. Sol-gel synthesis of quaternary $(P_2O_5)_{55}-(CaO)_{25}-(Na_2O)_{(20-x)}-(TiO_2)_x$ bioresorbable glasses for bone tissue engineering applications ($x = 0, 5, 10$, or 15). *Biomedical Materials* 2015;10(4):045025:1–10, [doi:10.1088/1748-6041/10/4/045025](https://doi.org/10.1088/1748-6041/10/4/045025). (3 citations)
3. Al Qaysi M†, Walters NJ†, Foroutan F†, Owens GJ, Kim H-W, Shah R & Knowles JC*. Strontium- and calcium-containing, titanium-stabilised phosphate-based glasses with prolonged degradation for orthopaedic tissue engineering. *Journal of Biomaterials Applications* 2015;30(3):300–310, [doi:10.1177/0885328215588898](https://doi.org/10.1177/0885328215588898). (6 citations)
2. Walters NJ & Gentleman E*. Evolving insights in cell-matrix interactions: Elucidating how non-soluble properties of the extracellular niche direct stem cell fate (review). *Acta Biomaterialia* 2015;11:3–16, [doi:10.1016/j.actbio.2014.09.038](https://doi.org/10.1016/j.actbio.2014.09.038). (39 citations)
1. Syed O, Walters NJ, Day RM, Kim H-W & Knowles JC*. Evaluation of decellularization protocols for production of tubular small intestine submucosa scaffolds for use in oesophageal tissue engineering. *Acta Biomaterialia* 2014;10:5042–53, [doi:10.1016/j.actbio.2014.08.024](https://doi.org/10.1016/j.actbio.2014.08.024). (29 citations)

Oral conference proceedings (peer-reviewed)

6. Walters NJ†, Yu TT, Foyt D, Vento H, Paulamäki J, Oommen OP, da Silva RMP, Hilborn J, Kellomäki M, Miettinen S* & Gentleman E*. Modular 3D cell niches: Optimisation of biochemical and biophysical properties for bone marrow stromal cell adhesion and survival. Proceedings of Scandinavian Society for Biomaterials Conference; oral presentation; 2017 Mar 15–17 Hafjell, Norway. *European Cells & Materials* 2017;33(S1):37.
5. Sousa-Moreno V†, Spratt D, Hassan I, Walters NJ, Sutherland J, Mardas N & Donos N*. Peri-implantitis microbiome variability across different disinfection protocols, implant surfaces and their relationship with biocompatibility dynamics: Proceedings of European Association for Osseointegration Conference; oral presentation; 2015 Sep 24–26; Stockholm, Sweden. *Clinical Oral Implants Research* 2015;26(S12):5, [doi:10.1111/clr.412678](https://doi.org/10.1111/clr.412678).
4. Khan MA†, Walters NJ & Young AM* (2014). Fibre-reinforced injectable orthopaedic composites with improved toughness and cell compatibility: Proceedings of Society for Biomaterials Conference; oral presentation; 2014 Apr 16–19; Denver, CO, USA, [doi:10.13140/RG.2.1.3068.4321](https://doi.org/10.13140/RG.2.1.3068.4321).
3. Walters NJ†, Khan MA & Young AM* (2013). Novel fibre-reinforced remineralising dental and orthopaedic composites with improved toughness and fatigue properties: Proceedings of Swiss Society for Biomaterials Conference; oral presentation; 2013 Jun 25–26; Davos, Switzerland. *European Cells & Materials* 2013;26(S4):3, [doi:10.13140/2.1.3117.4083](https://doi.org/10.13140/2.1.3117.4083).
2. Walters NJ†, Khan MA, Liaqat S & Young AM* (2013). Novel remineralising, antimicrobial dental & orthopaedic resin-based composites: Proceedings of Tissue Engineering & Regenerative Medicine International Society European Chapter Conference; oral presentation; 2013 Jun 17–20; Istanbul, Turkey, [doi:10.13140/RG.2.1.2544.1443](https://doi.org/10.13140/RG.2.1.2544.1443).
1. Walters NJ† & Young AM* (2012). Low shrinkage dental composites with high strength and toughness: Proceedings of Pan-European Region International Association of Dental Research Conference; oral presentation; 2012 Sep 12–15; Helsinki, Finland. *Journal of Dental Research* 2012;91(C):288, [doi:10.13140/RG.2.1.1757.7127](https://doi.org/10.13140/RG.2.1.1757.7127).

