
ERAN AGMON, Ph.D.

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EDUCATION AND TRAINING

- Stanford University**, Stanford, CA *2017–present*
Postdoctoral Research Fellow, Department of Bioengineering
Funding: NIH F32 Postdoctoral Fellowship
- Columbia University**, New York City, NY *2016–2017*
Postdoctoral Research Scientist, Department of Biological Sciences
- Indiana University**, Bloomington, IN *2016*
Joint Ph.D., Informatics and Computing, and Cognitive Science
Funding: NSF IGERT Fellowship
- Portland State University**, Portland, OR *2011*
M.Sc. in Systems Science
- University of California, San Diego**, San Diego, CA *2009*
B.S., Cognitive Science (minor in Biology)

RESEARCH INTERESTS

- Computational systems biologist trained in mathematical modeling, machine learning, and complex systems.
- Published models at several biological scales including molecular dynamics, metabolic networks, lipid membranes, whole cells, microbial colonies, neural systems, and organisms in dynamic environments.
- Interested in applying multiscale modeling and machine learning to map and interpret complex biological data, simplify the integration of diverse models, and speed up the rate of scientific discovery.

RESEARCH EXPERIENCE

- Stanford University** Stanford, CA
Integrative, multi-scale modeling in computational biology *2018–present*
Adviser: Markus W. Covert
- Led the development of Vivarium – a software tool that can make any mechanistic model into a module that can be wired together in multi-scale composite models.
- Allen Discovery Center for Systems Modeling of Infection** Stanford, CA
*Whole-cell model of *Escherichia coli** *2017–present*
Adviser: Markus W. Covert
- Worked with computational modelers, software engineers, and experimentalists to build the most comprehensive computational model of *E. coli* in the world.
- Columbia University** New York City, NY
Molecular model of membranes, lipid homeostasis, and cell death *2016–2017*
Adviser: Brent R. Stockwell
- Developed a coarse-grained molecular model of lipid membrane composition associated with a type of cell death called ferroptosis.
 - Predicted the deformation and degradation of the membrane, which was later experimentally validated.

Indiana University

Bloomington, IN

Dissertation research: Spatial model of metabolism/membrane interactions in a protocell

2013–2016

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 perturbational analysis to quantify the simulation's robustness, plasticity, fragility, and viability.

Indiana University

Bloomington, IN

Cellular model of tumor progression

2015

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.

Indiana University

Bloomington, IN

Computational model of action-switching agents

2011–2013

Advisor: Randall D. Beer

- Built a computational model to investigate the dynamics of embedded agents that can autonomously switch between actions, and applied a genetic algorithm for parameter search.

Portland State University

Portland, OR

Spiking neural model of adaptive sensory processing

2010–2011

Advisor: Patrick Roberts

- Built a spiking neural model of sensory processing in the electroreception of Mormyrid electric fish, which demonstrated their adaptive response to changing environments.

PUBLICATIONS*Published:*

1. Covert, M.W., Gillies, T.E., Kudo, T., and **Agmon, E.** (2021). A forecast for large-scale, predictive biology: lessons from meteorology. *Cell Systems*, 12: 6.
2. **Agmon, E.**, and Spangler, R.K. (2020). A multi-scale approach to modeling *E. coli* chemotaxis. *Entropy*, 22: 1101.
3. 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.
4. Talman, L., **Agmon, E.**, Peirce, S.M., and Covert, M.W. (2019). Multiscale models of infection. *Current Opinion in Biomedical Engineering*, 11, 102-108.
5. **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.
7. **Agmon, E.**, Gates, A.J., and Beer, R.D. (2016). The structure of ontogenies in a model protocell. *Artificial Life* 22 (4): 499-517.
8. 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.
9. **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.
10. **Agmon, E.**, & Beer, R. D. (2014). The evolution and analysis of action switching in embodied agents. *Adaptive Behavior*, 22(1), 3-20.
11. **Agmon, E.** (2014). Action Switching in Brain-Body-Environment Systems. In *Guided Self-Organization: Inception* (pp. 295-318). Springer Berlin Heidelberg.

