

Tyler N. Shendruk

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RESEARCH INTERESTS	Cyclosis, active matter, microbe motility, polymer dynamics, soft matter	
EMPLOYMENT	(1) Fellow for Physics and Biology Sept. 2016 to present The Rockefeller University, New York, NY - Independent Fellow at the Center for Studies in Physics and Biology - Area of Study: Intracellular flows and tissue dynamics (2) Postdoctoral Researcher Jan. 2014 to Sept. 2016 The University of Oxford, Oxford, UK - Advisor: Julia Yeomans - Area of Study: Swimmer dynamics and active nematic flows - EMBO-Long Term Fellow at the Rudolf Peierls Centre for Theoretical Physics - Research Associate Jan. 2015 to Sept. 2016 Wadham College, University of Oxford - Non-stipendiary Junior Research Fellow Nov. 2015 to Sept. 2016 St. Hilda's College, University of Oxford	
EDUCATION	(1) Doctorate in Philosophy Physics Oct. 2014 The University of Ottawa, Ottawa, Canada (Gary W. Slater) - Thesis Title: Theoretical and Computational Studies of Hydrodynamics-based Separation of Particles and Polymers in Microfluidic Channels (2) Polymers in Soft and Biological Matter 2012 The Boulder School in Condensed Matter and Materials Physics, Boulder, Colorado, USA (3) Bachelor of Science 2007 The University of Manitoba, Winnipeg, Canada - With honours in Science (4) Visiting Student 2006 to 2007 The University of Saskatchewan, Saskatoon, Canada - On Letter of Permission from University of Manitoba	
RESEARCH FUNDING	(1) European Molecular Biology Organization - EMBO Long-Term Fellowship 2013 (2) National Science and Engineering Research Council - Postdoctoral Fellowship (PDF) at MIT 2016 - Incompatible with Rockefeller Fellowship - declined - Summer Program in Taiwan 2011 - Alexander Graham Bell Canada Graduate Scholarship (CGS-D) 2009 - Canada Graduate Scholarship (CGS-M) 2008 - Undergraduate Student Research Awards (USRA) 2007 - Undergraduate Student Research Awards (USRA) 2005 (3) HPCVL/Sun Microsystems of Canada Inc. - Scholarship in the Computational Sciences and Engineering 2009	

AWARDS

- (1) British Science Association and Financial Times
 - BSA Media Fellowship 2014
- (2) The University of Ottawa
 - Pierre Laberge Prize, best doctoral thesis in the Sciences 2014
 - Dean's Scholarship 2014
 - National Excellence Scholarship, Ph.D. Program 2009
 - National Excellence Scholarship, Masters Program 2008
- (3) The University of Manitoba
 - Faculty of Science Undergraduate Student Research Award 2006
 - Dean's Honour List 2004 to 2007
- (4) The University of Saskatchewan
 - Guaranteed Transfer Award 2006
 - Norman MacLeod Reid Entrance Scholarship 2003
- (5) Canadian Association of Physicists
 - Best Student Oral Presentation Award - 3rd Place, CAP Congress 2013
 - Best Student Oral Presentation Award - DMBP 2013
- (6) CASSS - International Separation Science Society
 - CASSS Student Travel Grant 2011
- (7) GSAÉD Interdisciplinary Conference
 - 12th GSAÉD Interdisciplinary Conference Oral Presentation - 1st Place 2009
- (8) Canadian Undergraduate Physics Conference (CUPC)
 - 43rd Annual CUPC Poster Presentation - 2nd Place 2007

