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 hybrid simulations.
• Worked with several research groups to integrate Vivarium with their computational workflows.
• Integration with BioSimulators (https://biosimulators.org) supports the combination of several popular simulators including COBRA, BioNetGen, libRoadRunner, and COPASI.

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   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. **Agmon, E.**, Spangler, R.K., Skalnik, C.J., Poole, W., Morrison, J.H., Peirce, S.M., and Covert, M.W. (2022). Vivarium: an interface and engine for integrative multi-scale modeling in computational biology. *Bioinformatics*, btac049.
2. 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.
3. **Agmon, E.**, and Spangler, R.K. (2020). A multi-scale approach to modeling *E. coli* chemotaxis. *Entropy*, 22: 1101.
4. 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.
5. Talman, L., **Agmon, E.**, Peirce, S.M., and Covert, M.W. (2019). Multiscale models of infection. *Current Opinion in Biomedical Engineering*, 11, 102-108.
6. **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.
7. **Agmon, E.** and Stockwell, B.R. (2017). Lipid homeostasis and regulated cell death. *Current Opinion in Chemical Biology.* 39: 83-89.
8. **Agmon, E.**, Gates, A.J., and Beer, R.D. (2016). The structure of ontogenies in a model protocell. *Artificial Life* 22 (4): 499-517.
9. 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.
10. **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.
11. **Agmon, E.**, & Beer, R. D. (2014). The evolution and analysis of action switching in embodied agents. *Adaptive Behavior*, 22(1), 3-20.
12. **Agmon, E.** (2014). Action Switching in Brain-Body-Environment Systems. In *Guided Self-Organization: Inception* (pp. 295-318). Springer Berlin Heidelberg.

In review:

1. 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. bioRxiv.*

In preparation:

1. Hickey, J.W., **Agmon, E.**, Horowitz, N., Lamore, M., Sunwoo, J., Covert, M.W., and Nolan, G.P. (in preparation). Integrating Multiplexed Imaging and Multiscale Modeling Identifies Tumor Phenotype Transformation as a Critical Component of Therapeutic T Cell Efficacy.

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

NIH F32 Postdoctoral Fellowship.	2020
Adding an environment and motility in a whole-cell model of Escherichia coli	
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. *Brain-Body-Environment Systems in Behavior and Cognition.*	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. *Brain-Body-Environment Systems in Behavior and Cognition.*	2011–2015

TEACHING AND MENTORSHIP

Stanford University Bioengineering *2019–present*
Research Mentor
• Mentored eight BS and PhD students in whole-cell modeling of *E. coli*.
• Organized weekly meetings in which I taught systems biology concepts, reviewed the students' code, and established collaborative practices.

SSRP-Amgen Scholars Program *2021*
Research Mentor
• 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 *2020*
Co-instructor

Stanford International Genetically Engineered Machine (iGEM) competition *2019*
Mentor

Course: Autonomous Robotics 2014, 2016
Associate Instructor, Indiana University

Course: Brains & Minds, Robots & Computers 2013
Associate Instructor, Indiana University

OTHER AFFILIATIONS

NASA Ames Research Center Moffett Field, CA
Research Affiliate, Center for the Emergence of Life *2021–present*
- Consulted on machine learning approaches to modeling RNA synthesis and selection at the origin of life.

Institute for Advanced Study Princeton, NJ
Visiting Scholar, Program in Interdisciplinary Studies *2016–2017*
- Co-founded YHouse, a research institute focused on artificial intelligence and the science of awareness.

Tokyo Institute of Technology Tokyo, Japan
Visitor, Earth-Life Science Institute Origins Network *2017*
- Worked with an interdisciplinary group of scientists to model molecular evolution at the origins of life.

