Eóin McEvoy, PhD

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EDUCATION

National University of Ireland Galway, Ireland **August 2018**

Ph.D. Biomedical Engineering

Thesis: *A Thermodynamically Motivated Investigation of Cell and Tissue Remodelling*

National University of Ireland Galway, Ireland **May 2014**

B.E. Biomedical Engineering

RESEARCH EXPERIENCE

Postdoctoral Researcher, University of Pennsylvania, Philadelphia **Apr 2019-present**

Center for Engineering Mechanobiology

Advisor: Vivek Shenoy

- Developing computational models to uncover the driving forces for cancer cell invasion
- Demonstrated that ion flow through gap junctions amplifies cell swelling within proliferating tumour organoids

Related manuscripts currently under review.

Postdoctoral Researcher, National University of Ireland Galway **Sep 2018-Mar 2019**

Discipline of Biomedical Engineering

Advisor: Patrick McGarry

- Identified how pathological loading conditions in the heart may drive structural remodelling during cardiac hypertrophy

Related manuscripts currently under review.

Graduate Researcher, National University of Ireland Galway **Nov 2014-Aug 2018**

Discipline of Biomedical Engineering

Advisor: Patrick McGarry

- Developed free-energy based models to predict cell spreading and remodelling in response to substrate stiffness and ligand density

- Proposed a novel framework for transient actomyosin force generation and reorganisation under cyclic loading
- Identified experimentally that cardiac myocardium is compressible and proposed an anisotropic hyperelastic model to describe its mechanical behaviour

This work resulted in 4 publications in Biophys J, JMBBM, BMMB, and JBME.

Undergraduate Researcher, National University of Ireland Galway **Jun-Aug 2012**

Discipline of Electrical and Electronic Engineering

Advisor: Gearóid O'Laighin

- Developed code and designed enclosure for a lower limb venous pressure sensor

HONOURS AND AWARDS

Funding

Irish Research Council: Postgraduate Scholarship

NUIG Hardiman: Postgraduate Scholarship

All Ireland J.P McManus: Undergraduate Scholarship

Conference Awards

People's Choice Poster Award	Physical Sciences in Oncology, Minnesota (2019)
RAMI Bronze Medal for Best Paper	Bioengineering in Ireland, Castletroy (2019)
ASME Paper Competition 3rd Prize	World Congress of Biomechanics, Dublin (2018)
PhD Paper Competition 3rd Prize	SB^3C, Arizona (2017)
Best Paper in Biomechanics	Bioengineering in Ireland, Salthill (2016)
PhD Paper Competition 3rd Prize	Sir Bernard Crossland Symposium, Belfast (2016)

Additional

Medtech Innovation Design and Startup Competition 1st Prize	Galway (2017)
McKinsey and Company Insight Program	London (2017)
University Scholar	NUIG (2012-2014)

Invited Scientific Reviewer: Journal of Biomechanical Engineering; Extreme Mechanics Letters; International Journal of Non-Linear Mechanics; Mechanics Research Communications.

PUBLICATIONS

Published in Peer-Reviewed Journals

McEvoy, E., Deshpande, V.S., McGarry, P., 2019. *Transient active force generation and stress fibre remodelling in cells under cyclic loading*. **Biomechanics and Modeling in Mechanobiology** doi:10.1007/s10237-019-01121-9

McEvoy, E., Shishvan S.S., Deshpande, V.S., McGarry, P., 2018. *Thermodynamic Modeling of the Statistics of Cell Spreading on Ligand-Coated Elastic Substrates*. **Biophysical Journal.** doi:10.1016/j.bpj.2018.11.007

McEvoy, E., Holzapfel, G.A., McGarry, P., 2018. *Compressibility and Anisotropy of the Ventricular Myocardium: Experimental Analysis and Microstructural Modelling*. **J. Biomech. Eng**. doi:10.1115/1.4039947

McEvoy, E., Deshpande, V.S., McGarry, P., 2017. *Free energy analysis of cell spreading*. **J. Mech. Behav. Biomed. Mater.** 74. doi:10.1016/j.jmbbm.2017.06.006

Submitted manuscripts

McEvoy, E., Wijns, W., McGarry, P. *A thermodynamic transient cross-bridge model for prediction of contractility and remodelling of the ventricle*. **J. Mech. Behav. Biomed. Mater.** (revised manuscript in review)

Reynolds, N., **McEvoy, E.**, McGarry, P. *Influence of multi-axial dynamic constraint on cell alignment and contractility in engineered tissues*. **J. Mech. Behav. Biomed. Mater.** (revised manuscript in review)

McEvoy, E., Han, Y., Guo, M., Shenoy, V. *Gap junctions amplify spatial variations in cell volume in proliferating solid tumors*. **Nat Comms.** (in review)

Chen, X., te Boekhorst, V., **McEvoy, E.**, Friedl, P, Shenoy, V. *An active chemo-mechanical model predicts adhesion and microenvironmental regulation of 3D cell shapes*. **Submitted**

Gong, Z., Wisdom, K., **McEvoy, E.**, Adebowale, K., Chaudhuri, O., Shenoy, V. *Recursive feedback between matrix dissipation and chemo-mechanical signaling drives oscillatory growth of cancer cell invadopodia*. **Submitted**

TEACHING EXPERIENCE

Guest Lecturer, National University of Ireland Galway **Sep-Nov 2017**

Course: Advanced Biomechanics

Responsibilities: Delivered lectures on tissue hyperelasticity, viscoelasticity, and plasticity. Designed and supervised weekly computational (Matlab, Abaqus) and experimental (tissue preparation and loading) labs. Prepared and corrected assignment and exam questions.

