

Eran Agmon, Ph.D.

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Education and Training

- 2017–present **Postdoctoral Research Fellow**, *Department of Bioengineering, Stanford University.*
NIH F32 Postdoctoral Fellowship
- 2016–2017 **Postdoctoral Research Scientist**, *Department of Biological Sciences, Columbia University.*
- 2016 **Joint Ph.D., Informatics and Computing, and Cognitive Science**, *Indiana University.*
NSF IGERT Fellowship, Dynamics of Brain-Body-Environment Systems
- 2011 **M.Sc., Systems Science**, *Portland State University.*
- 2009 **B.S., Cognitive Science**, *University of California, San Diego.*

Research Experience

- 2018–present **Vivarium: a platform for multi-scale model integration in computational biology**, *Stanford University*
Advisor: Markus W. Covert,
- Led the development of an open-source platform that simplifies the integration of heterogeneous mechanistic models in computational biology.
 - Innovated in cutting-edge computational technology, including the invention of an interface that allows models to plug together, a simulation engine that runs at multiple spatial and temporal scales, and collaborative coding practices.
 - Applied the platform to model *E. coli* chemotaxis, micro-environment interactions, colony formation, and spatial organization.
- 2017–present **Whole-cell model of *E. coli***, *Stanford University*
Advisor: Markus W. Covert,
- Worked with a team of computational scientists, software engineers, and experimentalists to build the most comprehensive computational model of *E. coli* in the world.
 - Designed a factorial simulation protocol to identify flux constraints that agree with experimental fluxome data.
 - Collaborated with a visualization company to develop software that simplifies access to the model's output by navigating the causal connections.
- 2016–2017 **Molecular model of lipid membranes and cell death**, *Columbia University*,
Advisor: Brent R. Stockwell,
- Developed a coarse-grained molecular dynamics model of lipid membrane composition associated with a type of cell death called ferroptosis.
 - Predicted mechanisms for the deformation and degradation of the membrane, which were experimentally validated by collaborators in synthetic biology.
- 2013–2016 **Artificial protocell model (Dissertation research)**, *Indiana University*,
Committee: Randall D. Beer (chair), Colin Allen, Peter M. Todd, James A. Glazier,
- Developed a spatial model of a protocell that emerges from the co-construction of metabolism and membrane.
 - Applied a perturbation-based analysis to quantify the robustness, plasticity, fragility, and viability of the simulated cells.

- 2015 **Cellular model of tumor progression.**, *Indiana University*,
Sponsor: Amit Hagar,
 • Worked on a Cellular Potts model of tumors cells and their environments, focusing on the altered metabolic state known as the Warburg effect.
- 2011-2013 **Computational model of action-switching agents**, *Indiana University*,
Advisor: Randall D. Beer,
 • Built computational models to investigate the multi-scale dynamics of brain-body-environment system.
 • Applied genetic algorithms to search the parameter space of continuous-time recurrent neural networks.
- 2011 **Spiking neural model of sensory processing**, *Portland State University*
Advisor: Patrick Roberts,
 • Built a spiking neural model of sensory processing in the electroreception of Mormyrid electric fish, which successfully demonstrated their adaptive response to changing environmental conditions.

Other Experience

- 2016–2017 **Visiting Scholar**, *Program in Interdisciplinary Studies*,
Institute for Advanced Study, Princeton, NJ,
 • Co-founded YHouse, a research institute focused on artificial intelligence and the science of awareness.
- 2017 **Visitor**, *Earth-Life Science Institute Origins Network*,
Tokyo Institute of Technology, Tokyo, Japan,
 • Worked with an interdisciplinary group of scientists to model molecular evolution at the origins of life.

Teaching and Mentorship

- 2017-present **Research Mentor**,
 • Chris Skalnik (undergraduate honors thesis, Stanford University)
 • Michael Yang (undergraduate, Stanford University)
 • Colin Kalicki (undergraduate, Stanford University)
 • Gabrielle Cohn (undergraduate, Stanford University)
 • Julia Schaepe (PhD student, Stanford University)
 • Mac Klinkachorn (undergraduate, Stanford University)
 • Lee Talman (PhD student, University of Virginia).
- 2020 **Co-instructor**, *Build-A-Cell Chemical Reaction Network modeling tutorials*.
- 2019 **Mentor**, *Stanford International Genetically Engineered Machine (iGEM) competition*.
- 2014, 2016 **Associate Instructor**, *Indiana University*,
 • Course: Autonomous Robotics.
- 2013 **Associate Instructor**, *Indiana University*,
 • Course: Brains & Minds, Robots & Computers.