PUBLICATIONS

- (1) *Hydrodynamics of microswimmers in films*, A.J.T.M. Mathijssen, A. Doostmohammadi, J.M. Yeomans and **T.N. Shendruk**, *Journal of Fluid Mechanics*, 806, 35-70 (2016).
- (2) *Active micromachines: Microfluidics powered by mesoscale turbulence*, S.P. Thampi, A. Doostmohammadi, **T.N. Shendruk**, R. Golestanian and J.M. Yeomans, *Science Advances*, 2 (7) e1501854 (2016).
 - Received wide media coverage, including the Daily Mail, Wired, ScienceNews, Huffington Post, MIT Technological Review, Phys.org, and Popular Science.
- (3) *Encapsulation-free controlled release: Electrostatic adsorption eliminates the need for protein encapsulation in PLGA nanoparticles*, M.M. Pakulska, I.E. Donaghue, J. Obermeyer, A. Tuladhar, C.K. McLaughlin, **T.N. Shendruk** and M.S. Shoichet, *Science Advances*, 2 (5) e1600519 (2016).
 - Highlighted by the University of Toronto Engineering News
 - Media coverage by Forbes magazine, Nano Today, and Science Daily.
- (4) *Understanding the onset of oscillatory swimming in microchannels*, J. de Graaf, A.J.T.M. Mathijssen, M. Fabritius, H. Menke, C. Holm and **T.N. Shendruk**, *Soft Matter*, 12, 4704-4708 (2016).
- (5) *Lattice-Boltzmann hydrodynamics of anisotropic active matter*, J. de Graaf, H. Menke, A.J.T.M. Mathijssen, M. Fabritius, C. Holm and **T.N. Shendruk**, *Journal of Chemical Physics*, 144, 134106 (2016).

- (6) *Hotspots of boundary accumulation: Dynamics and statistics of micro-swimmers in flowing films*, Arnold J.T.M. Mathijssen, Amin Doostmohammadi, Julia M. Yeomans and **Tyler N. Shendruk**, *Journal of the Royal Society Interface*, **13**, 20150936 (2016).
- (7) *Upstream swimming in microbiological flows*, Arnold J.T.M. Mathijssen, **Tyler N. Shendruk**, Julia M. Yeomans and Amin Doostmohammadi, *Physical Review Letters*, **116** (2), 028104 (2016).
- (8) *Adverse-mode FFF: Multi-force ideal retention theory*, **T.N. Shendruk** and G.W. Slater, *Chromatography*, **2** (3), 392-409 (2015).
- (9) *Multi-particle collision dynamics algorithm for nematic fluids*, **T.N. Shendruk** and Julia M. Yeomans, *Soft Matter*, **11**, 5101-5110 (2015).
- (10) *Force-extension for DNA in a nanoslit: Mapping between the 3D and 2D limits*, H.W. de Haan and **T.N. Shendruk**, *ACS Macro Letters*, **4** (6), 632-635, (2015).
- (11) *Electrophoretic mobility of polyelectrolytes within a confining well*, **T.N. Shendruk**, M. Bertrand, and G.W. Slater, *ACS Macro Letters*, **4** (4), 472-476 (2015).
- (12) *Simulating the entropic collapse of coarse-grained chromosomes*, **T.N. Shendruk**, M. Bertrand, H.W. de Haan, J. Harden and G.W. Slater, *Biophysical Journal*, **108** (4), 810-820, (2015).
 - Cover article
 - Highlighted as *New and Notable*
 - Included in *Collection: Nuclear Organization*, curated by Jason D. Kahn
- (13) *Coarse-grained molecular dynamics simulations of depletion-induced interactions for soft matter systems*, **T.N. Shendruk**, M. Bertrand, J. Harden, G.W. Slater and H.W. de Haan, *Journal of Chemical Physics*, **141**, 244910 (2014).
- (14) *Hydrodynamic chromatography and field flow fractionation in finite aspect ratio channels*, **T.N. Shendruk**, G.W. Slater, *Journal of Chromatography A*, **1339**, 219-223 (2014).
- (15) *Field-flow fractionation and hydrodynamic chromatography on a microfluidic chip*, **T.N. Shendruk***, R. Tahvildari*, N.M. Catafard, L. Andrzejewski, C. Gigault, A. Todd, L. Gagne-Dumais, G.W. Slater and M. Godin, *Analytical Chemistry*, **85** (12), 5981-5988 (2013).
- (16) *Controlling grafted polymers inside cylindrical tubes*, T. Suo, **T.N. Shendruk**, O.A. Hickey, G.W. Slater and M. Whitmore, *Macromolecules*, **46** (3), 1221-1230 (2013).
- (17) *Structure of polyelectrolyte brushes subject to normal electric fields*, Y.-F. Ho, **T.N. Shendruk**, G.W. Slater and P.-Y. Hsiao, *Langmuir*, **29** (7), 2359-2370 (2013).
- (18) *Bifurcation of polyelectrolyte brushes subject to normal electric fields*, **T.N. Shendruk**, Y.-F. Ho, G.W. Slater, P.-Y. Hsiao, *Physics in Canada*, **69**, 3-4 (2013).
- (19) *Simulations of the free-solution electrophoresis of polyelectrolytes with a finite Debye length using the Debye-Hückel approximation*, O.A. Hickey, **T.N. Shendruk**, J.L. Harden and G.W. Slater, *Physical Review Letters*, **109** (9) 098302 (2012).
- (20) *Can slip walls improve field-flow fractionation or hydrodynamic chromatography?*, G.W. Slater and **T.N. Shendruk**, *Journal of Chromatography A*, **1256**, 206-212 (2012).

