

Emma K. Towlson

Center for Complex Network Research (CCNR), Northeastern University
177 Huntington Ave, Floor 11
Boston, MA, 02115
+1 (617) 373-2355
ektowlson@gmail.com

EMPLOYMENT	Associate Research Scientist	Jan. 2018 - present
	CCNR, Northeastern University P.I.: Prof. Albert-László Barabási	
	Part-time Lecturer	Sep. 2016 - present
	Research Affiliate Media Laboratory, Massachusetts Institute of Technology P.I.: Prof. Ed Boyden	Apr. 2018 - present
	Postdoctoral Research Associate	Apr. 2015 - Jan. 2018
EDUCATION	PhD Physics, Network Science	Oct. 2011 - Mar. 2015
	University of Cambridge. Cavendish Laboratory (Theory of Condensed Matter (TCM) Group) and Girton College. Supervisor: Dr. Sebastian Ahnert Collaborating with Prof. Ed Bullmore and the Brain Mapping Unit (BMU) Funded by the Engineering and Physical Sciences Research Council (EPSRC) Associate member of the Institute of Physics TCM graduate representative	
	MMathPhys (First Class Honours)	Oct. 2007 - Jun. 2011
	University of Warwick 4th Year project “Superfluidity in Strongly Coupled Light-Matter Systems” Supervisor: Dr. Marzena Szymanska	
	Undergraduate Research Scholarship Scheme (URSS)	Jul. 2010 - Sep. 2010
	University of Warwick Supervisor: Prof. Sandra Chapman	
COMPUTER SKILLS	Languages & Software: Extensive experience with Python programming, Bash scripting, and Matlab. Limited experience with C++. Working knowledge of network related software (including NetworkX, Cytoscape, Gephi, and GraphViz), L ^A T _E X typesetting, Microsoft Office, and OpenOffice. Exposure to image processing software (AFNI and SUMA). Large-Scale Computing Experience with cluster computing (Warwick University, Northeastern University), and the Google Cloud Platform. Operating Systems: Mac OS X, UNIX/Linux, Raspbian, and Windows. Courses: <i>C++: Programming in Modern C++</i> , University Computer Service Training, University of Cambridge (Oct. 2014 - Mar. 2015). <i>Algorithms: Design and Analysis Part I</i> , online course provided by Stanford University (Oct. 2014 - Dec. 2014).	
EDITORIAL DUTIES	Network Neuroscience, MIT Press Guest editor for Focus Feature “Bridging Scales and Levels” dedicated to participants of the Network Neuroscience satellite at NetSci 2017.	Jun. 2017 - Jun. 2018

PEER REVIEW **Journals:** *Nature Neuroscience*, *PLOS Computational Biology*, *Network Neuroscience*, *Scientific Reports*, *The European Physical Journal B (EPJ B)*, and *IEEE's Transactions on Network Science and Engineering*.

Funding proposals: Served on National Science Foundation (NSF) Advisory Panel. Reviewed for NSF, The City College of New York and Memorial Sloan-Kettering Cancer Center (CCNY-MSK) Partnership, and the Army Research Office (ARO).

Conference calls: ICCS 2018, NetSci 2018, IC2S2 2018, NetSciX 2018, CompleNet 2016 & 2017.

PUBLICATIONS ***Caenorhabditis elegans* and the network control framework - FAQs**

Emma K. Towlson, Gang Yan, Petra E. Vértés, Yee Lian Chew, Denise S. Walker, William R. Schafer, and Albert-László Barabási. *Under review at Phil. Trans. B*, 2018.

Network control principles predict neuron function in the *C. elegans* connectome

Gang Yan[†], Petra E. Vértés[†], Emma K. Towlson[†], Yee Lian Chew, Denise S. Walker, William R. Schafer, and Albert-László Barabási. *Nature*, 2017, 550: 519-523.

[†] *These authors contributed equally to this work.*

Recordings of *Caenorhabditis elegans* locomotor behaviour following targeted ablation of single motoneurons

Yee Lian Chew, Denise S. Walker, Emma K. Towlson, Petra E. Vértés, Gang Yan, Albert-László Barabási, and William R. Schafer. *Scientific Data*, 2017, 4: 170156.

Effect of antipsychotics on the community structure of brain functional networks

Ryan Flanagan, Lucas Lacasa, Emma K. Towlson, Sang Hoon Lee, and Mason A. Porter. *In preparation*, 2018.

Brain Networks Reveal the Effects of Antipsychotic Drugs on Schizophrenia Patients and Controls

Emma K. Towlson, Petra E. Vértés, Ulrich Müller, and Sebastian E. Ahnert. *In preparation*, 2018.

Multi-Subject Stochastic Blockmodels for Adaptive Analysis of Individual Differences in Human Brain Network Cluster Structure

Dragana M. Pavlović, Bryan Guillaume, Emma Towlson, Soroosh Afyouni, Petra E. Vértés, Thomas Yeo, Edward T. Bullmore, and Thomas E. Nichols. *Under review at NeuroImage*, 2018.

