

# SANDRA WINTERS

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Research interests:

evolutionary ecology • adaptive coloration • visual ecology  
complex signals • optimal phenotypes • computer vision

(Updated April 2022)

## ACADEMIC POSITIONS

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Sept 2022-Aug 2025 **Postdoctoral Researcher**

Academy of Finland project “The evolution of warning signal diversity”  
Ecology and Evolution of Interactions Lab ([predatorpreyinteractions.com](http://predatorpreyinteractions.com))  
Faculty of Biological and Environmental Sciences  
*University of Helsinki*, Helsinki, FI

Sept 2019-Aug 2022 **Research Associate**

BBSRC project “Concealing 3D objects” (PI: Innes Cuthill)  
Camo Lab ([camolab.com](http://camolab.com))  
School of Biological Sciences  
*University of Bristol*, Bristol, UK

## EDUCATION

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2019 **PhD** in Biological Anthropology, *New York University*, New York, NY, USA

2015 **MA** in Biological Anthropology, *New York University*, New York, NY, USA

2011 **MS** in Primate Behavior, *Central Washington University*, Ellensburg, WA, USA

2008 **BS** in Psychology & Anthropology, *University of Maryland*, College Park, MD, USA

## PUBLICATIONS

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Google scholar: [goo.gl/84wbvo](https://goo.gl/84wbvo) ORCID: [0000-0002-9561-5950](https://orcid.org/0000-0002-9561-5950)

### *Peer-reviewed journal articles*

[12] Higham JP, Kimmock CM, Mandalaywala TM, Heistermann M, Cascio J, Petersdorf M, **Winters S**, Allen WL, Dubuc C. 2021. Female ornamentation: is red skin coloration attractive to males, and related to condition, in female rhesus macaques? *Behavioral Ecology* 32:236-247. [doi.org/10.1093/beheco/araa121](https://doi.org/10.1093/beheco/araa121)

[11] Ghazanfar AA, Kelly LM, Takahashi DY, **Winters S**, Terrett R, Higham JP. 2020. Domestication phenotype linked to vocal behavior in marmoset monkeys. *Current Biology* 30:5026-5032. [doi.org/10.1016/j.cub.2020.09.049](https://doi.org/10.1016/j.cub.2020.09.049)

