Hyun Youk

**Contact Information**

University of Massachusetts Chan Medical School  
E-mail: hyun.youk@umassmed.edu  
Lab website: http://www.youklab.org  
ORCID: orcid.org/0000-0003-1687-5760

Albert Sherman Center, Room 5-1055  
368 Plantation Street  
Worcester, MA 01605

**Research Interests**

Long-lived, complex dynamics of living systems, with focus on:

- **Self-replicating dynamics**: limits to maintaining it and when it can stop and resume
- **Self-organizing dynamics**: spatial-order形成 dynamics with computer experiments

**Current Position**

Associate Professor of Quantitative Biology  
11/2020 - Present  
University of Massachusetts Chan Medical School, MA USA  
Department of Systems Biology

**Past Positions**

Assistant Professor of Physics & Quantitative Biology  
01/2015 - 10/2020  
Delft University of Technology, The Netherlands  
Kavli Institute of Nanoscience

Damon Runyon Postdoctoral Fellow  
2011 - 2014  
Laboratory of Wendell Lim - University of California, San Francisco, USA

**Education**

Massachusetts Institute of Technology, MA USA  
2006 - 2010  
Ph.D. in Physics

Johns Hopkins University, MD USA  
2004 - 2006  
M.A. in Astronomy & Physics

University of Toronto: Victoria College, Canada  
2000 - 2004  
Honours B.Sc. in Physics & Mathematics ("high distinction" designation)

**Selected Awards**

2022 - NIH-NIGMS Maximizing Investigators’ Research Award (MIRA)
2018 - EMBO Young Investigator
2018 - CIFAR Azrieli Global Scholar  
- CIFAR: Canadian Institute For Advanced Research  
- 2-year appointment at CIFAR for junior PIs of any nationality and country of residence.
2017 - IUPAP Young Scientist Prize in Biological Physics  
- IUPAP: International Union of Pure and Applied Physics  
- International award for young investigators within 8 years of obtaining a PhD.
2016 - Teacher of the Year Award in Nanobiology (Quantitative biology) program, TU Delft
2016 - Dutch Organization for Scientific Research (NWO) VIDI Physics Award  
- 5-year personal grant from NWO’s physics division (FOM).
2015 - European Research Council (ERC) Starting Grant  
- 5-year personal grant for early career PIs in Europe.
2014 - NIH-NIGMS K99/R00 Pathway to Independence Award. - Declined  
- 5-year grant to support postdoc-to-faculty transition and starting PIs in USA.  
- Declined due to my move to Europe.
2011 - Damon Runyon Fellowship Award  
- 3-year postdoctoral fellowship.
2011 - Jane Coffin Childs Memorial Fund Fellowship - Declined
2011 - Miller Research Fellowship (University of California, Berkeley) - Declined
   - 3-year independent research fellowship in any field of basic science.
2010 - Finalist, American Physical Society's (APS) PhD Thesis Prize in Biological Physics
   - 1 of 3 finalists: Annual prize for outstanding PhD research in biological physics.
2008 - NSERC Postgraduate Scholarship (2 years of graduate fellowship).
   - NSERC: Natural Sciences and Engineering Research Council of Canada.
2006 - Lester Wolfe Fellowship in Physics (Dept. of Physics, MIT).
2006 - Krieger School of Arts and Sciences Excellence in Teaching Award.
   - Campus-wide award: One of three teaching assistant winners in Arts & Sciences.
2003 - 1st Prize at the 39th Canadian Undergraduate Physics Conference.
   - National Winner: Award for best undergrad research and presentation in Canada.
2003 - Margaret & Thomas Paxton Taylor Award in Mathematics (Univ. of Toronto).
2000 - Arthur L. Schawlow Physics Scholarship (Victoria College, Univ. of Toronto).