The Rich Club of the *C. elegans* Neuronal Connectome

Emma K. Towlson, Petra E. Vértés, Sebastian E. Ahnert, William R. Schafer, and Edward T. Bullmore. *The Journal of Neuroscience*, 2013, 33(15): 6380-6387.

CONFERENCE **Cultivating Tipping Points: Network Science in Teaching**

PROCEEDINGS Catherine Cramer, Raluca Gera, Michaela Labriole, Hiroki Sayama, Lori Sheetz,

Emma Towlson, and Stephen Uzzo. *Complex Networks IX: Proceedings of the 9th Conference on Complex Networks CompleNet 2018*, Springer Proceedings in Complexity, pp 175-183.

Centrality Clubs and Concepts of the Core: Decoding the Communicative Organisation of the Brain

Emma K. Towlson, Petra E. Vértés, Sebastian E. Ahnert, and Edward T. Bullmore. *Proceedings of the European Conference on Complex Systems 2012*, Springer Proceedings in Complexity 2013, pp 497-501.

**INVITED
TALKS**

Introduction to network control: Concepts, methods, and applications to neuroscience

Educational lecture at OHBM, Singapore (Jun. 2018)

Control principles in the *Caenorhabditis elegans* nervous system

Talks at NetSci, Paris (Jun. 2018) and Analysis and Interpretation of Connectomes, Janelia Research Campus (May 2018)

Network Science

Talk at the Genetics Bootcamp, Dana-Farber Cancer Institute, Harvard Medical School (Jan. 2018)

How ‘rich’ is your brain?

Contribution to the Minute Madness competition to celebrate the 10th anniversary of women@CL. The Computer Laboratory, University of Cambridge (May 2014).

**TALKS &
CONFERENCE
CONTRIBUTIONS**

Control principles in the *Caenorhabditis elegans* nervous system

Talks at CompleNet, Northeastern University (2018) and Janelia Research Campus (Apr. 2016).

¿Six degrees of separación?: Experiences from designing and implementing an intensive, interdisciplinary, and project-based network science course in Guadalajara

Talk at NetSci, The JW Marriott Hotel, Indianapolis (Jun. 2017).

Experimental Test of Network Control: Functional predictions in the *C. elegans* nervous system

Poster at NetSci, The JW Marriott Hotel, Indianapolis (Jun. 2017)

Spatial Characteristics of Mesoscopic Connections in the Mouse Brain Network

Talk at NetSci, The K-Hotel, Seoul (Jun. 2016).

Connectivity in the Mouse Brain

Talk at Dana-Farber Cancer Institute, Harvard Medical School (Nov. 2015).

A Short Introduction to Networks/Graph Theoretical Analyses

Lecture at the first Summer Workshop on the Dynamic Brain, Friday Harbor Laboratories. Co-hosted by the Allen Institute for Brain Science and the Computational Neuroscience Program at the University of Washington (Sep. 2014).

Brain networks reveal the effects of antipsychotic drugs on schizophrenia patients and controls

Talk at NetSci, University of California (Jun. 2014).

The Globally Integrative Rich Club of the *C. elegans* Neuronal Connectome

Talk at 25th IUPAP International Conference on Statistical Physics, Seoul National University (Jul. 2013); poster at NetSci, Copenhagen (Jun. 2013).

Large Scale Brain Networks

Talk at Graduate Research Seminar, Girton College, University of Cambridge (Feb.

2013).

“Networks: Complex Futures”, LERU BRIGHT Conference

Representative for the University of Cambridge, University of Amsterdam (Aug. 2012)

Centrality Clubs and Concepts of the Core: Decoding the Communicative Organisation of the Brain

Talks at the BMU Networks Meeting, University of Cambridge (Oct. 2012) and ECCS, Université Libre de Bruxelles (Sep. 2012); poster at NetSci, Northwestern University (Jun. 2012).

Constructing Dynamic Networks and State Spaces from High Resolution Trading Data: Information Theoretic Approaches

Poster at the 4th Annual Oxford University SIAM Student Conference (Feb. 2011).

**FUNDING &
AWARDS**

NSF NCS-FO: Collaborative Research

Oct. 2017

\$237,499 over 2 years (of the \$707,296 total awarded to four groups).

Title: Ground-Truth Analysis and Modeling of Entire Individual *C. elegans* Nervous Systems

P.I.s: Prof. Edward Boyden (MIT), Prof. Albert-László Barabási (NEU), Prof. Max Tegmark (MIT), and Prof. Steven Flavell (MIT).

Responsible for the BarabásiLab component of the grant, both in terms of writing the proposal and carrying out the research given its success.

Network Neuroscience Satellite

Jun. 2017

James S. McDonnell Foundation (JSMF) sponsored \$20,000.

EPSRC Scholarship

2011

Awarded for research proposal for graduate study at the University of Cambridge.

Warwick Postgraduate Research Scholarship (WPRS)

2011

Selected for a prestigious scholarship for further study at the University of Warwick, one of around 15 available university wide.

Undergraduate Research Scholarship Scheme (URSS)

2010

Awarded £1000 for summer research proposal at the University of Warwick.

