

## Albert Brian Kao

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CONTACT INFORMATION E-mail: albert.kao@umb.edu  
Web: www.thekaolab.com

EDUCATION AND PROFESSIONAL POSITIONS 2022- **University of Massachusetts Boston**, Boston, MA USA  
Assistant Professor, Biology Department

2018-2022 **Santa Fe Institute**, Santa Fe, NM USA  
Baird Scholar  
Omidyar Postdoctoral Fellow

2015-2018 **Harvard University**, Cambridge, MA USA  
James S. McDonnell Foundation Postdoctoral Fellow  
Department of Organismic and Evolutionary Biology and  
Center for Brain Science  
Advisors: Naomi Pierce and Aravinthan Samuel

2009-2015 **Princeton University**, Princeton, NJ USA  
Ph.D., Ecology and Evolutionary Biology, January 2015  
Title: Collective wisdom in animal groups  
Advisor: Iain D. Couzin  
M.A., Ecology and Evolutionary Biology, May 2011

2003-2007 **Harvard University**, Cambridge, MA USA  
A.B., Honors in Physics, magna cum laude, June 2007  
Biophysics emphasis; cumulative GPA: 3.73.

FUNDING 2023-2026 NSF BRC-BIO #2233416: Emergent dynamics and leadership in  
collective timing decisions (\$465,934)  
2022 Anonymous lab support, UMass Boston (\$1,000,000)  
2018-2022 Baird Scholar, Santa Fe Institute  
2018-2022 Omidyar Postdoctoral Fellowship, Santa Fe Institute  
2015-2018 James S. McDonnell Foundation Postdoctoral Fellowship Award in  
Studying Complex Systems (\$200,000)  
2012-2014 NSF Doctoral Dissertation Improvement Grant (\$14,075)  
2010-2014 NSF Graduate Research Fellowship  
2006 Harvard Weissman International Internship Fellowship  
2005 Herschel Smith Harvard Summer Undergraduate Research Fellowship

PUBLICATIONS **Kao AB**, Hund AK, Santos FP, Young J-G, Bhat D, Garland J, Oomen RA,  
McCreery HF. Opposing responses to scarcity emerge from functionally unique  
sociality drivers. *The American Naturalist*, in press.

Galesic M, Barkoczi D, Berdahl AM, Biro D, Carbone G, Giannoccaro I, Goldstone  
RL, Gonzalez C, Kandler A, **Kao AB**, Kendal R, Kline M, Lee E, Massari GF,

Mesoudi A, Olsson H, Pescetelli N, Sloman SJ, Smaldino PE, Stein DL (2023) Beyond collective intelligence: Collective adaptation. *Journal of the Royal Society Interface* 20(200):20220736.

Winklmayr C, **Kao AB**, Bak-Coleman JB, Romanczuk P (2023) Collective decision strategies in the presence of spatio-temporal correlations. *Collective Intelligence* 2(1):26339137221148675.

Bak-Coleman JB, Alfano M, Barfuss W, Bergstrom CT, Centeno MA, Couzin ID, Donges JF, Galesic M, Gersick AS, Jacquet J, **Kao AB**, Moran RE, Romanczuk P, Rubenstein DI, Tombak KJ, Van Bavel JJ, Weber EU (2021) Stewardship of global collective behavior. *PNAS* 118(27):e2025764118.

[Press release from SFI](#)

Featured in:

[Vox](#)

Lutz MJ, Reid CR, Lustri CJ, **Kao AB**, Garnier S, Couzin ID (2021) Individual error correction drives responsive self-assembly of army ant scaffolds. *PNAS* 118(17):e2013741118.

Winklmayr C, **Kao AB**, Bak-Coleman JB, Romanczuk P (2020) The wisdom of stalemates: consensus and clustering as filtering mechanisms for improving collective accuracy. *Proceedings of the Royal Society: B* 287(1938):20201802.

Guerra AS, **Kao AB**, McCauley DJ, Berdahl AM (2020) Fisheries-induced evolution of anti-social behavior in marine fishes. *Proceedings of the Royal Society: B* 287(1935):20201752.

[Press release from UCSB](#)

**Kao AB**, Couzin ID (2019) Modular structure within groups causes information loss but can improve decision accuracy. *Philosophical Transactions of the Royal Society: B* 374(1774):20180378.

[Press release from SFI](#)

Alisch T, Crall JD, **Kao AB**, Zucker D, de Bivort BL (2018) MAPLE (Modular Automated Platform for Large-scale Experiments), a robot for integrated organism-handling and phenotyping. *eLife* 2018;7:e37166.

**Kao AB**, Berdahl AM, Hartnett AT, Lutz MJ, Bak-Coleman JB, Ioannou CC, Giam X, Couzin ID (2018). Counteracting estimation bias and social influence to improve the wisdom of crowds. *Journal of the Royal Society Interface* 15(141):20180130.

