
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 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 Integrative Graduate Education and Research Traineeship (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 EXPERIENCE

- Stanford University** Stanford, CA
Integrative, multi-scale modeling software for computational biology *2019–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 simulations.
 - Worked with several research groups to integrate Vivarium into their computational workflows.
- 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 scientists, software engineers, and experimentalists to build the most comprehensive computational model of *E. coli* in the world.
 - Focused on trans-membrane transport, chemotaxis, and colony formation.
- 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*Cellular model of tumor progression**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.

Bloomington, IN

2015

Indiana University*Computational model of action-switching agents**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.

Bloomington, IN

2011–2013

Portland State University*Spiking neural model of adaptive sensory processing**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.

Portland, OR

2010–2011

PUBLICATIONS

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). T cell phenotype drives tissue restructuring to balance T cell longevity and mediate tumor killing.

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.

AWARDS AND HONORS

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| NIH F32 Postdoctoral Fellowship. <i>Adding an environment and motility in a whole-cell model of Escherichia coli</i> | 2020 |
| Outstanding Dissertation Award, Indiana University Cognitive Science. | 2017 |
| Best Paper Award, European Conference on Artificial Life. | 2015 |
| 1st Place Poster, NSF IGERT Research Showcase. | 2015 |
| NSF IGERT Fellowship. <i>The Dynamics of Brain-Body-Environment Systems in Behavior and Cognition.</i> | 2014–2015 |
| Outstanding Teaching Award, Indiana University Cognitive Science. | 2014 |
| 1st Place Poster, NSF IGERT Research Showcase. | 2014 |
| Supplemental Research Fellowship, Cognitive Science Program. | 2014 |
| 2nd Place Poster, NSF IGERT Research Showcase | 2013 |
| NSF IGERT Fellowship in the Dynamics of Brain-Body-Environment Systems. | 2011–2015 |

TEACHING AND MENTORSHIP

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| Stanford University Bioengineering <i>Research Mentor</i> | 2019–present |
| <ul style="list-style-type: none"> • Mentored eight 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 |
| <ul style="list-style-type: none"> • 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 |

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| Stanford International Genetically Engineered Machine (iGEM) competition | 2019 |
| <i>Mentor</i> | |
| Course: Autonomous Robotics | 2014, 2016 |
| <i>Associate Instructor, Indiana University</i> | |
| Course: Brains & Minds, Robots & Computers | 2013 |
| <i>Associate Instructor, Indiana University</i> | |

OTHER AFFILIATIONS

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

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.

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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

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| 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

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| 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>NSF IGERT faculty lunches</i> | 2011–2012 |