- [10] **Winters S**, Allen W, Higham JP. 2020. The structure of species discrimination signals across a primate radiation. 2020. *eLife* 9:e47428. [doi.org/10.7554/eLife.47428](https://doi.org/10.7554/eLife.47428)
- [9] Minkner MMI, **Winters S**, Young C, Weiß B, Ganswindt A, Barrett L, Henzi P, Higham JP, Widdig A. 2020. Male characteristics as predictors of genital color and display variation in vervet monkeys. *Behavioral Ecology and Sociobiology* 74:14. [doi.org/10.1007/s00265-019-2787-4](https://doi.org/10.1007/s00265-019-2787-4)
- [8] Rigaiil L, Higham JP, **Winters S**, Garcia C. 2019. The redder the better? Skin coloration indicates quality in female Japanese macaques. *Behavioral Ecology and Sociobiology* 73:103. [doi.org/10.1007/s00265-019-2712-x](https://doi.org/10.1007/s00265-019-2712-x)
- [7] Dominy NJ, **Winters S**, Pease DE, Higham JP. 2018. Dr. Seuss and the real Lorax. *Nature Ecology and Evolution* 2:1196-1198. [doi.org/10.1038/s41559-018-0628-x](https://doi.org/10.1038/s41559-018-0628-x)
- [6] Petersdorf M, Dubuc C, Georgiev AV, **Winters S**, Higham JP. 2017. Is male rhesus macaque facial coloration under intrasexual selection? *Behavioral Ecology* 28:1472-1481. [doi.org/10.1093/beheco/axx110](https://doi.org/10.1093/beheco/axx110)
- [5] Rigaiil LR, MacIntosh AJJ, Higham JP, **Winters S**, Shimizu K, Mouri K, Suzumura T, Furuichi T, Garcia C. 2017. Testing for links between face color and age, dominance status, parity, weight, and intestinal nematode infection in a sample of female Japanese macaques. *Primates* 58:83-91. [doi.org/10.1007/s10329-016-0575-6](https://doi.org/10.1007/s10329-016-0575-6)
- [4] Dubuc C, Allen WL, Cascio J, Lee S, Maestripieri D, Petersdorf M, **Winters S**, Higham JP. 2016. Who cares? Experimental attention biases provide new insights into a mammalian sexual signal. *Behavioral Ecology* 27:68-74. [doi.org/10.1093/beheco/arv117](https://doi.org/10.1093/beheco/arv117)
- [3] Rigaiil LR, MacIntosh AJJ, Higham JP, **Winters S**, Shimizu K, Mouri K, Furuichi T, Garcia C. 2015. Multimodal advertisement of pregnancy in free-ranging female Japanese macaques (*Macaca fuscata*). *PLoS One* 10:e0135127. [doi.org/10.1371/journal.pone.0135127](https://doi.org/10.1371/journal.pone.0135127)
- [2] **Winters S**, Dubuc C, Higham JP. 2015. Perspectives: the looking time experimental paradigm in studies of animal visual perception and cognition. *Ethology* 121:625-640. [doi.org/10.1111/eth.12378](https://doi.org/10.1111/eth.12378)
- [1] Dubuc C, **Winters S**, Allen WL, Brent LJN, Cascio J, Maestripieri D, Ruiz-Lambides AV, Widdig A, Higham JP. 2014. Sexually selected skin colour is heritable and related to fecundity in a non-human primate. *Proceedings of the Royal Society B: Biological Sciences* 281:20141602. [doi.org/10.1098/rspb.2014.1602](https://doi.org/10.1098/rspb.2014.1602)

### **Book sections**

- [4] **Winters S**, Petersdorf M, Higham JP. 2019. Charles Darwin and sexual selection in relation to sex in the colors of monkeys. In: *Darwin's Roadmap to the Curriculum: Evolutionary Studies in Higher Education*, Wilson DS, Geher G, Head H, Sokol-Chang R (eds). Oxford University Press. p 97-116. [doi.org/10.1093/oso/9780190624965.003.0006](https://doi.org/10.1093/oso/9780190624965.003.0006)
- [3] **Winters S**. Aposematism. 2018. In: *Encyclopedia of Animal Cognition and Behavior*, Vonk J & Shackelford TK (eds). Springer, Cham. [doi.org/10.1007/978-3-319-47829-6\\_313-10/978-3-319-47829-6\\_313-1](https://doi.org/10.1007/978-3-319-47829-6_313-10/978-3-319-47829-6_313-1)
- [2] **Winters S**. Ornamentation. 2018. In: *Encyclopedia of Animal Cognition and Behavior*, Vonk J & Shackelford TK (eds). Springer, Cham. [doi.org/10.1007/978-3-319-47829-6\\_315-1](https://doi.org/10.1007/978-3-319-47829-6_315-1)
- [1] Higham JP & **Winters S**. 2016. Color and mate choice in non-human animals. In: *Handbook of Color Psychology*, Elliott AJ, Fairchild MD, (eds). Cambridge University Press: Cambridge, UK. p 502-530. [doi.org/10.1017/CBO9781107337930.025](https://doi.org/10.1017/CBO9781107337930.025)

### **Book & conference reviews**

- [3] **Winters S** & Higham JP. 2015. Martin Stevens: Sensory Ecology, Behaviour, and Evolution. *International Journal of Primatology* 36:205-208. [doi.org/10.1007/s10764-015-9811-y](https://doi.org/10.1007/s10764-015-9811-y)
- [2] **Winters S**, Dunayer ES, Petersdorf M, Simons ND, Tinsman J. 2015. Primatology and conservation in Hanoi, Vietnam. *Evolutionary Anthropology* 23:201-204. [doi.org/10.1002/evan.21429](https://doi.org/10.1002/evan.21429)
- [1] Higham JP, Amann AL, Bryer MAH, Thompson NA, **Winters S**. 2013. Review of The Evolution of Primate Societies (Eds. John C. Mitani, Josep Call, Peter M. Kappeler, Ryne A. Palombit, and Joan B. Silk). *International Journal of Primatology* 34:1298-1303. [doi.org/10.1007/s10764-013-9731-7](https://doi.org/10.1007/s10764-013-9731-7)