[Press release from SFI](#)

Berdahl AM\*, **Kao AB\***, Flack A, Westley PAH, Codling EA, Couzin ID, Dell AI,

Biro D (2018) Collective animal navigation and the emergence of migratory culture. *Philosophical Transactions of the Royal Society: B* 373(1746):20170009. **\*Joint first authors.**

Press release of theme issue from SFI

Graham JM\*, **Kao AB\***, Wilhelm DA, Garnier S (2017) Optimal construction of army ant living bridges. *Journal of Theoretical Biology* 435:184-198. **\*Joint first authors.**

Featured in:

[Quanta Magazine](#)

[Washington Post](#)

Reid CR, Lutz MJ, Powell S, **Kao AB**, Couzin ID, Garnier S (2015) Army ants dynamically adjust living bridges in response to a cost-benefit trade-off. *PNAS* 112(49):15113-15118.

**Kao AB**, Miller N, Torney C, Hartnett A, Couzin ID (2014) Collective learning and optimal consensus decisions in social animal groups. *PLoS Computational Biology* 10(8):e1003762.

**Kao AB**, Couzin ID (2014) Decision accuracy in complex environments is often maximized by small group sizes. *Proceedings of the Royal Society: B* 281(1784):20133305.

Featured in:

[The Loom](#) (National Geographic blog written by Carl Zimmer)

[Bloomberg Businessweek](#)

[The Telegraph](#)

[The Daily Mail](#)

Strandburg-Peshkin A, Twomey CR, Bode NWF, **Kao AB**, Katz Y, Ioannou CC, Rosenthal SB, Torney CJ, Wu HS, Levin SA, Couzin ID (2013) Visual sensory networks and effective information transfer in animal groups. *Current Biology* 23(17):R709-R711.

Swain DT, Leonard NE, Couzin ID, **Kao A**, Sepulchre RJ (2008) Alternating spatial patterns for coordinated group motion. *Proceedings of the 46th IEEE Conference on Decision and Control* 2925-2930.

Gabel CV, Gabel H, Pavlichin D, **Kao A**, Clark DA, Samuel AD (2007) Neural circuits mediate electrosensory behavior in *Caenorhabditis elegans*. *Journal of Neuroscience* 27(28):7586-7596.

SELECTED  
PRESENTATIONS

**Kao AB** (2022) Collective sensing in the slime mold *Physarum polycephalum*. APS (American Physical Society) March Meeting, Chicago, Illinois. March 16, 2022.

**Kao AB** (2022) Army ants and the physical forces that govern them. Part of the

tutorial “The Physics of Biological Movement Across Scales” at the APS (American Physical Society) March Meeting, Chicago, Illinois. March 13, 2022.

**Kao AB** (2022) The wisdom of crowds in naturalistic conditions. Vermont Complex Systems Center Fall/Spring 2021/2022 Seminar Series, University of Vermont, Burlington, Vermont. February 24, 2022.

**Kao AB** (2019) Observing changes in group size to infer the underlying drivers of sociality. ASAB (Association for the Study of Animal Behaviour) Annual Conference. Konstanz, Germany. August 28, 2019.

**Kao AB** (2019) The wisdom of animal crowds. Guest lecturer for the Graduate Workshop in Computational Social Science at the Santa Fe Institute (taught by Profs. John Miller and Scott Page). Santa Fe, NM. June 19, 2019.

**Kao AB** (2018) Counteracting estimation bias and social influence to improve the wisdom of crowds. Guest lecturer for Computational Social Science Seminar course at University of Pennsylvania (taught by Prof. Damon Centola). Philadelphia, PA. March 27, 2018.

**Kao AB** (2018) Collective computation and exploration in slime molds. Distributed, Collective Computation in Biological and Artificial Systems Conference. Janelia Farm, Ashburn, VA. March 20, 2018.

**Kao AB** (2017) Distributed search and decision-making in biology. Guest lecturer for Introduction to Complexity Science course at Providence College (taught by Prof. James Waters). Providence, RI. April 18, 2017.

**Kao AB** (2016) Improving the wisdom of crowds by counteracting estimation bias. Seminar at the Santa Fe Institute. Santa Fe, NM. October 17, 2016.

**Kao AB** (2015) Collective behavior across biology. Guest lecturer for Computational Social Science Seminar course at University of Pennsylvania (taught by Prof. Damon Centola). Philadelphia, PA. November 11, 2015.

**Kao, AB, Couzin ID** (2014) Collective wisdom in animal groups. 51st Annual Conference of the Animal Behavior Society. Princeton, NJ. August 10, 2014.

