

# Kevin Surya

Department of Mathematical Sciences  
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## Curriculum Vitae

September 2024

### Education

- 2021– Ph.D. Montana State University, Statistics
- 2021–23 M.Sc. (en-route) Montana State University, Statistics  
Thesis: *A Bayesian analysis of the genetic evolution in living fossils*
- 2020–21 Ph.D. Montana State University, Molecular Biosciences Program  
(1-year program before acceptance into a home department)
- 2015–19 B.Sc. Montana State University, Directed Interdisciplinary Studies  
(biology, statistics, and earth sciences)

### Appointments

- 2021– Graduate teaching assistant  
Department of Mathematical Sciences, Montana State University
- 2020– Graduate research assistant  
Deep Time Biology Lab (PI: Chris Organ)
- 2020–21 Graduate research assistant  
Molecular Biosciences Program, Montana State University
- 2020–20 Research intern/volunteer  
DinoChicken Lab (PI: Dana Rashid), Montana State University
- 2016–19 Undergraduate research assistant  
MSU Macroevolution Lab (PI: Chris Organ), Montana State University
- 2015–19 Undergraduate research assistant  
DinoChicken Lab
- 2017–19 Undergraduate research assistant  
Varricchio Lab (PI: David Varricchio), Montana State University

### Publications

- 10. **Surya, K.**, and C. L. Organ. (2024). Molecular change, not time, drives phenotypic diversity. *To be submitted to Nature*.
- 9. Prall, J., L. Feigin, **K. Surya**, E. Bender, A. Meade, and C. L. Organ. (2024). Phylogenetic prediction of discrete traits: Moving beyond phylogenetic bracketing. *To be submitted to Nature Methods*.
- 8. Gardner, J. D., J. P. Wilson, **K. Surya**, H. M. Flora, X. Xing, and C. L. Organ. (2024). Emergent evolution of limb mechanics and the rise of aerial locomotion in dinosaurs. *To be submitted to Nature*.
- 7. Rashid, D. J., J. R. Sheheen, T. Huey, **K. Surya**, J. B. Sanders, J. R. Horner, J. Voyich, and S. C. Chapman. (2023). Nonpathological inflammation drives the development of an avian flight adaptation. *PNAS*. [Link](#).
- 6. **Surya, K.**, J. D. Gardner, and C. L. Organ. (2023). Detecting punctuated evolution in SARS-CoV-2 over the first year of the pandemic. *Frontiers in Virology*. [Link](#).

5. Fernandes-Martins, M. C., L. M. Keller, M. Munro-Ehrlich, K. R. Zimlich, M. K. Mettler, A. M. England, R. Clare, **K. Surya**, E. L. Shock, D. R. Colman, and E. S. Boyd. (2021). Ecological dichotomies arise in microbial communities due to mixing of deep hydrothermal waters and atmospheric gas in a circumneutral hot spring. *Applied and Environmental Microbiology*. [Link](#).
4. Nemudryi, A., A. Nemudraia, T. Wiegand, **K. Surya**, M. Büyükyörük, C. Cicha, K. Vanderwood, R. Wilkinson, and B. Wiedenheft. (2020). Temporal detection and phylogenetic assessment of SARS-CoV-2 in municipal wastewater. *Cell Reports Medicine*. [Link](#).
3. Rashid, D. J., R. Bradley, A. M. Bailleul, **K. Surya**, H. N. Woodward, P. Wu, Y-H. Wu, D. B. Menke, S. G. Minchey, B. Parrot, S. L. Bock, C. Merzdorf, E. Narotzky, N. Burke, J. R. Horner, and S. C. Chapman. (2020). Distal spinal nerve development and divergence of avian groups. *Scientific Reports*. [Link](#).
2. Gardner\*, J. D., **K. Surya\***, and C. L. Organ. (2019). Early tetrapodomorph biogeography: Controlling for fossil record bias in macroevolutionary analyses. *Comptes Rendus Palevol*. [Preprint](#). [Link](#).  
\* contributed equally to the study
1. Rashid, D. J., **K. Surya**, L. M. Chiappe, N. R. Carroll, K. L. Garrett, B. Varghese, A. Bailleul, J. K. O'Connor, S. C. Chapman, and J. R. Horner. (2018). Avian tail ontogeny, pygostyle formation, and interpretation of juvenile Mesozoic specimens. *Scientific Reports*. [Link](#).