### **Published abstracts**

- [7] Higham JP, Allen WA, **Winters S**. 2018. The evolution of guenon face patterns. *Primate Research Supplement* 34:48. [doi.org/10.14907/primate.34.0\\_48\\_2](https://doi.org/10.14907/primate.34.0_48_2)
- [6] Rigaill L, MacIntosh AJJ, Higham JP, **Winters S**, Furuichi T, Garcia C. 2017. Face colour indicates female reproductive state but not individual characteristics in Japanese macaques (*Macaca fuscata*). *Folia Primatologica* 88:100-101. [doi.org/10.1159/000479094](https://doi.org/10.1159/000479094)
- [5] Rigaill LR, MacIntosh AJJ, Higham JP, **Winters S**, Shimizu K, Mouri K, Furuichi T, Garcia C. 2015. Female Japanese macaques advertise pregnancy in multiple modalities. *Folia Primatologica* 86:346. [doi.org/10.1159/000435825](https://doi.org/10.1159/000435825)

- [4] Rigai LR, MacIntosh AJJ, Higham JP, **Winters S**, Shimizu K, Mouri K, Furuichi T, Garcia C. 2015. Multiple sexual signals of pregnancy in Japanese macaques. *Primate Research Supplement* 31:72. [doi.org/10.14907/primate.31.0\\_72\\_2](https://doi.org/10.14907/primate.31.0_72_2)
- [3] Milich KM, Dubuc C, **Winters S**, Allen WL, Rosenfield KA, Graham S, Higham JP, Maestripieri D. 2015. Red-hot males: sexual strategies of high-ranking male rhesus macaques (*Macaca mulatta*). *American Journal of Physical Anthropology* 156(S60):225-226. [doi.org/10.1002/ajpa.22718](https://doi.org/10.1002/ajpa.22718)
- [2] **Winters S**, Kamilar JM, Webster TH, Bradley BJ, Higham JP. 2014. Primate camouflage as seen by felids, raptors, and conspecifics. *American Journal of Physical Anthropology* 153(S58):275. [doi.org/10.1002/ajpa.22488](https://doi.org/10.1002/ajpa.22488)
- [1] Simons ND, **Winters S**, Lorenz JG. 2014. Comparative analysis of length polymorphisms in the promoter region of the serotonin transporter gene (SLC6A4) in Cercopithecidae. *American Journal of Primatology* 73(S1):83. [doi.org/10.1002/ajp.20978](https://doi.org/10.1002/ajp.20978)

**Publications in progress** (fully drafted manuscripts)

- [1] **Winters S** & Higham JP. Simulated evolution of mating signal diversification in a primate radiation. Under review at *Proceedings of the Royal Society B: Biological Sciences*.
- [2] Middleton R, Tunstad SA, **Winters S**, McCallum S, Whitney, HM. Bloom fruits are structurally coloured by disordered epicuticular wax. Under review at *Current Biology*.
- [3] Eyre J, Williams SA, Grabowski M, **Winters S**, Pontzer H. Bi-iliac breadth has a significant effect on maximum core temperature, but not change in core temperature, in runners. Under review at *Proceedings of the National Academy of Sciences*.
- [4] **Winters S**, Kamilar JM, Webster TH, Bradley BJ, Higham JP. Primate camouflage in the eyes of felids, raptors, and conspecifics. In prep for resubmission to *Journal of Evolutionary Biology*.
- [5] Petersdorf M, Weyher AH, Heistermann M, Gunson JL, Govaerts A, Siame S, Mustill RL, Hillegas ME, **Winters S**, Dubuc C, Higham JP. Multimodal fertility signals in female Kinda baboons: a test of comparative predictions. Manuscript in prep.
- [6] **Winters S**, Allen WL, Dubuc C, Higham JP. Linking mating signal form and function in primates. Manuscript in prep.
- [7] Coyne SP, **Winters S**, Newman LE, Heistermann M, Maestripieri D, Higham JP. The ontogeny of sexual signals in female rhesus macaques. Manuscript in prep.

