

Sam Kriegman

Curriculum Vitae

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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).
[Interceptive 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
Outstanding Doctoral Dissertation Award, University of Vermont

2020 Computer Science Graduate Award, University of Vermont
[Top 10 Most Influential BioTech Projects](#), Project Management Institute

SERVICE [Beazley Designs of the Year](#), The Design Museum

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](#)”. *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*