## Grants & Awards (\$43,762)

21. Dr. William A. Stannard Awards for Excellence - Graduate Student Award for Teaching. 2024. \$500.
20. Montana State University (MSU) College of Letters and Science Dean's Student Travel Fund. 2024. \$899.
19. MSU Department of Mathematical Sciences Student Travel Award. 2024. \$1,000.
18. MSU Department of Mathematical Sciences Outstanding Graduate Student Award. 2023.
17. MSU Office of Student Engagement Student Club Rolling Funding: Molecular Biosciences Program student club. 2021. \$522.
16. MSU Graduate School Community-Building Mini-Grant. (2021). \$500.
15. Molecular Biosciences Program Fellowship. (2020). \$22,000++.
14. Society for the Study of Evolution (SSE)/BEACON Center for the Study of Evolution in Action Undergraduate Diversity at Evolution travel award. (2019). \$250++.
13. MSU Undergraduate Scholars Program (USP) Research Grant: Which phylogenetic branch length unit better fits species' phenotypic traits: Time or genetic substitution? (2018–2019). \$1,800.
12. MSU Office of Student Engagement Student Club Mass Funding: Dead Lizards Society, a paleontology journal club. (2018–2019). \$1,726.
11. Sigma Xi Grants-In-Aid of Research Program: Which phylogeny better fits species' trait data: Time or molecular tree? (2017–2018). \$1,000.
10. Geological Society of America (GSA) Rocky Mountain Section Travel Grant. (2017). \$90.
9. MSU USP Research Grant: Which phylogeny better fits species' trait data: Time or molecular tree? (2017–2018). \$1,800.
8. MSU College of Letters and Science Student Research Travel Grant. (2017). \$375.
7. GSA On To The Future Travel Awards. (2017). \$500++.
6. MSU USP Travel Grant: Paleohistology technique for sub-fossilized bone. (2017). \$500.
5. Kenny Dye Memorial Scholarship. (2017–2018). \$1,900.

4. Natural History Museum of Los Angeles Student Collections Study Award: Avian pygostyle fusion. (2017). \$1,300.
3. Montana Academy of Sciences Student Research Grant: Chicken pygostyle fusion sheds light on ankylosing spondylitis pathology. (2017–2018). \$700.
2. Montana IDeA Network of Biomedical Research Excellence (INBRE) Undergraduate Student Research Program: Chicken pygostyle fusion sheds light on ankylosing spondylitis pathology. (2017). \$4,600.
1. MSU USP Research Grant: Pelvic sexual dimorphism in Palaeognathae (Aves: Neornithes) and its evolutionary relationship with relative egg size. (2016–2017). \$1,800.

## Teaching

*As an instructor*

2024–25 STAT 216 – Introduction to Statistics, MSU (x1), Eval: TBD  
2021–22 M 121 – College Algebra, MSU (x2), Eval: 4.3/5

*As an assistant*

2023–24 STAT 412/512 – Methods for Data Analysis II, MSU (x2), Eval: 4.4/5  
2022–23 STAT 216 – Introduction to Statistics, MSU (x2), Eval: 4.5/5

## Software

1. **Surya, K.** (2022) `fallpaddy`: an R package for simulating, detecting, and visualizing punctuated evolution in any clades, from dinosaurs to viruses. [Link](#).

## Presentations

22. **Surya, K.,** J. D. Gardner, J. J. Borkowski, and C. L. Organ. (2024) Speciation's role in evolutionary divergence is systematically underestimated in comparative studies. Montana State University (MSU) Student Research Celebration.
21. **Surya, K.,** J. D. Gardner, J. J. Borkowski, and C. L. Organ. (2024) Speciation's role in evolutionary divergence is systematically underestimated in comparative studies. MSU Earth Sciences Colloquium.
20. **Surya, K.,** J. D. Gardner, J. J. Borkowski, and C. L. Organ. (2024) Speciation's role in evolutionary divergence is systematically underestimated in comparative studies. Perspectives on Speciation (Hybrid meeting).
19. **Surya, K.** (2023) A Bayesian analysis of the genetic evolution in living fossils. Master's en-route Thesis Defense.
18. **Surya, K.,** J. J. Borkowski, and C. L. Organ. (2022) The genomic evolution of living fossils. Montana American Statistical Association (ASA) Chapter Meeting.
17. **Surya, K.,** J. D. Gardner, and C. L. Organ. (2021) SARS-CoV-2 evolution is punctuated. Molecular Biosciences 1<sup>st</sup>-Year Fellow Presentations.
16. **Surya, K.,** and W. J. Freimuth. (2019) MSU EARTH101 – Earth System Sciences: Fossils and Evolution. *Guest Lecture*.
15. **Surya, K.,** and C. L. Organ. (2019) Molecular branch lengths fit trait evolution better than does time. Evolution Meeting.

