Sam Kriegman **Curriculum Vitae**

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Google Scholar Profile

APPOINTMENTS

2020– **Postdoctoral Associate**, University of Vermont

EDUCATION

2016–2020 **Ph.D.**, Computer Science, University of Vermont, USA
Design for an Increasingly Protean Machine.
Advisor: Josh Bongard

2014–2016 **M.S.**, Statistics, University of Vermont, USA
2006–2010 **B.S.**, Applied Mathematics, Ohio University, USA

PUBLICATIONS

18. S Kriegman, A-M Nasab, D Blackiston, H Steele, M Levin, R Kramer-Bottiglio, J Bongard. (2021).
Scale invariant robot behavior with fractals.
Preprint, in review.

17. D Blackiston, E Lederer, S Kriegman, S Garnier, J Bongard, M Levin. (2021).
A cellular platform for the development of synthetic living machines.
Science Robotics, 6(52): eabf1571.

16. D Shah, J Powers, L Tilton, S Kriegman, J Bongard, R Kramer-Bottiglio. (2021).
A soft robot that adapts to environments through shape change.
Nature Machine Intelligence, 3, 51-59.

15. D Shah, B Yang, S Kriegman, M Levin, J Bongard, R Kramer-Bottiglio. (2020).
Shape Changing Robots: Bioinspiration, Simulation, and Physical Realization.
Advanced Materials, 2002882.

14. J Powers, R Grindle, S Kriegman, L Frati, N Cheney, J Bongard. (2020).
Morphology dictates learnability in neural controllers.
Artificial Life Conference Proceedings, 52-59.

13. S Kriegman, A-M Nasab, D Shah, H Steele, G Branin, M Levin, J Bongard, R Kramer-Bottiglio. (2020).
Scalable sim-to-real transfer of soft robot designs.
IEEE Conference on Soft Robotics (RoboSoft), 359-366, 10.1109/RoboSoft48309.2020.9116004.

12. S Kriegman*, D Blackiston*, M Levin, J Bongard. (2020).
A scalable pipeline for designing reconfigurable organisms.
Proceedings of the National Academy of Sciences, 117(4): 1853-1859.
(*A perspective article on this work by P. Ball can be found here.*)

11. S Kriegman. (2019).
Why virtual creatures matter.
Nature Machine Intelligence, 1(10): 492-492.

10. D Matthews, S Kriegman, C Cappelle, J Bongard. (2019).
Word2vec to behavior: morphology facilitates the grounding of language in machines.
IEEE/RSJ Conference on Intelligent Robots and Systems (IROS)

9. S Kriegman, S Walker, D Shah, M Levin, R Kramer-Bottiglio, J Bongard (2019).
Automated shapeshifting for function recovery in damaged robots.
Robotics: Science and Systems (RSS), 10.15607/RSS.2019.XV.028
(*A perspective article on this work by H. Hauser can be found here.*)

8. S Kriegman, N Cheney, J Bongard. (2018).
How morphological development can guide evolution.
Nature Scientific Reports, 8(1): 13934.

7. S Beaulieu, S Kriegman, J Bongard. (2018).
Combating catastrophic forgetting with developmental compression.
Genetic and Evolutionary Computation Conference (GECCO), 386-393.

6. S Kriegman, N Cheney, F Corucci, J Bongard. (2018).
Interoceptive robustness through environment-mediated morphological development.
Genetic and Evolutionary Computation Conference (GECCO), 109-116, 10.1145/3205455.3205529.

5. J Powers, S Kriegman, J Bongard. (2018).
The effects of morphology and fitness on catastrophic interference.
Artificial Life Conference Proceedings, 606-613.

4. S Kriegman, C Cappelle, F Corucci, A Bernatskiy, N Cheney, J Bongard. (2017).
Simulating the evolution of soft and rigid-body robots.
Genetic and Evolutionary Computation Conference (GECCO), 1117-1120.

3. F Corucci, N Cheney, S Kriegman, J Bongard, C Laschi. (2017).
Evolutionary developmental soft robotics as a framework to study intelligence and adaptive behavior.
Frontiers in Robotics and AI, 4(34).

2. S Kriegman, N Cheney, F Corucci, J Bongard. (2017).
A minimal developmental model can increase evolvability in soft robots.
Genetic and Evolutionary Computation Conference (GECCO), 131-138, 10.1145/3071178.3071296.

1. S Kriegman, M Szubert, J Bongard, C Skalka. (2016).
Evolving spatially aggregated features from satellite imagery for regional modeling.
Parallel Problem Solving from Nature (PPSN), 707-716.
(*Nominated for Best Paper Award.*)

PATENTS

pending Engineered Multicellular Organisms.

AWARDS

2021 **The Cozzarelli Prize**, National Academy of Sciences

2020 Computer Science Graduate Award, University of Vermont
Top 10 Most Influential BioTech Projects, Project Management Institute
Beazley Designs of the Year, The Design Museum

Service

2019– Co-developer, Voxcraft: a low cost, open source soft robot design and construction kit for ages 12+

Editorships

2020– Review Editorial Board, *Frontiers Robotics and AI*

Advising

2020– Sida Liu, Master's: Multi-robot reinforcement learning.
2019– Caitlin Grasso, PhD: Awarded a NSF GRFP to study reconfigurable organisms.
2018– David Matthews, Undergrad: Differentiable physics.