- (21) *Electrophoresis: When hydrodynamics matter*, **T.N. Shendruk**, O.A. Hickey, G.W. Slater and J.L. Harden, *Current Opinion in Colloid & Interface Science*, 17 (2), 74-82 (2012).
- (22) *Operational-modes of field-flow fractionation in microfluidic channels*, **T.N. Shendruk** and G.W. Slater, *Journal of Chromatography A*, 1233, 100-108 (2012).
- (23) *Modeling the separation of macromolecules: A review of current computer simulation methods*, G.W. Slater, C. Holm, M.V. Chubynsky, H.W. de Haan, A. Dubé, K. Grass, O.A. Hickey, C. Kingsburry, D. Sean, **T.N. Shendruk** and L. Zhan, *Electrophoresis*, 30 (5), 792-818 (2009).
- (24) *Interfacial properties and characterization of Sc/Si multilayers*, **T.N. Shendruk**, A. Moewes, E.Z. Kurmaev, P. Ochinnikov, H. Maury, J.-M. André, K. Le Guen and P. Jonnard, *Thin Solid Films*, 518 (14), 3808-3812 (2010).
- (25) *The effect of surface spin disorder on the magnetism of γ -Fe₂O₃ nanoparticle dispersions*, **T.N. Shendruk**, R.D. Desautels, B.W. Southern and J. van Lierop, *Nanotechnology*, 18 (45), 455704 (2007).
- (26) *Magnetic fluctuations in Eu₂BaZn_xNi_{1-x}O₅ Haldane systems*, J. van Lierop, C.J. Voyer, **T.N. Shendruk**, D.H. Ryan, J.M. Cadogan and L. Cranswick, *Physical Review B*, 73, 174407 (2006).

SUBMITTED
PUBLICATIONS

- (1) *Dancing disclinations in confined living nematics*, **T.N. Shendruk**^{*}, A. Doostmohammadi^{*}, K. Thijssen^{*} and Julia M. Yeomans, *Soft Matter*, SM-ART-10-2016-002310, October (2016).
- (2) *Spin-induced macromolecular spooling*, **T.N. Shendruk**^{*}, D. Sean^{*}, D. Berard^{*}, J. Wolf, J. Dragoman, S. Battat, G.W. Slater and S.R. Leslie, *PRX*, XV10125, August (2016).
- (3) *Onset of meso-scale turbulence in living fluids*, A. Doostmohammadi^{*}, **T.N. Shendruk**^{*}, K. Thijssen^{*} and J. Yeomans, *Nature Communications*, NCOMMS-16-15514, June (2016).
- (4) *Rapid dynamics of cell-shape recovery in response to local deformations*, K. Haase, **T.N. Shendruk** and A. Pelling, *Soft Matter*, SM-ART-06-2016-001292, July (2016).