Publications

Journal publications

13. Hickey, J.W., **Agmon, E.**, Covert, M.W., and Nolan, G.P. (in preparation). CODEX imaging combined with integrative modeling of tumor/T-cell interactions.
12. **Agmon, E.**, Spangler, R.K., Skalnik, C.J., Morrison, J.H., Peirce, S.M., and Covert, M.W. (in preparation). Vivarium: an interface and engine for integrative multi-scale modeling in computational biology.

11. Skalnik, C.J., **Agmon, E.**, Spangler, R.K., Morrison, J.H., Talman, L., Peirce, S.M., and Covert, M.W. (in preparation). Simulating Colonies of Whole-Cell Escherichia coli Models.
10. **Agmon, E.**, and Spangler, R.K. (2020). A multi-scale approach to modeling *E. coli* chemotaxis. *Entropy*, 22: 1101.
9. Macklin, D.N., Ruggero, N.A., Carrera, J., Choi, H., Horst, T.A., Mason, J.C., Sun, G., **Agmon, E.**, DeFelice, M.M., Maayan, I., Lane, K., Spangler, R.K., Gillies, T.E., Paull, M.L., Akhter, S., Bray, S.R., Weaver, D.S., Keseler, I.M., Karp, P.D., Morrison, J.H., and Covert, M.W. (2020). Simultaneous cross-evaluation of heterogeneous *E. coli* datasets via mechanistic simulation. *Science*, 369, eaav3751.
8. Talman, L., **Agmon, E.**, Peirce, S.M., and Covert, M.W. (2019). Multiscale models of infection. *Current Opinion in Biomedical Engineering*, 11, 102-108.
7. **Agmon, E.**, Solon, J., Bassereau, P., and Stockwell, B.R. (2018). Modeling the effects of lipid peroxidation during ferroptosis on membrane properties. *Scientific Reports*, 8(1): 5155.
6. **Agmon, E.** and Stockwell, B.R. (2017). Lipid homeostasis and regulated cell death. *Current Opinion in Chemical Biology*. 39: 83-89.
5. **Agmon, E.**, Gates, A.J., and Beer, R.D. (2016). The structure of ontogenies in a model protocell. *Artificial Life* 22 (4): 499-517.
4. Taylor, T., Bedau, M. A., Channon, A., et al. (2016). Open-Ended Evolution: Perspectives from the OEE1 Workshop in York. *Artificial Life* 22 (3): 408-423.
3. **Agmon, E.**, Gates, A.J., Churavy, V. and Beer, R.D. (2016). Exploring the space of viable configurations in a model of metabolism-boundary co-construction. *Artificial Life*, 22 (2): 153-171.
2. **Agmon, E.**, & Beer, R. D. (2014). The evolution and analysis of action switching in embodied agents. *Adaptive Behavior*, 22(1), 3-20.
1. **Agmon, E.** (2014). Action Switching in Brain-Body-Environment Systems. In *Guided Self-Organization: Inception* (pp. 295-318). Springer Berlin Heidelberg.

Proceedings

5. Covert, M.W., and **Agmon, E.** (2019). Building whole-cell computational models to predict cellular phenotypes and accelerate discovery. *Proceedings of the Solvay Conference in Chemistry*.
4. **Agmon, E.**, Glazier, J.A, and Beer, R.D. (2017). Structural Coupling of a Potts Model Cell. *Proceedings of the 14th European Conference on Artificial Life 2017*, (pp. 13-20). MIT Press.
3. Virgo, N., **Agmon, E.**, and Fernando, C. (2017). Lineage selection leads to evolvability at large population sizes. *Proceedings of the Fourteenth European Conference on Artificial Life*, (pp. 420-427). MIT Press.
2. **Agmon, E.**, Gates, A.J., and Beer, R.D. (2015). Ontogeny and adaptivity in a model protocell. In P. Andrews, L. Caves, R. Doursat, S. Hickinbotham, F. Polack, S. Stepney, T. Taylor & J. Timmis (Eds.), *Proceedings of the European Conference on Artificial Life 2015* (pp. 216-223). MIT Press. **[Winner of Best Paper Award]**
1. **Agmon, E.**, Gates, A.J., Churavy, V. and Beer, R.D. (2014). Quantifying robustness in a spatial model of metabolism-boundary co-construction. In H. Sayama, J. Rieffel, S. Risi, R. Doursat & H. Lipson (Eds.), *Artificial Life 14: Proceedings of The Fourteenth International Conference on the Synthesis and Simulation of Living Systems* (pp. 514-521). MIT Press.