Poster conference proceedings (peer-reviewed)

13. Yu TT†, Walters NJ†, Vento H, Oommen OP, Hilborn J, Miettinen S* & Gentleman E*. Sequential synthesis of modular poly(ethylene glycol)–peptide hydrogels for controlling stiffness, degradability and biomolecule presentation in 3D artificial stem cell niches. Proceedings of Tissue Engineering & Regenerative Medicine International Society European Chapter Conference; poster presentation; 2017 Jun 26–30 Davos, Switzerland. *European Cells & Materials* 2017.
12. Vuornos K†, Ojansivu M, Koivisto J, Parraga Meneses J, Walters NJ, Hyttinen J, Ihalainen J, Kellomäki M & Miettinen S*. Osteogenic differentiation of human adipose stem cells in 3D hydrogels. Proceedings of Tissue Engineering & Regenerative Medicine International Society European Chapter Conference; poster presentation; 2017 Jun 26–30 Davos, Switzerland. *European Cells & Materials* 2017.
11. Vuornos K†, Ojansivu M, Koivisto J, Parraga Meneses J, Walters NJ, Hyttinen J, Ihalainen J, Kellomäki M & Miettinen S*. Osteogenic differentiation of human adipose stem cells in 3D hydrogels. Proceedings of Scandinavian Society for Biomaterials Conference; poster presentation; 2017 Mar 15–17 Hafjell, Norway. *European Cells & Materials* 2017;33(S1):36.
10. Walters NJ†, Miettinen S* & Gentleman E*. An illustrated review of mechanotransduction and its impact on stem cell fate. Proceedings of BioMediTech Research Day; poster presentation; 2016 Nov 25 Tampere, Finland.
9. Yu TT†, Zia S† & Walters NJ†. A unique pre-accelerator programme to enhance entrepreneurial researchers' preparedness to commercialise in the tissue engineering and regenerative medicine field. Proceedings of The Inaugural UK Regenerative Medicine Conference; poster presentation; 2016 Sep 20–21 London, UK.
8. Walters NJ†, Yu TT, Oommen OP, Hilborn J, Miettinen S* & Gentleman E*. Sequential synthesis of modular poly(ethylene glycol)–peptide hydrogels for nanoscale control over extracellular matrix features. Proceedings of Tissue Engineering &

Regenerative Medicine International Society European Chapter Conference; poster presentation; 2016 Jun 28 – Jul 1 Uppsala, Sweden. *European Cells & Materials* 2016;31(S1):P356.

7. Walters NJ[‡], Yu TT, Oommen OP, Hillborn J, Miettinen S* & Gentleman E*. Synthesis of four-arm poly(ethylene glycol)—nitrophenyl carbonate for PEG—peptide hydrogels. Proceedings of Scandinavian Society for Biomaterials Conference; poster presentation; 2016 Jun 1–3 Reykjavik, Iceland, [doi:10.13140/RG.2.1.2946.2806](https://doi.org/10.13140/RG.2.1.2946.2806).

6. Koivisto J[‡], Walters NJ, Parraga J & Kellomäki M*. Macro- and micro-scale mechanical characterisation of hydrogels. Proceedings of BioMediTech Research Day & Kauppi Campus Science Day; poster presentations; 2015 Dec 4 & 2016 Feb 11; Tampere, Finland, [doi:10.13140/RG.2.1.2795.6567](https://doi.org/10.13140/RG.2.1.2795.6567).

5. Walters NJ[‡], Miettinen S & Kellomäki M*. Spermidine cross-linked gellan gum hydrogels with a broad range of moduli for studying the influence of matrix stiffness on adipose-derived stromal cell fate: Proceedings of Tissue Engineering & Regenerative Medicine International Society World Congress; poster presentation; 2015 Sep 8–11 Boston, MA, USA. *Tissue Engineering Part A* 2015;21(s1):258–9, [doi:10.13140/RG.2.1.3535.9840](https://doi.org/10.13140/RG.2.1.3535.9840).

4. Walters NJ[‡], Palmer G, Ashley PF & Young AM* (2015). Monocalcium phosphate Induces greater hydroxyapatite mineral formation than tricalcium phosphate on dental composites containing ε-poly-L-lysine: Proceedings of Tissue Engineering & Regenerative Medicine International Society World Congress; poster presentation; 2015 Sep 8–11 Boston, MA, USA. *Tissue Engineering Part A* 2015;21(s1):346–7, [doi:10.13140/RG.2.1.3273.8400](https://doi.org/10.13140/RG.2.1.3273.8400).

3. Walters NJ[‡], Dakkouri LI, Ashley PF & Young AM* (2014). Calcium phosphate-precipitating, antimicrobial composite biomaterials: Proceedings of Tissue Engineering & Regenerative Medicine International Society European Chapter Conference; poster presentation; 2014 Jun 10–13 Genova, Italy. *Journal of Tissue Engineering & Regenerative Medicine* 2014;8(S1):263–4, [doi:10.1002/term.1932](https://doi.org/10.1002/term.1932).