Invited Talks

Mar, 2021 "Protean machines". IT University of Copenhagen.
Mar, 2021 "Living robots". *The Int'l Workshop on Embodied Intelligence*.
Mar, 2021 "How to evolve your robot". Guest lecture, Introduction to Soft Robotics, Yale University.

Oct, 2020 "Living deepfakes". Guest lecture for the MIT Media Lab's Deepfakes course (MAS.S60).
Apr, 2020 "Computer designed organisms". *Artificial Life Virtual Seminar Series*.

Recorded Presentations

May, 2020 "Design for soft robot blocks". *IEEE International Conference on Soft Robotics (RoboSoft).*
June, 2019 "Shapeshifting robots". *Robotics: Science and Systems (RSS)* in Freiburg, Germany.

Interviews

to appear "Xenobots". *Bloomberg Moonshot*
Apr, 2021 "How UVM researchers revamped their groundbreaking living robots". *WCAX (CBS 3)*
Feb, 2021 "Evolving robot forms". *Time Horizons Podcast*

Sep, 2020 "Tiny, Programmable, Living Robots". *Constant Wonder*
Apr, 2020 "Soft Robotics with Sam Kriegman". *IEEE Soft Robotics Podcast*
Mar, 2020 "Xenobots". *Futureproof*
Feb, 2020 "Living Robots". *TalkSport Radio*
Jan, 2020 "UVM researchers develop tiny living robots". *WCAX (CBS 3)*
Jan, 2020 "UVM aids in creating living robots". *WPTZ (NBC 5)*
Jan, 2020 "Forscher haben erstmals 'lebende' Mini-Roboter erschaffen". *Die Welt*

Selected Media Coverage

Apr, 2021 "Frog stem cell research changes what we know about how organisms are built". *The Washington Post*
Apr, 2021 "Robots made out of frog cells". *Science Friday*
Mar, 2021 "Scientists create new 'living robots' that have memory and assemble themselves". *The Independent*
Mar, 2021 "Cells Form Into 'Xenobots' on Their Own". *Quanta Magazine*
Mar, 2021 "Living robots made from frog skin cells can sense their environment". *New Scientist*
Mar, 2021 "Frog skin cells turned themselves into living machines". *Science News*

Dec, 2020 "The big scientific breakthroughs of 2020". *The Week*
Dec, 2020 "The 10 Most Spectacular Scientific Advances of 2020". *La Razón (Spain)*
Dec, 2020 "Part Robot, Part Frog: Xenobots Are the First Robots Made From Living Cells". *Discover Magazine*
Nov, 2020 "The Xenobot Future Is Coming – Start Planning Now". *Wired*

Apr, 2020 "Meet the Xenobots: Virtual Creatures Brought to Life". ***New York Times***
Feb, 2020 "Giant Moon rocket, living robots and quantum computer – January's best science images". *Nature*
Feb, 2020 "Tiny machines made from the stem cells of frogs". *The Intelligence (Economist Radio)*
Feb, 2020 "Meet the Xenobot, the World's First-Ever 'Living' Robot". *Seeker*
Jan, 2020 "The religious, moral, and ethical implications of Xenobots". *BBC Radio 4 Sunday*
Jan, 2020 "A research team builds robots from living cells". *The Economist*
Jan, 2020 "Scientists use stem cells from frogs to build first living robots". *The Guardian*
Jan, 2020 "Meet the xenobot: world's first living, self-healing robots created from frog stem cells". *CNN*
Jan, 2020 "Scientists create first living, self-healing robots (on-air with Fredricka Whitfield)". ***CNN***
Jan, 2020 "Meet Xenobot, an Eerie New Kind of Programmable Organism". *Wired*
Jan, 2020 "Scientists Assemble Frog Stem Cells Into First 'Living Machines'". *Smithsonian Magazine*
Jan, 2020 "World's First 'Living Machine' Created Using Frog Cells and Artificial Intelligence". *Scientific American*
Jan, 2020 "These tiny living robots could help science eavesdrop on cellular gossip". *Popular Science*
Jan, 2020 "These Are the First Living Robots: Machines Made from Frog Stem Cells". *Popular Mechanics*
Jan, 2020 "Behold the xenobots – part frog, part robot. But are they alive?". *Christian Science Monitor*
Jan, 2020 "Scientists at UVM, Tufts create 'living robots'". *Boston Globe*
Jan, 2020 "How tiny 'biobots' could enter bodies to clean arteries and administer drugs". *The Times*
Jan, 2020 "Living robots created as scientists turn frog cells into 'entirely new life-forms'". *The Telegraph*
Jan, 2020 "Living Robots, Designed By Computer". *Science Friday*
Jan, 2020 "Living robots". *BBC World Service*
Jan, 2020 "These 'xenobots' are living machines designed by an evolutionary algorithm". *MIT Technology Review*
Jan, 2020 "The 'xenobot' is the world's newest robot – and it's made from living animal cells". *CTV News*
Jan, 2020 "World's First 'Living Robot' Invites New Opportunities And Risks". *Forbes*
Jan, 2020 "Tiny 'xenobots' made from cells could heal our bodies and clean the environment". *Fox News*
Jan, 2020 "Scientists Create First 'Living Robots' in Major Breakthrough". *The Independent*
Jan, 2020 "World's first 'living robots' are made from the stem cells of frogs". *New York Post*
Jan, 2020 "Algorithm Designs Robots Using Frog Cells". *The Scientist*
Jan, 2020 "Xenobots: 1st living robots made from stem cells". *ESPN*
Jan, 2020 "Xenobot". *Wikipedia*