^{*} joint first author

INVITED
COLLOQUIA

- (1) MIT, *Physical Mathematics Seminar*
 - *From Ceilidh dancing to meso-scale turbulence* Oct. 2016
- (2) Imperial College London, *Interscale interactions in fluid mechanics and beyond*
 - *Screened active matter* July 2016
- (3) University of York, Department of Mathematics
 - *Self-organisation of microfluidic spin-states in active nematics* June 2016
- (4) University of Warwick, *Theoretical Physics Group at Warwick*
 - *Mesoscopic modelling of active nematics* Feb. 2016
- (5) Theoretical Soft Matter and Biophysics, Institute of Complex Systems and Institute for Advanced Simulation, Forschungszentrum Jülich
 - *A nematic-MPCD algorithm* Nov. 2015
- (6) University of Ontario Institute of Technology
 - *From simple swimmers to spontaneous swirls* July 2015

- (7) University of Stuttgart, Institute for Computational Physics
 • *Bifurcation of Polyelectrolyte Brushes* 2014
- (8) University of Warwick, Mathematical Interdisciplinary Research at Warwick: Microfluidics Modelling
 • *Mesoscopic modelling of electro-hydrodynamics* 2014
- (9) Queen's University, Condensed Matter Physics & Optics
 • *Controlling polyelectrolyte brush structure* 2013
- (10) University of Manitoba, Department of Physics and Astronomy
 • *Microfluidic field-flow fractionation* 2011

CONFERENCE
PRESENTATIONS

- (1) *Mixing in cytoplasmic suspensions: Moving beyond enhanced diffusivity*, **T.N. Shendruk**, The EMBO Fellows' Meeting (2016) - talk.
- (2) *Self-organisation of spin-states in active nematics*, **T.N. Shendruk**, S.P. Thampi, A. Doostmohammadi, R. Golestanian and J. Yeomans, Active and smart matter: A new frontier for science and engineering (2016) - poster.
- (3) *Particle-based mesoscopic algorithm for filament-motor hydrodynamics*, **T.N. Shendruk**, J. Yeomans, The EMBO Meeting (2015) - poster.
- (4) *Particle-based mesoscale algorithm for active matter*, **T.N. Shendruk**, J. Yeomans, Gordon Research Conferences: Soft Condensed Matter Physics (2015) - poster.
- (5) *Particle-based mesoscopic algorithm for nematic fluids*, **T.N. Shendruk**, J. Yeomans, 24th Discrete Simulation of Fluid Dynamics (2015) - poster.
- (6) *A mesoscopic particle-based method for active-nematics*, **T.N. Shendruk**, J. Yeomans, Physics and Biology of Active Systems (2015) - talk.
- (7) *Particle-based mesoscale algorithm for active matter*, **T.N. Shendruk**, J. Yeomans, British Society of Rheology Winter Meeting (2014) - talk.
- (8) *Particle-based mesoscale simulations of nematodynamics within nano-confined geometries*, **T.N. Shendruk**, J. Yeomans, CECAM Nanofluidics in Physics and Biology (2014) - invited participant talk.
- (9) *Polyelectrolyte electrophoresis and resulting electro-osmotic flow within a confining potential well*, **T.N. Shendruk**, M. Bertrand, G.W. Slater, CISM Flowing Soft Matter (2014) - invited participant talk.
- (10) *Depletion induced collapse of a macromolecular chain*, M. Bertrand, **T.N. Shendruk**, H. de Haan, J.L. Harden, G.W. Slater, APS Physics March Meeting (2014) - talk.
- (11) *The role of the cortex & cytoplasm in deformations of the plasma membrane*, Kristina Haase, **T.N. Shendruk**, A.E. Pelling, 58th Annual Meeting of the Biophysical Society (2014) - poster.
- (12) *Electrophoretic mobility within a confining well*, **T.N. Shendruk**, M. Bertrand, G.W. Slater, Waterloo Soft Matter Theory (2013) - talk.
- (13) *Normal electric fields bifurcate polyelectrolyte brushes*, **T.N. Shendruk**, Y.-F. Ho, G.W. Slater, P.-Y. Hsiao, 30th Annual Meeting of the Canadian Biomaterials Society (2013) - talk.
- (14) *Bifurcation of polyelectrolyte brushes subject to normal electric fields*, **T.N. Shendruk**, Y.-F. Ho, G.W. Slater, P.-Y. Hsiao, Canadian Association of Physicists Congress (2013) - talk.

