

Sam Kriegman

Curriculum Vitae

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APPOINTMENTS

- 2021– **Postdoctoral Fellow**, Wyss Institute, Harvard University
Advisor: [Michael Levin](#)
- 2021– **Postdoctoral Fellow**, Allen Discovery Center, Tufts University
Advisor: Michael Levin
- 2020–2021 **Postdoctoral Associate**, University of Vermont
Advisor: [Josh Bongard](#)

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

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

ARTICLES

7. 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.
6. 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.
5. 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.
4. 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](#).)

3. S Kriegman (2019).
[Why virtual creatures matter.](#)
Nature Machine Intelligence, 1(10): 492.
2. S Kriegman, N Cheney, J Bongard (2018).
[How morphological development can guide evolution.](#)
Nature Scientific Reports, 8(1): 13934.
1. 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).

PEER-REVIEWED CONFERENCE PUBLICATIONS

11. S Kriegman, A-M Nasab, D Blackiston, H Steele, M Levin, R Kramer-Bottiglio, J Bongard (2021).
[Scale invariant robot behavior with fractals.](#)
Robotics: Science and Systems (RSS), 10.15607/RSS.2021.XVII.059
10. 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.
9. 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.
8. 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)
7. 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](#).)
6. S Beaulieu, S Kriegman, J Bongard (2018).
[Combating catastrophic forgetting with developmental compression.](#)
Genetic and Evolutionary Computation Conference (GECCO), 386-393.
5. 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.
4. J Powers, S Kriegman, J Bongard (2018).
[The effects of morphology and fitness on catastrophic interference.](#)
Artificial Life Conference Proceedings, 606-613.
3. 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.
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.

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

2020–2021 [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

July, 2021 [“Sim2Life: AI-generated biological constructs”](#). Cross Roads.
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

July, 2021 [“Fractal robots”](#). *Robotics: Science and Systems (RSS)*.
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

Jun, 2021 [“Biological Robots May Soon Build You a Better Heart”](#). *Bloomberg Moonshot*
Apr, 2021 [“Xen and the Art of Motorcell Maintenance”](#). *AI with AI*
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*