Selected conference proceedings:

1. 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*.
2. **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.
4. **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**]
5. **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.

Submitted/under review:

1. **Agmon, E.**, Spangler, R.K., Skalnik, C.J., Poole, W., Morrison, J.H., Peirce, S.M., and Covert, M.W. (in review). Vivarium: an interface and engine for integrative multi-scale modeling in computational biology.
2. Skalnik, C.J., **Agmon, E.**, Spangler, R.K., Talman, L., Morrison, J.H., Peirce, S.M., and Covert, M.W. (in review). Whole-Colony Modeling of *Escherichia coli*.

In preparation:

1. Hickey, J.W., **Agmon, E.**, Covert, M.W., and Nolan, G.P. (in preparation). Integration of CODEX imaging with agent-based models of tumor/t-cell interactions.

AWARDS AND HONORS

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

TEACHING AND MENTORSHIP

Stanford University Bioengineering <i>Research Mentor</i>	2017–present
• Mentored seven BS and PhD students in whole-cell modeling of <i>E. coli</i> . • Organized weekly meetings in which I taught systems biology concepts, reviewed the students' code, and established collaborative practices.	
SSRP-Amgen Scholars Program <i>Research Mentor</i>	2021
• This program provides training to undergraduate students who, by reason of their background, work and life experiences, would bring diversity to graduate study in the biomedical and biological sciences.	

Build-A-Cell Chemical Reaction Network modeling tutorials <i>Co-instructor</i>	2020
Stanford International Genetically Engineered Machine (iGEM) competition <i>Mentor</i>	2019
Course: Autonomous Robotics <i>Associate Instructor, Indiana University</i>	2014, 2016
Course: Brains & Minds, Robots & Computers <i>Associate Instructor, Indiana University</i>	2013

OTHER AFFILIATIONS

Research Affiliate at Center for the Emergence of Life <i>NASA Ames Research Center, Moffett Field, CA</i> • Consulted on machine learning approaches to modeling RNA synthesis and selection at the origin of life.	2021–present
Visiting Scholar, Program in Interdisciplinary Studies <i>Institute for Advanced Study, Princeton, NJ</i> • Co-founded YHouse, a research institute focused on artificial intelligence and the science of awareness.	2016–2017
Visitor, Earth-Life Science Institute Origins Network <i>Tokyo Institute of Technology, Tokyo, Japan</i> • Worked with an interdisciplinary group of scientists to model molecular evolution at the origins of life.	2017

INVITED TALKS

1. **Agmon E.** “Vivarium: an interface and engine for multi-scale modeling in computational biology.” *Build-A-Cell workshop*. NIST, Gaithersburg, MD, 2020.
2. **Agmon E.** “A multi-scale platform for whole-cells and colonies.” *Basement seminar*. Stanford Bioengineering Department, 2020.
3. **Agmon E.** “Structural coupling of a Potts model cell.” *14th European Conference on Artificial Life*. Lyon, France, 2017.
4. **Agmon E.** “Computational models of heterogeneous lipid membranes.” *Frontiers in Computing Systems*. Columbia University, NY, 2017.
5. **Agmon E.** “Simulations of Ferroptosis.” *p53 Multi-Group meeting*. Columbia University, NY, 2017.
6. **Agmon E.** “The biological foundations of enactivism.” *Workshop on the Biological Foundations of Enactivism, at Artificial Life 16*. Cancun, Mexico, 2016.
7. **Agmon E.** “Whole-cell models and perturbation-based analysis.” *Department of Biological Sciences*. Columbia University, NY, 2016.
8. **Agmon E.** “The dynamics of protocell ontogenies.” *ENSO online seminar*. 2016.
9. **Agmon E.** “Ontogeny and adaptivity in a model protocell.” *Evolutionary Systems Biology Lab*. Albert Einstein College of Medicine, NY, 2016.
10. **Agmon E.** “Action switching in embodied, dynamical agents.” *Workshop on self-organization in brain-body-environment system*. University of Cincinnati, OH, 2015.
11. **Agmon E.** “Ontogeny and adaptivity in a model protocell.” *ECAL 15*. York, UK, 2015.
12. **Agmon E.** “The physiology and metabolic closure of organisms.” *Workshop on the causal factors of robustness and plasticity in living systems*. Bloomington, IN, 2014.
13. **Agmon E.** “Biological individuation, ontogeny and adaptation.” *Cognitive Science Program*. Bloomington, IN, 2015.
14. **Agmon E.** “Quantifying robustness in a spatial model of metabolism-boundary co-construction.” *Artificial Life 14*. New York City, NY, 2014.
15. **Agmon E.** “Action switching in embodied, dynamical agents.” *4th Annual Midwest Cognitive Science Conference*. Dayton, OH, 2014.

