

## JOHN H ABEL

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### EDUCATION

2018	<b>Harvard University</b> PhD in Systems Biology
2015	<b>UC Santa Barbara</b> MS in Chemical Engineering
2013	<b>Tufts University</b> BS in Chemical Engineering <i>magna cum laude</i>

### RESEARCH POSITIONS

Postdoctoral fellow	<b>Harvard Medical School</b> Department of Anesthesia, Critical Care and Pain Medicine Massachusetts General Hospital <i>with Emery N. Brown</i>	2018 -
Research affiliate	<b>Massachusetts Institute of Technology</b> Picower Institute for Learning and Memory	2018 -
Graduate researcher	<b>Harvard University</b> Department of Systems Biology <i>with Francis J. Doyle III, Elizabeth B. Klerman</i>	2015 - 2018
Graduate researcher	<b>UC Santa Barbara</b> Department of Chemical Engineering <i>with Francis J. Doyle III, Linda R. Petzold</i>	2013 - 2015
Undergraduate researcher	<b>Tufts University</b> Department of Chemical Engineering <i>with Hyunmin Yi</i>	2011 - 2013

### HONORS, AWARDS, AND FELLOWSHIPS

2020	Research Merit Award, Society for Research on Biological Rhythms
2019	Certificate of Distinction in Teaching, Harvard University
2019	NIH Postdoctoral F32 Ruth L. Kirschstein NRSA Fellowship
2018	NIH Postdoctoral T32 Traineeship, Harvard Medical School
2016	NIH Predoctoral T32 Traineeship, Harvard Medical School
2016	Research Excellence Award, Society for Research on Biological Rhythms
2014	Mellichamp Fellowship in Systems Biology, UC Santa Barbara
2014	Honorable Mention, NSF Graduate Research Fellowship Program
2013	High Thesis Honors, Tufts University
2012	Meritorious Winner, COMAP Mathematical Contest in Modeling
2011	Meritorious Winner, COMAP Mathematical Contest in Modeling

## FUNDING

Automatic control of propanidid and propofol anesthesia-induced unconsciousness  
NIH/NIA F32-AG064886, role: PI, 9/1/2019-9/1/2021

## JOURNAL ARTICLES

<https://scholar.google.com/citations?user=B5qvOBcAAAAJ>

1. **JH Abel**<sup>†</sup>, MA Badgeley<sup>†</sup>, B Meschede-Krasa, G Schamberg, IC Garwood, K Lecamwasam, S Chakravarty, DW Zhou, M Keating, PL Purdon, and EN Brown, "Machine learning of EEG spectra classifies unconscious states during propofol-induced anesthesia," submitted.
2. Y Shan, **JH Abel**, Y Li, M Izumo, KH Cox, B Jeong, S-H Yoo DP Olson, FJ Doyle III, and JS Takahashi, "Dual-color single-cell imaging of the suprachiasmatic nucleus reveals a circadian role in network synchrony," in revision.
3. F Rijo-Ferreira, VA Acosta-Rodriguez<sup>†</sup>, **JH Abel**<sup>†</sup>, I Kornblum, I Bento, G Kilaru, EB Klerman, MM Mota, and JS Takahashi, "The malaria parasite has an intrinsic clock," *Science* 368 (6492), 2020. doi: 10.1126/science.aba2658
4. **JH Abel**, K Lecamwasam, MA St. Hilaire, EB Klerman, "Recent advances in modeling sleep: from the clinic to society and disease," *Current Opinion in Physiology* 15, 2020. doi: 10.1016/j.cophys.2019.12.001
5. **JH Abel**, A Chakrabarty, EB Klerman, and FJ Doyle III, "Pharmaceutical-based entrainment of circadian phase via nonlinear model predictive control," *Automatica* 100, 2019. doi: 10.1016/j.automatica.2018.11.012
6. C Mazuski, **JH Abel**, S Chen, T Hermanstyn, FJ Doyle III, and ED Herzog, "Entrainment of circadian rhythms depends on firing rates and neuropeptide release of VIP SCN neurons," *Neuron* 99 (3), 2018. doi: 10.1016/j.neuron.2018.06.029
7. V Carmona-Alcocer, **JH Abel**, TC Sun, LR Petzold, FJ Doyle III, CL Simms, and ED Herzog, "Ontogeny of circadian rhythms and synchrony in the suprachiasmatic nucleus," *Journal of Neuroscience* 38 (6), 2018. doi: 10.1523/jneurosci.2006-17.2017
8. **JH Abel**<sup>†</sup>, B Drawert<sup>†</sup>, A Hellander, and LR Petzold, "GillesPy: a Python package for stochastic model building and simulation," *IEEE Life Sciences Letters* 2 (3), 2017. doi: 10.1109/lis.2017.2652448
9. **JH Abel** and FJ Doyle III, "A systems theoretic approach to analysis and control of mammalian circadian dynamics," *Chemical Engineering Research and Design* 116, 2016. doi: 10.1016/j.cherd.2016.09.033
10. S Jung, **JH Abel**, J Starger, and H Yi, "Porosity-tuned chitosan-polyacrylamide hydrogel microspheres for improved protein conjugation," *Biomacromolecules* 17 (7), 2016. doi:10.1021/acs.biomac.6b00582
11. **JH Abel**<sup>†</sup>, K Meeker<sup>†</sup>, D Granados-Fuentes, PC St. John, T Wang, BB Bales, FJ Doyle III, ED Herzog, and LR Petzold, "Functional network inference of the suprachiasmatic nucleus," *Proceedings of the National Academy of Sciences* 113 (16), 2016. doi: 10.1073/pnas.1521178113
12. E Kang, S Jung, **JH Abel**, A Pine, and H Yi, "Shape-encoded chitosan-polyacrylamide hybrid hydrogel microparticles with controlled macroporous structures via replica molding for programmable biomacromolecular conjugation," *Langmuir* 32 (21), 2016. doi: 10.1021/acs.langmuir.5b04653