Publications:

A. Xu and H. Youk.
Cellular biophysics: Electric cell death
Nature Physics (News and Views) (In press 2024)

R. M. Walker, V. C. Sanabria, and H. Youk.
Microbial life in slow and stopped lanes
Trends in Microbiology (Review) (Dec. 2023)

H. Daneshpour, P. van den Bersselaar, C.-H. Chao, T. G. Fazzio, and H. Youk.
Macroscopic quorum sensing sustains differentiating embryonic stem cells
Nature Chemical Biology (Research Article) 19, 596-606 (Jan. 2023)
bioRxiv (Preprint) (December 2020)

D. S. Laman Trip, T. Maire, and H. Youk.
Slowest possible replicative life at frigid temperatures for yeast
Nature Communications (Research Article) 13, 7518 (Dec. 2022)
bioRxiv (Preprint) (June 2022)

L. Koopmans and H. Youk.
Predictive landscapes hidden beneath biological cellular automata
Journal of Biological Physics (Review) 47, 355-369 (Nov. 2021)
arXiv (Preprint) (May 2021)

T. Maire, T. Allertz, M. A. Betjes, and H. Youk.
Dormancy-to-death transition in yeast spores occurs due to gradual loss of gene-expressing ability
Molecular Systems Biology (Research Article) 16, e9245 (Nov. 2020)
bioRxiv (Preprint) (August 2020)

D. S. Laman Trip and H. Youk.
Yeasts collectively extend the limits of habitable temperatures by secreting glutathione
Nature Microbiology (Research Article) 5, 943-954 (April 2020)
bioRxiv (Preprint) (August 2019)

Y. Dang, D. A. J. Grundel, and H. Youk.
Cellular dialogues: cell-cell communication through diffusible molecules yields dynamic spatial patterns
H. Daneshpour and H. Youk.
Modelling cell-cell communication for immune systems across space and time
*Current Opinion in Systems Biology* (Review) 18, 44-52 (Dec. 2019)

D. S. Laman Trip, T. Maire, and H. Youk.
Evaluation of Schink et al.: Having the gem shine through a fog
*Cell Systems* (Featured as Exemplary Peer Review), 9, 3-7 (July 2019)

E. P. Olimpio*, Y. Dang*, and H. Youk.
Statistical dynamics of spatial-order formation by communicating cells
*iScience* (Research Article - *co-first authors), 2, 27-40 (April 2018)

E. P. Olimpio, D. R. Gomez-Alvarez, and H. Youk.
Progress towards quantitative design principles of multicellular systems
in *Systems Biology* (Book chapter) - (Editors: J. Nielsen & S. Hohmann) (March 2017)

B. A. Doganer, L. K. Q. Yan, and H. Youk.
Autocrine signaling and quorum sensing: Extreme ends of a common spectrum
*Trends in Cell Biology* (Review) 26, 262-271 (April 2016)

T. Maire and H. Youk.
Molecular-level tuning of cellular autonomy controls the collective behaviors of cell populations
*Cell Systems* (Research Article) 1, 349-360 (Nov. 2015)

T. Maire and H. Youk.
A collective path towards regeneration
*Cell* (Preview), 161, 195-196 (April 2015).

**Publications:**

Before starting my group 2005-2014

H. Youk, and W. A. Lim.
Sending mixed messages for cell population control
*Cell* (Preview), 158, 973-975 (Aug. 2014).

H. Youk, and W. A. Lim.
Secreting and sensing the same molecule allows cells to achieve versatile social behaviors
*Science* (Research Article), 343, 1242782 (Feb. 2014).

H. Youk and A. van Oudenaarden.
Microbiology: Altruistic defence
*Nature* (News and Views), 467 34-35 (Sept. 2010).

H. Youk, A. Raj, and A. van Oudenaarden.
Imaging single mRNA molecules in yeast
in *Method in Enzymology: A Guide to Yeast Genetics (3rd Ed.)* (2010).

H. Youk and A. van Oudenaarden.
Growth landscape formed by perception and import of glucose in yeast
*Nature* (Research Article), 462, 875-879 (Dec. 2009).
J. Gore, H. Youk, and A. van Oudenaarden. 
Snowdrift game dynamics and facultative cheating in yeast 
Nature (Research Letter). 459, 253-256 (May 2009).