## FUNDING

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### ***Fellowships & Assistantships***

- 2022-2025 Postdoctoral Researcher (3 years), *Academy of Finland*  
2015-2017 MacCracken Fellowship (2 years), *New York University*  
2012-2015 NSF IGERT Training Fellowship (3 years), *New York University*  
2010-2011 Research Assistantship (1 year), *Central Washington University*  
2009-2010 Graduate Assistantship (1 year), *Central Washington University*

### ***Competitive Research Grants***

- 2023 *Academy of Finland* Postdoctoral Researcher Fellowship (**€269,743**)  
2023 *Finnish Cultural Foundation* Expenditure Grant (**€3,000**)  
2023 *Finnish Cultural Foundation* Working Grant (**€30,000**) \*declined in favour of Academy of Finland Postdoctoral Researcher Fellowship  
2016 *National Science Foundation* Doctoral Dissertation Research Improvement Grant (**\$22,611**)  
2015 *American Society of Primatologists* General Small Grant (**\$1,250**)  
2010 *Central Washington University* Graduate Student Summer Research Grant (**\$3,500**)

### ***Institutional Research Awards***

- 2015 *New York Consortium in Evolutionary Primatology* Research Award (**\$3,000**)  
2014 *New York Consortium in Evolutionary Primatology* Research Award (**\$3,498**)

### ***Travel Awards***

- 2019 *Animal Behavior Society* Graduate Student Travel Grant (**\$500**)  
2018 *International Society for Behavioral Ecology* Travel Award (**\$500**)  
2016 *International Society for Behavioral Ecology* Travel Award (**\$1,250**)  
2016 *New York University* Dean's Student Travel Grant (**\$500**)  
2014 *New York University* Student Senators Council's Conference Fund Award (**\$630**)  
2014 *New York University* Dean's Student Travel Grant (**\$500**)

## TEACHING EXPERIENCE

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### ***Adjunct Instructor***

- Human Evolution, New York University (22 undergraduates): 2018  
Human Origins Laboratory, New York University (2 x 22 undergraduates): 2014, 2018  
Human Evolution Laboratory, New York University (2 x 22 undergraduates): 2014, 2017

### ***Teaching Assistant***

- Quantitative Methods, New York University (15 graduate students): 2016  
Genetics Laboratory, Central Washington University (2 x 30 undergraduates): 2010  
Sociocultural Anthropology & Linguistics, University of Maryland College Park (20 undergraduates): 2007

### ***Guest lectures***

- 2018 “Darwin and the origin of evolution by natural selection”  
Human Origins (120 undergraduates), New York University
- 2017 “Primate diet, predation, and ecology”  
Human Evolution (120 undergraduates), New York University
- 2016 “Introduction to R Programming” & “Mixed models”  
Quantitative Methods (15 graduate students), New York University
- 2014 “Studying primates in biological anthropology”  
Departmental Seminar (10 graduate students), New York University
- 2013 “Approaches in Behavioral Ecology I: Observation”  
Primate Behavioral Ecology (20 undergraduates), New York University
- 2010 “Forensic anthropology”  
Intro to Biological Anthropology (60 undergraduates), Central Washington University

### **SUPERVISING & MENTORING**

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- 2021 Mentored 3 Bioinformatics MSc students in the Mentoring Group at University of Bristol
- 2019 Supervised 1 undergraduate intern in the Camo Lab at University of Bristol
- 2018-2019 Co-supervised 1 undergraduate thesis project at New York University
- 2018 Mentored 2 undergraduate students through the NYU Diversity Undergraduate Research Incubator program (designed to provide research opportunities and academic mentoring to undergraduates from underrepresented or underserved populations)
- 2014-2018 Supervised 6 undergraduate interns in the Primate Reproductive Strategies Lab at New York University
- 2016-2017 Women’s Mentoring Circle (peer mentoring program) at the American Museum of Natural History
- 2015-2016 Co-supervised 1 undergraduate thesis project at City University of New York