13. **JH Abel**, LA Widmer, PC St. John, J Stelling, and FJ Doyle III, "A coupled stochastic model explains differences in Cry knockout behavior," *IEEE Life Sciences Letters* 1 (1), 2015. doi: 10.1109/lis.2015.2439498
14. PC St. John, SR Taylor, **JH Abel**, and FJ Doyle III, "Amplitude metrics for cellular circadian bioluminescence reporters," *Biophysical Journal* 107 (11), 2014. doi: j.bpj.2014.10.026

## PEER-REVIEWED CONFERENCE PROCEEDINGS

1. **JH Abel**, MA Badgeley, TE Baum, S Chakravarty, PL Purdon, EN Brown, "Constructing a control-ready model of EEG signal during general anesthesia in humans," in press for *21st IFAC World Congress*. arXiv: 1912.08144
2. AS Waite<sup>†</sup>, S Chakravarty<sup>†</sup>, **JH Abel**, EN Brown, "A simulation-based comparative analysis of PID and LQG control for closed-loop anesthesia delivery," in press for *21st IFAC World Congress*. arXiv: 1912.06724
3. **JH Abel**, A Chakrabarty, and FJ Doyle III, "Nonlinear model predictive control for circadian entrainment using small-molecule pharmaceuticals," *Proceedings of the 20th IFAC World Congress*, July 2017. doi: 10.1016/j.ifacol.2017.08.1596

## BOOK CHAPTERS

1. **JH Abel**, A Chakrabarty, and FJ Doyle III, "Controlling time: nonlinear model predictive control for populations of circadian oscillators," in *Emerging Applications of Control and System Theory*, R Tempo, S Yurkovich, P Misra Eds. New York, NY: Springer Publishing, 2018. ISBN: 978-3-319-67068-3
2. B Drawert, K Sanft, **JH Abel**, S Hellander, A Pourzanjani, A Hellander, and LR Petzold, "Simulation of well-mixed and spatially inhomogeneous biochemical systems," in *Quantitative Biology: Theory, Computational Methods, and Models*, B Munsky, W Hlavacek, L Tsimring, Eds. Cambridge, MA: The MIT Press, 2018. ISBN: 978-0-262-03808-9

## PATENTS AND APPLICATIONS

1. H Yi, S Jung, and **JH Abel** "Macroporous chitosan-polyacrylamide hydrogel microspheres and preparation thereof," US Patent App. 16/311,063, published 2019.
2. H Yi, E Kang, S Jung, and **JH Abel**, "Fabrication of macroporous polymeric hydrogel microparticles," US Patent App. 16/090,453, published 2019.

## CONFERENCE TALKS

1. **JH Abel**, A Asgari-Targhi, EB Klerman, and FJ Doyle III, "Designing a critical resetting protocol for achieving large phase shifts in humans," presented at Meeting of the Society for Research on Biological Rhythms (SRBR 2018), Amelia Island, Florida, USA, May 2018. (contributed talk)
2. **JH Abel**, A Chakrabarty, and FJ Doyle III, "Nonlinear model predictive control for circadian entrainment using small-molecule pharmaceuticals," presented at IFAC World Congress 2017, Toulouse, France, July 2017. (contributed talk, proceedings listed above)
3. **JH Abel**, "Control of the Mammalian Circadian Oscillator," presented at International School and Conference on Network Science (NetSci) 2017, Indianapolis, Indiana, USA, June 2017. (invited talk)

4. **JH Abel** and FJ Doyle III, "Identifying circadian drug targets for maintained oscillatory precision," presented at 2016 Meeting of the American Institute of Chemical Engineers (AIChE 2016), San Francisco, California, USA, November 2016. (contributed talk)
5. **JH Abel**, K Meeker, D Granados-Fuentes, PC St. John, T Wang, BB Bales, ED Herzog, LR Petzold, and FJ Doyle III, "Inferring the functional resynchronization network in the suprachiasmatic nucleus," presented at Meeting of the Society for Research on Biological Rhythms (SRBR 2016), Palm Harbor, Florida, USA, May 2016. (contributed talk)
6. **JH Abel** and LR Petzold (jointly given). "The effects of stochasticity on circadian rhythms," presented at Lorentz Center Workshop on Human Circadian Rhythms, Leiden, Netherlands, July 2015. (invited talk)