G.-W. Chern, D. Clarke, H. Youk, and O. Tchernyshyov. 
Halfvortices in flat nanomagnets 
in Quantum Magnetism, Proceedings of NATO Advanced Study Institute (2008)

J.B. Fouet, F. Mila, D. Clarke, H. Youk, O. Tchernyshyov, P. Fendley, and R.M. Noack. 
Condensation of magnons and spinons in a frustrated ladder 
Physical Review B (Research Article) 73, 214405, (2006).

H. Youk, G.-W. Chern, K. Merit, B. Oppenheimer, and O. Tchernyshyov. 
Composite domain walls in flat nanomagnets: The magnetostatic limit 
Journal of Applied Physics (Research Article) 99, 08B101, (2006).

G.-W. Chern, H. Youk, and O. Tchernyshyov. 
Topological defects in flat nanomagnets: The magnetostatic limit 
Journal of Applied Physics (Research Article) 99, 08Q505, (2006).

H. Youk, R. List, and T. Ola. 
The growth of ice crystals by molecular diffusion 
Journal of the Atmospheric Sciences (Research Article) 63, (6) 1650-1657. (2006).

H. Youk. 
Numerical study of quadrupole magnetic traps for neutral atoms: Anti-Helmholtz coils and U-chip 
Canadian Undergraduate Physics Journal (Research Article) Vol. III (2), 13-18. (2005).

Teaching

- At UMass Chan Medical School:
  - Co-director of Graduate Program in Systems, Computational, and Quantitative Biology (grad.; 2023 - present)
  - Founded and co-directed Summer Program in Quantitative Biology (undergrad, 2023)
  - Quantitative Approaches in Gene Regulation - Co-instructor (grad.; 2022 - present)
  - Systems Biology - Co-instructor (grad.; 2022 - present)
  - Cancer and Cell Signaling - Co-instructor (grad.; 2020 - 2021)

- At TU Delft:
  - AP3162: Physics of Cellular Systems - Mathematical modelling of cellular dynamics (grad.; 2016 - 2020)
  - AP3161D: Cellular dynamics - Stochasticity and Signaling (grad.; 2015 - 2016)
  - NB3030: Proposal writing (grad; 2018 - 2019)
  - NB1140: Physics I - Classical Mechanics and Thermodynamics (undergrad; 2015 - 2019)
  - TN1661: Orientation to physics research (undergrad.; 2015 - 2017)
  - Nanobiology minor (undergrad.; 2016)

- At MIT:
  - Instructor for Advanced Undergraduate Seminar - 7.342: Systems and Synthetic Biology: How the Cell Solves Problems. (undergrad.; Sept. - Dec. 2010)
  - Instructor for Physics III: Survey of Modern Physics (June - Aug. 2010)
    Minority Introduction To Engineering and Science (MITES 2010) program at MIT.
  - Instructor for Calculus II: Multivariable calculus (June - Aug. 2009)
Minority Introduction To Engineering and Science (MITES 2009) program at MIT.
- Instructor for Physics III: Oscillations and Waves (June - Aug. 2008)

Minority Introduction To Engineering and Science (MITES 2008) program at MIT.

**Advisees**

- **Current PhD Students:**
  Michela Oster (Sept. 2023 –)

- **Previous PhD Students:**
  4. Diederik Laman Trip (09/2017 - 02/2022)
    - Next: Postdoc, Pedro Beltrao’s group at ETH Zurich, Switzerland
  3. Theo Maire (09/2017 - 02/2022)
    - Next: Postdoc, Felix Hol’s group at Pasteur Institute, Paris
  2. Hirad Daneshpour (10/2016 - 09/2021)
    - Next: Consultant, KPMG, The Netherlands
  1. Yiteng Dang (11/2015-01/2020)
    - Next: ELBE Postdoc Fellow at Max Planck Institutes (MPI) for Physics of Complex Systems & of Molecular Cell Biology and Genetics, Germany