2. Walters NJ[‡], Dakkouri LI, Ashley PF & Young AM* (2013). Remineralising dental composite with high conversion and low shrinkage for improved restoration longevity: Proceedings of European Dental Materials Conference; poster presentation; 2013 Aug 29–30; Birmingham, UK, [doi:10.13140/RG.2.1.2019.8566](https://doi.org/10.13140/RG.2.1.2019.8566).

1. Walters NJ, Hulsart-Billström G[‡], Engvist H & Larsson S* (2013). Premixed calcium phosphate cement as a carrier for bone morphogenetic protein 2: Proceedings of European Calcified Tissue Society Congress; poster presentation; 2013 May 18–21; Lisbon, Portugal. *Bone Abstracts* 2013;1:76, [doi:10.1530/boneabs.1.PP87](https://doi.org/10.1530/boneabs.1.PP87).

Symposium proceedings

1. Walters NJ[‡]. Modular cell niches for studying and directing stem cell fate in three-dimensions (2015): Proceedings of The use of polymers to study and direct stem cell fate in three-dimensions; 2015 Sep 29–30; Uppsala, Sweden, [doi:10.13140/RG.2.1.2995.4323](https://doi.org/10.13140/RG.2.1.2995.4323).

Other publications

Walters NJ. Harnessing hydrogels for healthy tissue. Royal Society of Biology member profile. *The Biologist* 2015;62(6):34.

Patent applications

UCL Business. GB Patent Filing No. 1313898.7 2013. Contributor to patent content (not listed as author).

Degree theses & projects

5. Walters NJ. Remineralising composites with improved cytocompatibility and containing antimicrobial agents for conservative treatment of caries. PhD thesis. *University College London* 2016; supervisors: Young AM, Ashley PF & Salih V, [doi:10.13140/RG.2.1.2295.8489](https://doi.org/10.13140/RG.2.1.2295.8489).

4. Walters NJ. A novel injectable hyaluronic acid hydrogel containing strontium as a carrier of bone morphogenetic protein 2 (rhBMP-2) for orthopaedic applications. MSc project. *Uppsala University* 2011; supervisors: Larsson S & Hulsart-Billström G, [doi:10.13140/RG.2.1.2340.0729](https://doi.org/10.13140/RG.2.1.2340.0729).

3. Walters NJ. Premixed monetite-forming calcium phosphate cement as a carrier for bone morphogenetic protein 2: A biphasic release profile. MSc project. *Uppsala University* 2011; supervisors: Varghese OP & Hulsart-Billström G, *confidential*.

2. Walters NJ. Characterisation of wild-type human adenovirus serotypes Ad4, Ad11, Ad12 and Ad17 and modified viruses Ad5HVR48 and Ad5f35 in comparison to Ad5 for potential use as oncolytic agents. MSc thesis. *Uppsala University* 2010; supervisors: Essand M & Leja-Jarblad J, [doi:10.13140/RG.2.1.4699.3682](https://doi.org/10.13140/RG.2.1.4699.3682).

1. Walters NJ. Cloning of the C-terminal domain of ribosomal stalk protein L7/L12 from *E. coli* for determination of its specific role in GTPase activation. BSc thesis. *Uppsala University* 2006; supervisor: Sanyal S, [doi:10.13140/RG.2.1.4130.8560](https://doi.org/10.13140/RG.2.1.4130.8560).

Acknowledgements for other contributions to publications (peer-reviewed)

3. Virjula S, Zhao F, Leivo J, Vanhatupa S, Kreutzer J, Vaughan TJ, Honkala A-M, Viehig M, Mullen CA, Kallio P, McNamara LM & Miettinen S*. The effect of stretching on the osteogenic differentiation and mechanical properties of human adipose stem cells. *Journal of the Mechanical Behavior of Biomedical Materials* 2017;72:38–48, [doi:10.1016/j.jmbbm.2017.04.016](https://doi.org/10.1016/j.jmbbm.2017.04.016).

2. Gentleman E, Fredholm YC, Jell G, Lotfibakshaiesh N, O'Donnell MD, Hill RG & Stevens MM*. The effects of strontium-substituted bioactive glasses on osteoblasts and osteoclasts *in vitro*. *Biomaterials* 2010;31:3949–56, [doi:10.1016/j.biomaterials.2010.01.121](https://doi.org/10.1016/j.biomaterials.2010.01.121).

1. Gentleman E, Swain RJ, Evans ND, Boonrungsiman S, Jell G, Ball MD, Shean TAV, Oyen ML, Porter AE & Stevens MM*. Comparative materials differences revealed in engineered bone as a function of cell-specific differentiation. *Nature Materials* 2009;8:763–70, [doi:10.1038/nmat2505](https://doi.org/10.1038/nmat2505).