14. Gardner, J. D., **K. Surya**, and C. L. Organ. (2019) Phylogeography of the tetrapod water-land transition. MSU Earth Sciences Colloquium.
13. **Surya, K.**, and C. L. Organ. (2019) Does trait evolution follow time or genetic substitution? National Conference of Undergraduate Research (NCUR).
12. **Surya, K.**, D. J. Rashid, and S. C. Chapman (2019) Chicken tail vertebral fusion sheds light on a human backbone disease. Montana Academy of Sciences Annual Meeting.
11. **Surya, K.**, D. J. Rashid, L. M. Chiappe, N. R. Carroll, K. L. Garrett, B. Varghese, A. Bailleul, J. K. O'Connor, S. C. Chapman, and J. R. Horner. (2018) Bird tail growth necessitates re-interpretation of Mesozoic bird fossils. MSU Earth Sciences Colloquium.
10. **Surya, K.**, and C. L. Organ. (2018) Which phylogeny better fits species' trait data: Time or molecular tree? MSU Student Research Celebration Topical Session: *Macroevolution: The Fellowship of the Tree*.
9. **Surya, K.**, and C. L. Organ. (2018) Which phylogeny better fits species' trait data: Time or molecular tree? NCUR.
8. **Surya, K.**, I. M. Brenes, J. D. Gardner, L. W. Viñola López, C. L. Organ, and D. J. Varricchio (2017) Pelvic coevolution with egg size and shape: Implications for extinct dinosaurs. Geological Society of America Annual Meeting.
7. Rashid, D. J., **K. Surya**, S. C. Chapman, L. M. Chiappe, A. M. Bailleul, and J. R. Horner (2017) Pygostyle development and its implications for the Cretaceous long- to short-tailed avian transition. Society of Vertebrate Paleontology Annual Meeting.
6. **Surya, K.**, D. J. Rashid, and S. C. Chapman (2017) Chicken pygostyle fusion sheds light on ankylosing spondylitis pathology. Montana IDeA Network of Biomedical Research Excellence (INBRE) Summer Research Poster Session.
5. **Surya, K.**, L. W. Viñola López, and E.-T. Lamm (2017) Paleohistology technique for sub-fossilized bone. International Symposium on Paleohistology.
4. **Surya, K.**, I. M. Brenes, L. W. Viñola López, J. D. Gardner, C. L. Organ, and D. J. Varricchio (2017) Pelvic sexual dimorphism in modern birds (Aves: Neornithes) and its evolutionary relationship with relative egg size. MSU Student Research Celebration.
3. **Surya, K.**, I. M. Brenes, L. W. Viñola López, J. D. Gardner, C. L. Organ, and D. J. Varricchio (2017) Pelvic sexual dimorphism in modern birds (Aves: Neornithes) and its evolutionary relationship with relative egg size. MSU Earth Sciences Colloquium.
2. **Surya, K.**, L. W. Viñola López, I. M. Brenes, J. D. Gardner, C. L. Organ, and D. J. Varricchio (2017) Pelvic sexual dimorphism in modern birds (Aves: Neornithes) and its evolutionary relationship with relative egg size. NCUR.
1. **Surya, K.** (2016) Assessment on the origins of avian active flight. MSU Earth Sciences Colloquium.

## Professional Service

### Panel Organizer

2021 Molecular Biosciences Career Panel: Primarily Undergraduate Institutions

2021 Molecular Biosciences Career Panel: NIH and Health/Bioinformatics Industries (moderator)

### Service to Profession

- Peer co-reviewer ( $n = 6$ ; *Biology Letters* [1], *Evolution* [1], *Journal of Evolutionary Biology* [2], *Proceedings of the Royal Society B* [1], and *Science Advances* [1])