Selected Presentations

- Aug. 2020 **"Vivarium: an interface and engine for multi-scale modeling in computational biology"** *Build-A-Cell workshop*, NIST, Gaithersburg, MD.
- Feb. 2020 **"A multi-scale platform for whole-cells and colonies"** *Basement seminar*, Stanford Bioengineering Department.
- Sep. 2017 **"Structural coupling of a Potts model cell,"** *14th European Conference on Artificial Life*, Lyon, France.
- Mar. 2017 **"Computational models of heterogeneous lipid membranes,"** *Frontiers in Computing Systems*, Columbia University, NY.
- Feb. 2017 **"Simulations of Ferroptosis,"** *p53 Multi-Group meeting*, Columbia University, NY.
- July 2016 **"The biological foundations of enactivism,"** *Workshop on the Biological Foundations of Enactivism*, at *Artificial Life 16*, Cancun, Mexico.
- January 2016 **"The dynamics of protocell ontogenies"**, ENSO online seminar.
- October 2015 **"Ontogeny and adaptivity in a model protocell,"** *Evolutionary Systems Biology Lab*. *Albert Einstein College of Medicine*, New York, NY.
- October 2015 **"Action switching in embodied, dynamical agents,"** *Workshop on Self-organization in brain-body-environment systems*, University of Cincinnati, OH.
- July 2015 **"Ontogeny and adaptivity in a model protocell,"** *ECAL 15*, York, UK.
- December 2014 **"The physiology and metabolic closure of organisms,"** *Workshop on the causal factors of robustness and plasticity in living systems*, Bloomington, IN.
- August 2014 **"Quantifying robustness in a spatial model of metabolism-boundary co-construction,"** *Artificial Life 14*, New York City, NY.
- May 2014 **"Action switching in embodied, dynamical agents,"** *4th Annual Midwest Cognitive Science Conference*, Dayton, OH.
- June 2013 **"Action switching in brain-body-environment systems,"** *Department of Informatics*, *University of Zaragoza*, Spain.

Posters

- January 2020 **"A simulation platform for whole-cell/whole-colony modeling,"** *Build-A-Cell workshop*, NASA Ames, Mountain View, CA.
- August 2019 **"Adding an environment and motility to a large-scale model of *Escherichia coli*,"** *qBio*, San Francisco, CA.
- March 2018 **"Towards a whole-cell model of *E. coli*,"** *Allen Discovery Center*, Stanford, CA.
- Jan. 2017 **"The structure of ontogenies in a model protocell,"** *Expanding Views on the Emergence of the Biosphere*, Tokyo Institute of Technology, Tokyo, Japan.

Honors and Awards

- 2020 NIH F32 Postdoctoral Fellowship
- 2017 Outstanding Dissertation Award, Indiana University Cognitive Science
- 2015 Best Paper Award, European Conference on Artificial Life
- 2015 1st Place Poster, IGERT Research Showcase
- 2014-2015 NSF IGERT Fellowship in the Dynamics of Brain-Body-Environment Systems
- 2014 Outstanding Teaching Award, Indiana University Cognitive Science
- 2014 1st Place Poster, IGERT Research Showcase
- 2014 Cognitive Science Supplemental Research Fellowship
- 2013 2nd Place Poster, IGERT Research Showcase
- 2011-2015 NSF IGERT Fellowship in the Dynamics of Brain-Body-Environment Systems

Selected Workshops and Seminars

September 2017 Agency in the Physical Sciences, at the European Conference on Artificial Life 17. Lyon, France

March 2017 Frontiers in Computing Systems. Columbia University

February 2017 p53 P01 Multi-Group meeting. Columbia University

January 2017 Expanding Views on the Emergence of the Biosphere: 5th ELSI International Symposium. Tokyo Institute of Technology

July 2016 The Biological Foundations of Enactivism, at Artificial Life 16. Cancun, Mexico

November 2015 Re-conceptualizing the Origins of Life. Carnegie Institution for Science, Washington D.C.

October 2015 Self-organization in brain-body-environment systems. University of Cincinnati

August 2015 Towards an Integrative Approach to the Study of Awareness. Kobe University, Japan

December 2014 The Causal Factors of Robustness and Plasticity in Living Systems. Indiana University

July 2013 Adaptivity workshop. University of the Basque Country

Service

Reviewer IEEE International Conference on Bioinformatics & Biomedicine (BIBM), 2019.

Program cmte International Conference on Complex Systems (ICCS), 2018.

Associate Editor Journal of Adaptive Behavior, 2016-present.

Program cmte Conference on Complex Systems, 2017.

Organizer Workshop on Agency in the Physical Sciences, at the ECAL 17, September 2017.

Organizer The Biological Foundations of Enactivism, at Artificial Life 16, July 2016.

Program cmte Conference on Artificial Life, 2016-2020.

Reviewer Artificial Life Journal, 2015-present.

Organizer E-cog: weekly meeting on Embodied, Embedded, and Enactive approaches in Cognitive Science, 2013-2015.

Organizer Causal Factors of Robustness and Plasticity in Living Systems, 2014.

Organizer Apophenia: weekly discussions of Complex Systems and Cognitive Science, 2012-2013.

Organizer IGERT faculty lunches, 2011-2012.