Graduate Teaching Assistant, National University of Ireland Galway **Nov 2014-Aug 2018**

Courses: Biomechanics, Engineering Programming, Advanced Biomechanics

Responsibilities: Supervision of weekly experimental and computational labs. Correction of assignments and delivery of tutorials.

INDUSTRY EXPERIENCE

Associate R&D Engineer, Medtronic Galway **May-Oct 2014**

Responsibilities: Continuous improvement of trans-aortic valve implant (TAVI)
Design of novel coronary stent delivery balloon
Improvement of related manufacturing processes

Co-op Engineer, Vistakon (J&J) Limerick **Aug-Apr 2013**

Responsibilities: Design of Experiments (DOE) for injection moulding of contact lenses
Code development for data acquisition from production lines and analysis

MENTORING EXPERIENCE

Research Experience for Undergraduates (REU) **Jun-Aug 2019**

Involvement: Mentored a high-potential student during a 10-week engagement with high-level computational research program, within the Center for Engineering Mechanobiology (CEMB) at UPenn. The aim was for the student to develop practical research skills: collaborating, designing experiments, collecting and analyzing data, and communicating. Resultant manuscript currently in preparation.

Undergraduates Expanding Boundaries (UExB) **July 2020**

Involvement: CEMB arranged a remote research experience opportunity for gifted undergraduate students, during which I mentored successful applicants for 4 weeks on image analysis and numerical modelling.

OUTREACH

Centre for Talented Youth Ireland, Galway **Feb-May 2017**

Involvement: Developed and delivered a 10-week *Intro to Engineering* series for talented youths (10-13 yrs). Prepared an overview of a different engineering field each week (mechanical, energy systems, electronic etc) including a relevant activity or experiment (e.g. egg drop, marble roller coaster, rubber band cars).

"I'm an Engineer, Get Me Out Of Here" **March 2018**

Involvement: Online activity where I engaged with primary- and secondary-level students in an online forum over 2 weeks, answering all of their questions about the world of engineering.

CONFERENCE PROCEEDINGS

McEvoy, E., Chen, X., Ranamukhaarachchi, S., Fraley, S., Shenoy, V. (2020) *An active free-energy model to predict cancer cell streaming and invasion.* **Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C),** Online due to Covid-19

McEvoy, E., Chen, X., Shenoy, V. (2019) *An active free-energy-based model to investigate cancer cell invasion.* **Physical Sciences in Oncology (PSON) Annual Meeting**, Minneapolis, MN, USA

McEvoy, E., McGarry, J.P (2019) *A thermodynamically motivated cross-bridge cycling framework to predict myofibril remodeling under conditions associated with LV hypertrophy* **Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C)**, Seven Springs, PA, USA

McEvoy, E., Holzapfel, G.A., McGarry, J.P. (2018) *A micro-structural model of the ventricular myocardium*. **10th European Solid Mechanics Conference (ESMC)**, Bologna, Italy

McEvoy E., Shishvan, S.S., Deshpande, V.S., McGarry, J.P (2018). *A thermodynamic framework for cell spreading and dynamic contractility*. **8th World Congress of Biomechanics (WCB)**, Dublin, Ireland

McEvoy E., Shishvan, S.S., Deshpande, V.S., McGarry, J.P (2017). *A thermodynamic statistical mechanics model to investigate the influence of ligand density and substrate stiffness on cell spreading*. **Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C)**, Tucson, AZ, USA

McEvoy E., Shishvan, S.S., Deshpande, V.S., McGarry, J.P (2017) *Modelling cell-substrate interaction to investigate the influence of collagen density and stiffness on cell spreading*. **International Conference of Biomedical Technology (ECCOMAS)**, Hannover, Germany

McEvoy, E., Ristori, T., Loerakker, S., Deshpande, V.S., McGarry, J.P. (2016). *Analysis of cell spreading on micropatterned substrates using a thermodynamically consistent non-local active model.* **Summer Biomechanics, Bioengineering, and Biotransport Conference**, Washington DC, USA

Research has also been disseminated at the following Irish national conferences and meetings:

- Bioengineering in Ireland (2015, 2016, 2017, 2018, 2019)
- Sir Bernard Crossland Symposium (2016)
- Matrix Biology Ireland (2017)
- Joint Meeting for the Irish Mechanics Society (IMS) and the Irish Society for Scientific Engineering & Computation (ISSEC) (2015)