

Tyler N. Shendruk

CONTACT INFORMATION	Center for Studies in Physics and Biology The Rockefeller University 1230 York Avenue New York, NY 10065	<i>Tel:</i> +1(212) 327-7561 <i>Fax:</i> +1(212) 327-8544 tshendruk@rockefeller.edu tnshendruk.com
RESEARCH INTERESTS	algorithm development active matter biopolymer dynamics	biophysics microbe motility soft condensed matter
EMPLOYMENT	(1) Fellow for Physics and Biology 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	Sept. 2016 to present
	(2) Postdoctoral Researcher 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 Wadham College , University of Oxford	2014 to 2016
	• Non-stipendiary Junior Research Fellow St. Hilda's College , University of Oxford	2015 to 2016
EDUCATION	(1) Doctorate in Philosophy Physics The University of Ottawa , Ottawa, Canada • Advisor: Gary W. Slater • Thesis Title: Theoretical and Computational Studies of Hydrodynamics-based Separation of Particles and Polymers in Microfluidic Channels	2014
	(2) Bachelor of Science The University of Manitoba , Winnipeg, Canada • With honours in Science	2007
RESEARCH FUNDING	(1) European Molecular Biology Organization • EMBO Long-Term Fellowship	2013
	(2) National Science and Engineering Research Council • Postdoctoral Fellowship (PDF) at MIT • Incompatible with Rockefeller Fellowship - declined • Summer Program in Taiwan • Alexander Graham Bell Canada Graduate Scholarship (CGS-D) • Canada Graduate Scholarship (CGS-M) • Undergraduate Student Research Awards (USRA)	2016 2011 2009 2008 2007 and 2005
	(3) HPCVL/Sun Microsystems of Canada Inc. • Scholarship in the Computational Sciences and Engineering	2009

- SELECT 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) Ontario Student Assistance Program
 - Ontario Graduate Scholarship, Incompatible with CGS - declined 2009
 - (4) The University of Manitoba
 - Faculty of Science Undergraduate Student Research Award 2006
 - (5) The University of Saskatchewan
 - Norman MacLeod Reid Entrance Scholarship 2003
- SELECT PROFESSIONAL SERVICE
- (1) Conference Organization
 - Complex Active and Adaptive Material Systems *Gordon Research Seminar* upcoming (2019)
 - Emergence and Physics Far from Equilibrium *Third General Discussion Meeting* 2015
EPSRC
 - (2) Refereeing 2012 to present
 - Physical Review Letters, Journal of Chemical Physics, Soft Matter, Physical Review E, Biomacromolecules, European Physical Journal, and others
 - (3) Administration
 - *Organizer*, Center for Studies in Physics and Biology Seminar Series, **Rockefeller University** 2017
 - *JRF representative*, Research Task Group, **St. Hilda's College**, Oxford Committee for supporting research with funding of £14,000 2016
 - *Vice-President*, Graduate Physics Student Association, Department of Physics, University of Ottawa 2011-2012
 - *Trustee*, **CUPE 2626**, University of Ottawa Union Representing TAs, RAs, Markers and Proctors 2009 to 2013
 - *Departmental Steward*, **CUPE 2626**, University of Ottawa Union Representing TAs, RAs, Markers and Proctors 2008 to 2010
- STUDENTS ADVISED
- (1) Arnold Mathijssen (DPhil student; PI Julia Yeomans) 2014-2016
 - Sam Edwards Thesis Prize winner
 - Currently HFSP cross-disciplinary fellow at Stanford University
 - (2) Andrew Balin (DPhil student; PI Julia Yeomans) 2015-2017
 - To defend this term
 - Accepted an associate position at Goldman Sachs, London
 - (3) Kristian Thijssen (visiting student; PI Paul van der Schoot) 2016-2017
 - Currently Marie Curie Early-Stage Researcher at the University of Oxford
 - (4) Julian Wolf (Undergraduate project; PI Sabrina Leslie) 2015-2017
 - Currently Ph.D. candidate at UC Berkeley
 - (5) Ranya Virk (Undergraduate project; PI Sabrina Leslie) 2017