### *Memberships*

- Society for the Study of Evolution (2017–)
- American Statistical Association Student Chapter at MSU (2022– ; vice president 2024–)
- Society of Systematic Biologists (2017–2023)
- MSU Molecular Biosciences Program Student Committee (treasurer/general student committee member 2020–2022)
- MSU Dead Lizards Society (paleontology journal club; co-president 2017–2018)
- MSU Asian Student Interracial Association (officer 2021)
- Sigma Xi (2017–2018)
- Montana Academy of Sciences (2016–2018)
- Society of Vertebrate Paleontology (2015–2019)
- Geological Society of America (2016–2018)

### **Volunteer & Public Outreach**

- 2018, 19 Montana State University (MSU) Family Science Day
- 2018 Montana Science Olympiad
- 2018 Morning Star Elementary School STEM Expo
- 2017 Society of Vertebrate Paleontology volunteer at the Geological Society of America Annual Meeting
- 2017 Museum of the Rockies (MOR) Scout's Day
- 2016 MOR volunteer in *MSU Catapalooza*
- 2016 MOR volunteer in *Adventures in the Lost World*
- 2016–17 MOR dinosaur educational cart and fossil preparation volunteer (212.5 hours)
- 2015–16 Volunteer fossil preparator for L. J. Krumenacker, Ph.D.

### **National and International Conferences Attended**

- 2024 Perspectives on Speciation (Hybrid meeting)
- 2019, 21 Evolution Meeting
- 2017 Geological Society of America Annual Meeting
- 2017 International Symposium on Paleohistology
- 2016, 17 Society of Vertebrate Paleontology Annual Meeting

### **Workshop Attended**

- 2020 Multiscale Microbial Dynamics Modeling Summer School (online)
- 2018 RevBayes Demonstration and Mini Workshop by Tracy Heath

### **Paleontological Field Experience**

- 2018 Excavation, Foremost Formation, north of Rudyard, MT, USA (10 days)
- 2016 Excavation and prospection, Two Medicine Formation, west of Choteau, MT, USA (31 days)

### **Skills**

- Data science and programming (R, PYTHON, GIT, BASH, SQL, and using an HPC cluster)
- Bayesian modeling (NIMBLE, STAN, JAGS, PYMC, and REVBAYES)
- Mathematical statistics (and using LATEX)
- Package development (R)

- Machine learning (e.g., random forest), multivariate statistics (e.g., PCA and factor analysis), nonparametric statistics (R), and biostatistics (R)
- Phylogenetic comparative methods (R, BAYESTRAITS, and LEVOLUTION)
- Multiple sequence alignment and editing (ALIVIEW, JALVIEW, MUSCLE, MAFFT, PAGAN, TRIMAL)
- Phylogenetic inference and divergence time estimation (MESQUITE, RAPIDNJ, SDM, PHYD\*, TREEPL, LSD2, FASTTREE, PHYML, RAXML, IQ-TREE, MRBAYES, BEAST1, and BEAST2)
- Selection inference (HYPHY/DATAMONKEY)
- Light and fluorescence microscopy
- Histochemistry (picosirius red, alcian blue, modified tetrachrome, von Kossa, Giemsa, hematoxylin, eosin, and toluidine blue stainings)
- Immunohistochemistry (tuj1, TUNEL assay, and sambucus nigra stainings)
- Bone demineralization with a cation exchange resin
- Dissection (embryonic and post-hatching birds)
- Paleontology field work (excavation and prospection)
- Paleontology techniques (fossil preparation, molding, and casting)
- Paleohistology techniques

## References

1. **Chris Organ**  
Department of Earth Sciences  
Montana State University, Bozeman, MT, USA  
[organ@montana.edu](mailto:organ@montana.edu) | 406 589 6462
2. **Andrew Hoegh**  
Department of Mathematical Sciences  
Montana State University, Bozeman, MT, USA  
[andrew.hoegh@montana.edu](mailto:andrew.hoegh@montana.edu) | 406 994 2032
3. **John Borkowski**  
Department of Mathematical Sciences  
Montana State University, Bozeman, MT, USA  
[john.borkowski@montana.edu](mailto:john.borkowski@montana.edu) | 406 994 4606
4. **Dana Rashid**  
Department of Microbiology and Immunology  
Montana State University, Bozeman, MT, USA  
[danarashid5@gmail.com](mailto:danarashid5@gmail.com) | 406 994 6525
5. **David Varricchio**  
Department of Earth Sciences  
Montana State University, Bozeman, MT, USA  
[djv@montana.edu](mailto:djv@montana.edu) | 406 994 6907