**Kao AB, Miller N, Torney CJ, Hartnett A, Couzin ID** (2014) Collective learning and optimal consensus in social animal groups. Society for Integrative and Comparative Biology Annual Meeting. Austin, TX. January 4, 2014.

**Kao AB** (2013) Individual-level rules governing social information use and the wisdom of the crowds in humans. Princeton Research Symposium. Princeton, NJ. October 20, 2013.

TEACHING  
EXPERIENCE

**Graduate courses**  
Spring 2023 BIOL 653 Quantitative Ecology Current Lit (9 students), UMass Boston

### Undergraduate courses

Fall 2022 BIOL 347/348 Animal Behavior & Lab (45 students), UMass Boston  
Overall course evaluation: 4.47/5  
Overall instructor evaluation: 4.80/5

### Ph.D. students

2022- Shoubhik Banerjee (Integrative Biosciences), UMass Boston

### Graduate student thesis committees

2023- Averie St. Germaine (Biology), UMass Boston  
2022- Vajra Badha (Physics), UMass Boston  
2022- Vic Chiang (Developmental and Brain Sciences), UMass Boston

### Undergraduate researchers

2023 Benno Rodemann, UMass Boston  
2023 Tony Thang, UMass Boston  
2021 Michelle Kummel, Princeton University  
REU summer student at the Santa Fe Institute  
Co-mentored with Chris Kempes & Mingzhen Lu  
2021 Adeena Ahsan, Minerva Schools at KGI  
REU summer student at the Santa Fe Institute  
Co-mentored with Chris Kempes & Mingzhen Lu  
2020 Miguel Velez, Harvey Mudd College  
REU summer student at the Santa Fe Institute  
Project title: Individual learning rules in the construction of power distribution  
2019 Aram Moghaddassi, UC Berkeley  
REU summer student at the Santa Fe Institute  
Project title: A more robust and realistic model for associative memory  
2016 Naomi Suminski, Simmons College  
2013-2014 Lauren Song, Princeton University  
Senior thesis title: The role of weighted voting in the wisdom of crowds

### High school researchers

2016 Maxwell Zegans  
Project title: Distributed search in structured environments by the acellular slime mold *Physarum polycephalum*

### MEETINGS ORGANIZED

**Workshop:** “What is biological computation?” Santa Fe Institute, September 11-13, 2019 (38 participants, \$80,570 budget).

**Working group:** “Sociality under scarcity.” Santa Fe Institute, February 4-7, 2019 (8 participants, \$10,658 budget).

### SERVICE ROLES

2022- Member of the IACUC at UMass Boston

### OUTREACH ACTIVITIES

2020-2021 **How2Recycle program, Charlottesville, VA**  
 Advisory committee to support transparency in the How2Recycle label

2019 **Northeastern N.M. Science Fair Judge, Las Vegas, NM**

2018-2019 **Santa Fe Indian School Senior Honors Project, Santa Fe, NM**  
 Mentor to a high school student on their year-long senior project

2016- **Letters to a Pre-Scientist Program**  
 Pen pal to 5th-8th grade students interested in animal behavior

2015 **A Better World by Design Conference, Providence, RI**  
 Nature // Society – Biomimicry and Design Panelist

2014 **Tech to Reconnect, San Diego Zoo, San Diego, CA**  
 Consultant to design and prototype the Bat Mask

2014 **Art of Science Exhibitor, Princeton, NJ**  
 Displayed at the New York Hall of Science Mar 20-May 28, 2018

2010, 2012 **Hopewell Elementary Science Fair Judge, Hopewell, NJ**

MEDIA [Exolore Podcast](#), July 28, 2022.

APPEARANCES [The New York Times](#), October 25, 2021.

[Todd Nief's Show](#), October 5, 2020.

[Complexity \(official SFI podcast\)](#), February 26, 2020.

[Quanta Magazine](#), July 19, 2019.

[Quanta Magazine](#), February 26, 2019.

[Science Magazine](#), April 18, 2017.

AD-HOC  
 REVIEWER AT

The American Naturalist  
 Bulletin of Mathematical Biology  
 Bioinformatics  
 Cognition  
 Collective Intelligence  
 eLife  
 Entropy  
 Ethology  
 Frontiers in Applied Mathematics and Statistics  
 Frontiers in Physics  
 Frontiers in Robotics and AI  
 Journal of the Royal Society Interface  
 Journal of Theoretical Biology  
 Methods in Ecology and Evolution  
 Nature Communications  
 Oikos  
 Philosophical Transactions of the Royal Society: B  
 PNAS  
 Proceedings of the Royal Society: A  
 Proceedings of the Royal Society: B  
 PLOS Computational Biology  
 PLOS ONE  
 Scientific Reports  
 Theoretical Ecology  
 Thinking & Reasoning  
 Trends in Cognitive Sciences