### **PRESENTATIONS**

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#### ***Invited research talks***

- [4] **Winters S** (2018). Linking visual signal form and function in primates: facial variability in guenons and rhesus macaques. *New York Consortium in Evolutionary Primatology Seminar Series*, New York, NY, USA.
- [3] **Winters S** (2018). The evolution of guenon face patterns as diverse mating signals. *Biological Anthropology Seminar Series*, New York University, New York, NY, USA.
- [2] **Winters S** (2016). Guenon face patterns and the maintenance of primate reproductive isolation. *Sexual Selection and Parental Investment Seminar Series*, Yale University, New Haven, CT, USA.
- [1] **Winters S** (2014). Primate camouflage in the eyes of felids, raptors, and conspecifics. *New York Consortium in Evolutionary Primatology Seminar Series*, New York, NY, USA.

### ***Podium presentations at conferences***

- [9] **Winters S & Higham HP** (2019). Simulating the evolution of inter-specific mating signal diversity: a machine learning approach. Joint meeting of the *36<sup>th</sup> International Ethological Conference* and the *56<sup>th</sup> Annual Conference of the Animal Behavior Society*, Chicago, USA.
- [8] **Winters S, Allen WL, Higham JP** (2017). Analyzing visual signals using biologically-inspired computer vision algorithms. Joint meeting of the *35<sup>th</sup> International Ethological Conference* and the *2017 Summer Meeting of the Association for the Study of Animal Behaviour*, Estoril, Portugal.
- [7] **Winters S & Higham JP** (2016). Visual biases and the evolution of species discrimination in guenons. Joint meetings of the *26th Congress of the International Primatology Society* and the *39th Meeting of the American Society of Primatologists*, Chicago, IL, USA.
- [6] **Winters S & Higham JP** (2016). Visual biases and the evolution of species discrimination in guenons. *16th International Behavioral Ecology Congress*, Exeter, UK.
- [5] **Winters S, Kamilar JM, Webster TH, Bradley BJ, Higham JP** (2014). Primate camouflage as seen by felids, raptors, and conspecifics. *83rd Annual Meeting of the American Association of Physical Anthropologists*, Calgary, Canada. **\*Winner of best student presentation award.**
- [4] **Winters S & Sheeran SK** (2011). Maternal response to infant disability: a case study of traumatic injury to an infant Tibetan macaque (*Macaca thibetana*). *Society for Psychological Anthropology Conference*, Spokane, WA, USA.
- [3] **Winters S, Sheeran LK, Wagner S, Li J, Matheson M** (2011). Social recruitment in Tibetan macaques (*Macaca thibetana*) at Mt. Huangshan, China. *64th Northwest Anthropology Conference*, Moscow, ID, USA.
- [2] **Winters S & Sheeran SK** (2011). Maternal response to infant disability: a case study of traumatic injury to an infant Tibetan macaque (*Macaca thibetana*). *64th Northwest Anthropology Conference*, Moscow, ID, USA.
- [1] **Winters S, Simons N, Lorenz** (2011). Polymorphisms in the promoter region of the serotonin transporter gene in cercopithecine primates. *64th Northwest Anthropology Conference*, Moscow, ID, USA.

### ***Poster presentations at conferences***

- [4] **Winters S, Kamilar JM, Webster TH, Bradley BJ, Higham JP**. (2015) Primate camouflage as seen by felids, raptors, and conspecifics. *52nd Annual Conference of the Animal Behavior Society*, Anchorage, AK, USA.
- [3] **Winters S, Allen WL, Higham JP**. (2014) Machine learning reveals facial regions critical for species recognition in guenons. *25th Congress of the International Primatological Society*, Hanoi, Vietnam.
- [2] **Winters S, Allen WL, Higham JP**. (2014) Machine learning reveals facial regions critical for species recognition in guenons. *15th International Behavioral Ecology Congress*, New York, NY, USA
- [1] **Winters S**. (2010) Enrichment use in captive orangutans at Smithsonian National Zoological Park. *63rd Northwest Anthropology Conference*, Ellensburg, WA, USA.