- (15) *The electrophoretic mobility of a polyelectrolyte within a confining potential well*, M. Bertrand, **T.N. Shendruk**, G.W. Slater, Canadian Association of Physicists Congress (2013) - talk.
- (16) *Microfluidic field-flow fractionation and hydrodynamic chromatography*, C. Gigault, **T.N. Shendruk**, R. Tahvildari, G.W. Slater and M. Godin, Canadian Association of Physicists Congress (2013) - talk.
- (17) *Electrophoretic mobility of a polyelectrolyte within a radially confining potential well*, **T.N. Shendruk**, M. Bertrand, G.W. Slater, APS Physics March Meeting (2013) - talk.
- (18) *Field-flow fractionation: Improving the method by changing fluid-analyte-wall interactions*, G.W. Slater, **T.N. Shendruk**, ITP 19th International Symposium, Exhibit & Workshops on Electro- and Liquid Phase-separation Techniques, (2012) - talk.
- (19) *FFF: Verification of Faxén-mode*, **T.N. Shendruk**, R. Tahvildari, C. Gigault, L. Andrzejewski, A. Todd, L. Gagné-Dumais, M. Godin, G.W. Slater, The Boulder School in Condensed Matter and Materials Physics Poster Session, (2012) - poster.
- (20) *Mesoscopic simulations of free solution electrophoresis of polyelectrolytes with finite Debye length*, G.W. Slater, O.A. Hickey, **T.N. Shendruk**, APS Physics March Meeting (2012) - talk.
- (21) *FFF: Verification of Faxén-mode*, **T.N. Shendruk**, R. Tahvildari, C. Gigault, L. Andrzejewski, A. Todd, L. Gagné-Dumais, M. Godin, G.W. Slater, Gordon Research Conferences: Colloidal, Macromolecular & Polyelectrolyte Solutions (2012) - poster.
- (22) *Ideal retention theory for FFF in microfluidic devices*, G.W. Slater, **T.N. Shendruk**, 27th International Symposium on MicroScale Bioseparations and Analytes, (2012) - talk.
- (23) *Tethered polyelectrolytes: Driving and dragging*, **T.N. Shendruk**, G.W. Slater, O.A. Hickey, P.Y. Hsiao, Summer Institute in Taiwan (2011) - poster.
- (24) *Ideal retention theory for FFF*, **T.N. Shendruk**, G.W. Slater, The 15th International Symposium on Field- and Flow-based Separations (2011) - talk.
- (25) *Faxén mode: Field-flow fractionation*, **T.N. Shendruk**, G.W. Slater, Gordon Research Conferences: Colloidal, Macromolecular & Polyelectrolyte Solutions (2011) - poster.
- (26) *Coating microchannels to improve field-flow fractionation*, **T.N. Shendruk**, G.W. Slater, APS Physics March Meeting (2011) - talk.
- (27) *Modeling the effects of surface roughness on gas-solid flow*, **T.N. Shendruk**, D.J. Bergstrom, International Conference on Multiphase Flow (2010) - poster.
- (28) *Mesoscopic simulations of microfluidic flow in irregular geometries*, **T.N. Shendruk**, G.W. Slater, APS Physics March Meeting (2009) - poster.
- (29) *Two-fluid simulations of turbulent liquid-solid flow in a vertical tube*, **T.N. Shendruk**, D.J. Bergstrom, CFDSC (2009) - talk.
- (30) *Mesoscopic simulations of planar impact*, **T.N. Shendruk**, GSAÉD Annual Interdisciplinary Conference (2009) - talk.