PRESENTATIONS

1. **Agmon E.** "Vivarium: an interface and engine for integrative multi-scale modeling." *COMBINE 2021.*
2. **Agmon E.** "Vivarium: an interface and engine for multi-scale modeling in computational biology." *Build-A-Cell workshop.* NIST, Gaithersburg, MD, 2020.
3. **Agmon E.** "A multi-scale platform for whole-cells and colonies." *Basement seminar.* Stanford Bioengineering Department, 2020.
4. **Agmon E.** "Structural coupling of a Potts model cell." *14th European Conference on Artificial Life.* Lyon, France, 2017.
5. **Agmon E.** "Computational models of heterogeneous lipid membranes." *Frontiers in Computing Systems.* Columbia University, NY, 2017.
6. **Agmon E.** "Simulations of Ferroptosis." *p53 Multi-Group meeting.* Columbia University, NY, 2017.
7. **Agmon E.** "The biological foundations of enactivism." *Workshop on the Biological Foundations of Enactivism, at Artificial Life 16.* Cancun, Mexico, 2016.
8. **Agmon E.** "Whole-cell models and perturbation-based analysis." *Department of Biological Sciences.* Columbia University, NY, 2016.
9. **Agmon E.** "The dynamics of protocell ontogenies." *ENSO online seminar.* 2016.
10. **Agmon E.** "Ontogeny and adaptivity in a model protocell." *Evolutionary Systems Biology Lab.* Albert Einstein College of Medicine, NY, 2016.
11. **Agmon E.** "Action switching in embodied, dynamical agents." *Workshop on self-organization in brain-body-environment system.* University of Cincinnati, OH, 2015.
12. **Agmon E.** "Ontogeny and adaptivity in a model protocell." *ECAL 15.* York, UK, 2015.
13. **Agmon E.** "The physiology and metabolic closure of organisms." *Workshop on the causal factors of robustness and plasticity in living systems.* Bloomington, IN, 2014.
14. **Agmon E.** "Biological individuation, ontogeny and adaptation." *Cognitive Science Program.* Bloomington, IN, 2015.
15. **Agmon E.** "Quantifying robustness in a spatial model of metabolism-boundary co-construction." *Artificial Life 14.* New York City, NY, 2014.
16. **Agmon E.** "Action switching in embodied, dynamical agents." *4th Annual Midwest Cognitive Science Conference.* Dayton, OH, 2014.

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

SELECTED POSTERS

1. **Agmon E.**, Spangler, R.K., Morrison, J.H., and Covert, M.W. "A simulation platform for whole-cell/whole-colony modeling." *Build-A-Cell workshop.* NASA Ames, Mountain View, CA, 2020.
2. **Agmon E.**, Spangler, R.K.,and Covert, M.W. "Adding an environment and motility to a large-scale model of *Escherichia coli*." *qBio.* San Francisco, CA, 2019.
3. **Agmon E.** et al. "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

COMBINE 2021 (virtual).	2021
Build-A-Cell (virtual). *Hosted by NIST, Gaithersburg, MD.*	2020
Build-A-Cell. *NASA Ames, Mountain View, CA.*	2020
qBio. *San Francisco, CA.*	2019
Agency in the Physical Sciences, at the Conference on Artificial Life 17. *Lyon, France.*	2017
Frontiers in Computing Systems. *Columbia University, NY.*	2017
Expanding Views on the Emergence of the Biosphere: 5th ELSI International Symposium. *Tokyo Institute of Technology, Tokyo, Japan.*	2017
The Biological Foundations of Enactivism, at Artificial Life 16. *Cancun, Mexico.*	2016
Re-conceptualizing the Origins of Life. *Carnegie Institution for Science, Washington D.C.*	2015
Self-organization in brain-body-environment systems. *University of Cincinnati, OH.*	2015
Towards an Integrative Approach to the Study of Awareness. *Kobe University, Japan.*	2015
The Causal Factors of Robustness and Plasticity in Living Systems. *Indiana University, IN.*	2014
Adaptivity workshop. *University of the Basque Country, San Sebastian, Spain.*	2013
New England Complex Systems Institute Summer School. *Massachusetts Institute of Technology, MA.*	2010

PROFESSIONAL SERVICE

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