

## Emma K. Towlson

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Center for Complex Network Research (CCNR), Northeastern University  
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EMPLOYMENT	<b>Associate Research Scientist</b>	Jan. 2018 - present
	CCNR, Northeastern University P.I.: Prof. Albert-László Barabási	
	<b>Part-time Lecturer</b>	Sep. 2016 - present
	<b>Research Affiliate</b> Media Laboratory, Massachusetts Institute of Technology P.I.: Prof. Ed Boyden	Apr. 2018 - present
	<b>Postdoctoral Research Associate</b>	Apr. 2015 - Jan. 2018
EDUCATION	<b>PhD Physics, Network Science</b>	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	
	<b>MMathPhys (First Class Honours)</b>	Oct. 2007 - Jun. 2011
	University of Warwick 4th Year project “Superfluidity in Strongly Coupled Light-Matter Systems” Supervisor: Dr. Marzena Szymanska	
	<b>Undergraduate Research Scholarship Scheme (URSS)</b>	Jul. 2010 - Sep. 2010
	University of Warwick Supervisor: Prof. Sandra Chapman	
COMPUTER SKILLS	<b>Languages &amp; Software:</b> 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 <sup>A</sup> T <sub>E</sub> X typesetting, Microsoft Office, and OpenOffice. Exposure to image processing software (AFNI and SUMA). <b>Large-Scale Computing</b> Experience with cluster computing (Warwick University, Northeastern University), and the Google Cloud Platform. <b>Operating Systems:</b> Mac OS X, UNIX/Linux, Raspbian, and Windows. <b>Courses:</b> <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	<b>Network Neuroscience, MIT Press</b> 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) panel for the funding call "Integrative Strategies for Understanding Neural and Cognitive Systems". 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<sup>†</sup>, Petra E. Vértés<sup>†</sup>, Emma K. Towlson<sup>†</sup>, Yee Lian Chew, Denise S. Walker, William R. Schafer, and Albert-László Barabási. *Nature*, 2017, 550: 519-523.

<sup>†</sup> *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  
PROCEEDINGS**

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

Catherine Cramer, Raluca Gera, Michaela Labriole, Hiroki Sayama, Lori Sheetz, Emma Towlson, and Stephen Uzzo. *Complex Networks IX: Proceedings of the 9<sup>th</sup> 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.

## **ORGANISATIONAL 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 undergraduates. By 2011, the society held over 200 members and had secured sponsorship from Teach First.

**EDUCATION**      **Networks in Classroom Education (NiCE) Teacher Workshop**      Jul. 2017  
**RESEARCH &**      United States Military Academy (USMA), West Point  
**DEVELOPMENT**      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 &**      **Network Science Graduate Course**      Sep. 2016 - Present  
**SUPERVISION**      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.

**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).