**ORGANISA-
TIONAL
EXPERIENCE**

The International Conference on Complex Systems 2018

Jul. 2018

Special sessions chair. The Hyatt Regency, Cambridge.

CompleNet 2018

Mar. 2018

Local organising chair. NEU, Boston.

Network Neuroscience Satellite

Jun. 2017

The JW Marriott Hotel, Indianapolis.

Spearheaded the timely development of a Brain Networks NetSci associated satellite that had been running for 2 years into a larger Network Neuroscience satellite. Led the committee of ~ 20 experts in the field to achieve this, and sustained over 120 attendees throughout the day, making it one of the largest satellites NetSci has hosted to date. Continuing coordination of expansion for the next conference in Jun. 2018.

Cavendish Graduate Student Conference 2013

Dec. 2013

Chair of the organising committee for this one day conference for c.150 young physics researchers at Cambridge. Plenary speaker Dr. Simon Singh and sponsored by BP.

Organiser for the Cambridge Networks

Network (CNN)

Jul. 2013 - Mar. 2015

Primarily conglomerated events by liaising with networks groups across the UK.

“The 3 Peaks Challenge: Warwick in Africa... in Wales?!”

Jul. 2011

Organised for and inspired 60 people to climb Ben Nevis, Scafell Pike and Snowdon in 24 hours. The event was covered in local media and raised around £15,000.

Warwick MathPhys Society

May 2008 - Jun. 2011

Co-founded the society, authored 2 revision guides and delivered lectures to under-

graduates. By 2011, the society held over 200 members and had secured sponsorship from Teach First.

EDUCATION RESEARCH & DEVELOPMENT	Networks in Classroom Education (NiCE) Teacher Workshop	Jul. 2017
	United States Military Academy (USMA), West Point	
	Led sessions in this workshop for ~ 30 K-12 teachers of various subjects, aimed at introducing Network thinking to the classroom and as a curriculum development tool.	
	Network Science Summer Course	Jun. 2017
	Universitat Politècnica de Catalunya (UPC), Barcelona	
	Designed and delivered a week long summer course introducing Network Science to ~ 30 Masters level students in the Statistics department.	
	Network Science Summer Course	Jun. 2017
	Signa Lab, Instituto Tecnológico y de Estudios Superiores de Occidente (ITESO), Guadalajara	
	Designed a 6 week long summer course introducing Network Science to ~ 20 undergraduate students from diverse disciplinary backgrounds, and delivered 2 of those weeks. The course is highly interactive, including hands-on activities with toy networks, drones, and Lego.	
TEACHING & SUPERVISION	Network Science Graduate Course	Sep. 2016 - Present
	Co-instructed with Prof. Albert-László Barabási and Dr. Sean Cornelius.	
	CCNR, Physics Department, Northeastern University.	
	Visiting Faculty	Aug. 2016 - Present
	Collaborated with and supported Jose Brum's career change from Director-General of the Brazilian Association for Synchrotron Light Technology to brain research.	
	Visiting Graduate Students	Aug. 2015 - Present
	Supervised and co-supervised 2 students visiting CCNR.	
	Summer Student	Jun. 2013 - Sep. 2013
	Co-supervised a student working on network community structure with Dr. Sebastian Ahnert.	
	Mathematics IA/B/Biology and Physics Supervisor for Natural Sciences Tripos Students	Oct. 2011 - Mar. 2015
	324 hours, King's, Trinity, Corpus Christi, and Pembroke Colleges, University of Cambridge.	
	IB Physics Lab Demonstrator	Oct. 2011 - Dec. 2011
	Cavendish Laboratory, University of Cambridge.	
	Mathematics Supervisor	Oct. 2010 - Jun. 2011
	60 hours, University of Warwick.	
OUTREACH	"What is so exciting about physics?"	Sep. 2015
	Featured in a booklet produced by Cavendish Inspiring Women (CiW) and distributed to high schools across the UK.	
	Physics at Work	Sep. 2012
	Gave talks on behalf of TCM to teenagers at the Cavendish Laboratory.	
	Physics Olympiad/Senior Physics Challenge	Jul. 2012, Jul. 2013, Jul. 2014
	Coach for the team of 17-18 year olds selected to represent the UK in the Physics Olympiad.	

**VOLUNTARY
WORK**

Warwick in Africa Project

Aug. 2009 - Aug. 2013

- Visited South Africa (Johannesburg and Stellenbosch) 5 times to lead classes and work with the African teachers to improve mathematics education in deprived townships.
- With 11 other volunteers opened a Winter School during the public sector strikes (Aug. 2010) to prepare finalists for their exams which was attended by more than 300 students. Received thanks from the South African Department of Education.
- During a small pilot scheme established links with Stellenbosch University (Jul. 2011) and following a personal ambition arranged for the first set of students from Makapula High School to be entered in the South African Mathematics Olympiad (Mar. 2012).
- Part of the interview panel for 2012 student teacher candidates.
- Co-ordinated the expansion of the scheme in Stellenbosch to involve the National University of Singapore, lecturers from the University of Warwick, and corporate volunteers from Ernst & Young and Standard Chartered (Jul. 2012).