- SELECT TEACHING
- (1) **Rudolf Peierls Centre for Theoretical Physics**, Oxford
 - Adjudicating Vivas (PhD transfer examinations) ×3 2014 to 2015
 - (2) **Wadham College**, Oxford
 - Organize events to foster intellectual exchange 2015 to 2016
Wadham Inspires, *Wadham in Objects*, and *Student-Supervisor Science Symposium*
 - (3) **University of Ottawa**
 - Invited Lecturer 2011 to 2012
 - a. Biological Physics - *Introduction to hydrodynamics* (Graduate)
 - b. Statistical Mechanics - *Computational methods* (Graduate)
 - c. Nanotechnology and Modern Methods in Experimental Biophysics - *Computational Methods in Biophysics* (Graduate)
 - d. Physics of Continuous Media - *Introduction to COMSOL* (4th year)
 - e. Physics of Continuous Media - *Microfluidics* (4th year)
 - f. Solid State Physics - *Semiconductor crystals* (3rd year)
 - Teaching Assistant 2008 to 2013
 - a. Computational Physics (Graduate)
 - b. Graduate level Physics of Continuous Media (Graduate)
 - c. Graduate level Biological Physics (Graduate)
 - d. Statistical Mechanics (Graduate)
 - e. Advanced Dynamics (4th year)
 - f. Electromagnetic Theory (3rd year)
 - g. Solid State Physics (3rd year)
 - h. Physics and Applied Physics Laboratory I Experiment (1st year)
 - i. Principles of Physics I tutorial discussion group (1st year)
 - j. General Introductory Physics laboratory sessions (1st year)

PUBLICATIONS

- (1) *Biopolymer dynamics driven by helical flagella*, A.K. Balin, A. Zöttl, J.M. Yeomans and **T.N. Shendruk**, *Physical Review Fluids*, *2*, 113102 (2017).
- (2) *Rotation-induced macromolecular spooling of DNA*, **T.N. Shendruk**^{*}, D. Sean^{*}, D. Berard^{*}, J. Wolf, J. Dragoman, S. Battat, G.W. Slater and S.R. Leslie, *Physical Review X*, *7*, 031005 (2017).
- (3) *Onset of meso-scale turbulence in active nematics*, A. Doostmohammadi^{*}, **T.N. Shendruk**^{*}, K. Thijssen^{*} and J.M. Yeomans, *Nature Communications*, *8*, 15326 (2017).
 - Highlighted by the The Rockefeller University Newswire and news outlets, including Phys.org and Science Newline.
- (4) *Dancing disclinations in confined living nematics*, **T.N. Shendruk**^{*}, A. Doostmohammadi^{*}, K. Thijssen^{*} and J.M. Yeomans, *Soft Matter*, *13* (21), 3853-3862 (2017).
 - Cover article
 - Highlighted in Seek, the Rockefeller University research magazine
- (5) *Rapid dynamics of cell-shape recovery in response to local deformations*, K. Haase, **T.N. Shendruk** and A. Pelling, *Soft Matter*, *13* (3) 567-577 (2017).
- (6) *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).
- (7) *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.
- (8) *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.
- (9) *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).
- (10) *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).
- (11) *Hotspots of boundary accumulation: Dynamics and statistics of micro-swimmers in flowing films*, A.J.T.M. Mathijssen, A. Doostmohammadi, J.M. Yeomans and **T.N. Shendruk**, *Journal of the Royal Society Interface*, *13*, 20150936 (2016).
- (12) *Upstream swimming in microbiological flows*, A.J.T.M. Mathijssen, **T.N. Shendruk**, J.M. Yeomans and A. Doostmohammadi, *Physical Review Letters*, *116* (2), 028104 (2016).
- (13) *Adverse-mode FFF: Multi-force ideal retention theory*, **T.N. Shendruk** and G.W. Slater, *Chromatography*, *2* (3), 392-409 (2015).