16. **Agmon E.** “Action switching in brain-body-environment systems.” *Department of Informatics*. University of Zaragoza, Spain, 2013.
17. **Agmon E.** “A dynamical account of probabilistic inference.” *Guided Self-Organization 5*. Sydney, Australia, 2012.

SELECTED POSTERS

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

SELECTED WORKSHOPS AND SEMINARS

Build-A-Cell (virtual). <i>Hosted by NIST, Gaithersburg, MD.</i>	2020
Build-A-Cell. <i>NASA Ames, Mountain View, CA.</i>	2020
qBio. <i>San Francisco, CA.</i>	2019
Agency in the Physical Sciences, at the Conference on Artificial Life 17. <i>Lyon, France.</i>	2017
Frontiers in Computing Systems. <i>Columbia University, NY.</i>	2017
Expanding Views on the Emergence of the Biosphere: 5th ELSI International Symposium. <i>Tokyo Institute of Technology, Tokyo, Japan.</i>	2017
The Biological Foundations of Enactivism, at Artificial Life 16. <i>Cancun, Mexico.</i>	2016
Re-conceptualizing the Origins of Life. <i>Carnegie Institution for Science, Washington D.C.</i>	2015
Self-organization in brain-body-environment systems. <i>University of Cincinnati, OH.</i>	2015
Towards an Integrative Approach to the Study of Awareness. <i>Kobe University, Japan.</i>	2015
The Causal Factors of Robustness and Plasticity in Living Systems. <i>Indiana University, IN.</i>	2014
Adaptivity workshop. <i>University of the Basque Country, San Sebastian, Spain.</i>	2013
New England Complex Systems Institute Summer School. <i>Massachusetts Institute of Technology, MA.</i>	2010

PROFESSIONAL SERVICE

Reviewer. <i>IEEE International Conference on Bioinformatics & Biomedicine (BIBM).</i>	2019
Program committee. <i>International Conference on Complex Systems (ICCS).</i>	2018
Associate Editor. <i>Journal of Adaptive Behavior.</i>	2016-present
Program committee. <i>Conference on Complex Systems.</i>	2017
Organizer. <i>Workshop on Agency in the Physical Sciences, at the ECAL 17</i>	2017
Organizer. <i>The Biological Foundations of Enactivism, at Artificial Life 16</i>	2016
Program committee. <i>Conference on Artificial Life.</i>	2016–2020
Program committee. <i>Artificial Life 15: The Fifteenth International Conference on the Synthesis and Simulation of Living Systems.</i>	2016
Reviewer. <i>Artificial Life Journal</i>	2015–present
Organizer. <i>E-cog: weekly meeting on Embodied, Embedded, and Enactive approaches in Cog Sci</i>	2013–2015
Organizer. <i>Workshop on the Causal Factors of Robustness and Plasticity in Living Systems.</i>	2014
Organizer. <i>Apophenia: weekly discussions of Complex Systems and Cognitive Science</i>	2012–2013
Organizer. <i>IGERT faculty lunches</i>	2011–2012