#### INVITED LECTURES

1. **JH Abel**, "Suprachiasmatic nucleus: a master circadian pacemaker in mammals," presented at MCB 186: Sleep and Circadian Clocks: From Biology to Public Health, Harvard University, February 2020.
2. **JH Abel**, "Circadian oscillation in the malaria parasite: from genes to models," presented at Scientific Staff Meeting of the Division of Sleep and Circadian Disorders, Brigham and Women's Hospital, November 2019.
3. **JH Abel**, "Suprachiasmatic nucleus: a master circadian pacemaker in mammals," presented at MCB 186: Sleep and Circadian Clocks: From Biology to Public Health, Harvard University, February 2019.
4. **JH Abel**, "Controlling circadian rhythms," presented at Chronobiology and the Brain Seminar Series, Harvard Medical School, February 2018.
5. **JH Abel**, "Suprachiasmatic nucleus: a master circadian pacemaker in mammals," presented at MCB 186: Sleep and Circadian Clocks: From Biology to Public Health, Harvard University, February 2018.
6. **JH Abel**, "Suprachiasmatic nucleus: a master circadian pacemaker in mammals," presented at MCB 186: Sleep and Circadian Clocks: From Biology to Public Health, Harvard University, February 2017.
7. **JH Abel**, "Modeling the Circadian Rhythm," presented at CS 341: Systems Biology, Colby College, November 2015.

## TEACHING

January 2020	<i>Introduction to Physiological Closed-Loop Control (HST S56)</i> , MIT Role: Instructor Taught 20-hour, 3-credit MIT course in control theory and its medical applications (in collaboration with three members of MIT NSRL). Approximately 20 graduate and undergraduate students.
Fall 2019	<i>Sleep (Gen Ed 1038)</i> , Harvard University Role: Teaching Fellow Instructors: Charles A. Czeisler, Frank A.J.L. Scheer
January 2019	<i>Introduction to Physiological Closed-Loop Control (HST S56)</i> , MIT Role: Instructor Taught 20-hour, 3-credit MIT course in control theory and its medical applications (in collaboration with four members of MIT NSRL). Approximately 20 graduate and undergraduate students.
Spring 2017	<i>Sleep and Circadian Clocks: Biology to Public Health (MCB 186)</i> , Harvard University Role: Teaching Fellow Instructors: Charles A. Czeisler, Frank A.J.L. Scheer
Fall 2014	<i>Analytical Methods in Chemical Engineering (CHE 132A)</i> , UCSB Role: Teaching Assistant Instructor: Baron Peters

## UNDERGRADUATE STUDENTS MENTORED

Kimaya Lecamwasam	MIT/Wellesley Undergraduate Researcher	2018 -
Shikha Sharma	Harvard University Summer Researcher	2016
David McBride	UC Santa Barbara Undergraduate	2015
Dustin Oakes	UC Santa Barbara HSAP	2015
Amanda N. Luan	UC Santa Barbara Undergraduate (co- with P.C. St. John)	2014
Jesse Starger	Tufts University Undergraduate	2013

## PROFESSIONAL ACTIVITIES

### *Professional societies*

American Institute of Chemical Engineers (AIChE), Member  
Society for Research on Biological Rhythms (SRBR), Member

### *Conference organizing*

July 2020	Chair, Organizer of Invited Session “Precision Medicine Enabled by Automatic Control” (with Lindsey Brown) at International Federation of Automatic Control (IFAC) World Congress
July 2017	Chair, Organizer of Invited Session “Optimal Control and Optimization of Biological Systems” (with Steffen Waldherr) at International Federation of Automatic Control (IFAC) World Congress

### *Peer reviewer*

Journal of Biological Rhythms  
International Federation of Automatic Control (IFAC) World Congress  
IEEE International Conference on Biomedical and Health Informatics  
IEEE Engineering in Medicine and Biology Society (EMBS) Conference  
PeerJ Computer Science

### *Computing skills*

- Languages: Python (including numpy, scipy, scikit-learn, pandas, cython), Matlab, some use of C++, R, and Unix shell scripts.
- Algorithms: Experience in methods for numerical solutions to ordinary and partial differential equations, stochastic simulation algorithms, linear/nonlinear programming, evolutionary algorithms, and artificial neural networks.
- Applications: Vim, Wolfram Mathematica,  $\text{\LaTeX}$ , Stata, common Microsoft database, spreadsheet, and presentation software.
- Operating Systems: Unix/Linux, OSX.

Current as of: May 23, 2020.