- (14) *Multi-particle collision dynamics algorithm for nematic fluids*, **T.N. Shendruk** and J.M. Yeomans, *Soft Matter*, *11*, 5101-5110 (2015).
- (15) *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).
- (16) *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).
- (17) *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
- (18) *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).
- (19) *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).
- (20) *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).
- (21) *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).
- (22) *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).
- (23) *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).
- (24) *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).
- (25) *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).
- (26) *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).
- (27) *Operational-modes of field-flow fractionation in microfluidic channels*, **T.N. Shendruk** and G.W. Slater, *Journal of Chromatography A*, *1233*, 100-108 (2012).
- (28) *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).

- (29) *Interfacial properties and characterization of Sc/Si multilayers*, **T.N. Shendruk**, A. Moewes, E.Z. Kurmaev, P. Ochin, H. Maury, J.-M. André, K. Le Guen and P. Jonnard, *Thin Solid Films*, 518 (14), 3808-3812 (2010).
- (30) *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).
- (31) *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) *Enhanced gel formation in binary mixtures of nanocolloids with short-range attraction*, J.L. Harden, H. Guo, M. Bertrand, **T.N. Shendruk**, S. Ramakrishnan and R.L. Leheny, *Journal of Chemical Physics*, accepted, A17.09.0289R, December (2017).

- Future cover article

* joint first author

SELECT INVITED
COLLOQUIA
(TOTAL OF 12)

- (1) University of York, Department of Mathematics
 - *Dancing to turbulence: Transitions in confined active nematic flows* June 2017
- (2) MIT, Physical Mathematics Seminar
 - *From Ceilidh dancing to meso-scale turbulence* Oct. 2016
- (3) Imperial College London, Interscale interactions in fluid mechanics and beyond
 - *Screened active matter* July 2016
- (4) Theoretical Soft Matter and Biophysics, Institute of Complex Systems and Institute for Advanced Simulation, Forschungszentrum Jülich
 - *A nematic-MPCD algorithm* Nov. 2015
- (5) University of Stuttgart, Institute for Computational Physics
 - *Bifurcation of polyelectrolyte brushes* 2014

SELECT
CONFERENCE
PRESENTATIONS
(TOTAL OF 36)

- (1) *Active solvent-solute composites*, **T.N. Shendruk**, MRS Spring Meeting: Active Colloids with Order (2018) - upcoming invited participant talk.
- (2) *Dancing topological defects in living fluids*, **T.N. Shendruk**, A. Doostmohammadi, K. Thijssen and J. Yeomans, Gordon Research Conferences: Complex Active & Adaptive Material Systems (2017) - poster.
- (3) *Mixing in cytoplasmic suspensions: Moving beyond enhanced diffusivity*, **T.N. Shendruk**, The EMBO Fellows' Meeting (2016) - talk.
- (4) *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.
- (5) *Particle-based mesoscale algorithm for active matter*, **T.N. Shendruk**, J. Yeomans, Gordon Research Conferences: Soft Condensed Matter Physics (2015) - poster.

SCIENCE COMMUNICATION	(1) The Conversation,	
	• <i>How we simulated a microscopic wind farm — powered by bacteria</i>	2016
	(2) Financial Times	
	• 18 science briefs in the daily paper and FT Weekend Magazine	2014
	• <i>Scientist on Assignment</i> 15 blog posts	2014
	(3) EMBOencounters	
	• <i>Journalists and scientists share a common goal</i>	2014
(4) The Royal Institution Family Fun Day (London),		
• <i>Nature's Raincoats</i>	2014	
(5) Maclean's Magazine		
• <i>Where No Man has Tweeted Before</i>	2013	
(6) The Fulcrum (student newspaper)		
• Weekly science column (40 science briefs)	2010 to 2013	
(7) Gazette (university's online news publication)		
• 4 scientific profiles	2011	