- (31) *Modeling dense liquid-solid flow*, D.J. Bergstrom, **T.N. Shendruk**, 61st Annual Meeting of the APS Division of Fluid Dynamics (2008) - talk.
- (32) *Dynamic REIXS liquid cell*, **T.N. Shendruk**, A. Moewes, R. Green, D. Muir, MEDSI/Pan-American SRI in conjunction with The Canadian Light Source Annual Users' Meeting (2008) - poster.
- (33) *Interfacial structure of Sc/Si multilayers*, **T.N. Shendruk**, E.Z. Kurmaev, A. Moewes, P. Jonnard, 21st International Conference on X-Ray and Inner-Shell Processes (2008) - poster.
- (34) *Particle-wall specularly effects on turbulent multiphase flow*, **T.N. Shendruk**, D.J. Bergstrom, 43rd Annual Canadian Undergraduate Physics Conference (2007) - poster.

SCIENCE
COMMUNICATION

- (1) *How we simulated a microscopic wind farm — powered by bacteria*, The Conversation, 25 July (2016).
- (2) *Nature's Raincoats*, The Royal Institution Family Fun Day (London), May 17 (2014).
- (3) *Physics: Antifragility can bring order from chaos*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 5 Dec. (2014).
- (4) *Biochemistry: The cold facts*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 24 Oct. (2014)
- (5) *Marine ecology: A tough job but some fish has gotta do it*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 10 Oct. (2014).
- (6) *Biomimicry: Turning dewdrops into drinking water*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 10 Oct. (2014).
- (7) *Entomology: The beetle with extra zap*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 3 Oct. (2014).
- (8) *How Egypt lost its hartebeests*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 3 Oct. (2014).
- (9) *Journalists and scientists share a common goal*, **Tyler N. Shendruk**, (2014) EMBOencounters. August: 28 (2014).
- (10) *Animal behaviour: Herding instincts*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 26 Sept. (2014).
- (11) *Psychology: Confidence tricks*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 26 Sept.
- (12) *Biodiversity: How to save the worlds crops*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 19 Sept. (2014).
- (13) *Pharmacology: Sleeping pills dream or nightmare?*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 26 Sept. (2014).
- (14) *European Space Agency chooses site for comet landing*, **Tyler N. Shendruk**, Financial Times. 15 Sept. (2014)
- (15) *Physics: Is the world really 3D?*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 12 Sept. (2014).

- (16) *Evolutionary biology: Rabbit DNA decoded*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 12 Sept. (2014).
- (17) *High-tech archaeology unlocks Stonehenge secrets*, **Tyler N. Shendruk**, Financial Times. 10 Sept. (2014).
- (18) *Sports field concussion examinations inadequate, say scientists*, **Tyler N. Shendruk**, Financial Times. 10 Sept. (2014).
- (19) *Critics fume over WHO call for curbs on ecigarette sales*, **Tyler N. Shendruk**, Financial Times. 5 Sept.
- (20) *Biomimetics: A paler shade of white*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 5 Sept. (2014).
- (21) *Aerospace engineering: Jets get smart skin*, **Tyler N. Shendruk**, Financial Times (FT Weekend Magazine), 5 Sept. (2014).
- (22) *Where no man has tweeted before*, **Tyler N. Shendruk**, (2013) Macleans. Online: June (2014).

REFERENCES

- References available upon request.