## RESEARCH EXPEDITIONS

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- 2019 Cayo Santiago field station, Puerto Rico, USA: looking time experiments and standardized image collection in free-ranging rhesus macaques. Funded by *The Leakey Foundation* (PI James Higham) (6 weeks).
- 2017 Gashaka Gumti National Park, Nigeria: behavioural data and standardized image collection in wild putty nosed (*Cercopithecus nictitans*) and mona monkeys (*C. mona*). Funded by the *National Science Foundation* (2 months; project cut short when the site was evacuated due to security concerns).
- 2015 CERCOPAN primate sanctuary, Calabar, Nigeria: looking time experiments, standardized image collection, biological sampling (cheek, vaginal swabs) of captive guenons (*Cercopithecus* spp.). Funded by the *New York Consortium for Evolutionary Primatology* and the *International Primatological Society* (5 months).
- 2014 CEROC PAN primate sanctuary, Calabar, Nigeria and Gashaka Gumti National Park, Nigeria: reconnaissance trip with Dr James Higham (PhD supervisor) to evaluate the suitability of these sites and collect pilot data for my dissertation research. Funded by the *New York Consortium for Evolutionary Primatology* (1 month).
- 2011 Cayo Santiago field station, Puerto Rico, USA: audio playback experiments and looking time experiments in free-ranging rhesus macaques, under the supervision of Dr Dana Pfefferle. Funded by the *Max Planck Institute for Evolutionary Primatology* (6 months).
- 2010 Vally of the Wild Monkeys, Huangshan Mountains, China: behavioural data collection in free-ranging Tibetan macaques (*Macaca thibetana*). Funded by a *Central Washington University* (3 months).
- 2005 El Zota Field Station, Costa Rica: “Primate Behavior and Conservation” field course (run by DANTA: Association for Conservation of the Tropics) (1 month).

## TECHNICAL SKILLS

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Programming	Languages: MATLAB, R, Python, Java, Visual Basic, NetLogo, JavaScript, HTML Skills: machine learning, computer vision, image processing & analysis, artificial neural networks, agent-based modeling, data wrangling
Statistics	generalized linear mixed models, phylogenetic comparative methods
Laboratory	DNA extraction (saliva), PCR, gel electrophoresis, ELISA enzyme immunoassays
Field	standardized image collection, looking time experiments, audio playback experiments, behavioral data collection, collection of biological samples (e.g., swabs, hair samples), ecological data collection, handling anesthetized primates

## OUTREACH

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- Tweet primarily about science @SandraWinters22 (>1000 followers)
- Guest curator of @BioTweeps twitter handle (2016)
- Leader of educational trips to the Bronx Zoo for New York University students (2015-2016)



## **PROFESSIONAL SERVICE**

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Ad-hoc peer reviewer: The American Naturalist, American Journal of Primatology, Animal Behavior and Cognition, Animal Behaviour, Animal Cognition, Behavioral Ecology, Ecology & Evolution, Evolution, Integrative Zoology, Journal of Mammalian Evolution, Journal of the Royal Society Interface, PLoS One, Proceedings of the Royal Society B: Biological Sciences, Scientific Reports (review metrics: [publons.com/a/1189818](https://publons.com/a/1189818))

## **SOCIETY MEMBERSHIPS**

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2011-present Animal Behavior Society  
2014-present International Society for Behavioral Ecology  
2018-present Society for the Study of Evolution  
2019-present Association for the Study of Animal Behaviour  
2014-2019 Northeastern Evolutionary Primatologists  
2016-2019 American Association of University Women  
2010-2017 International Primatological Society  
2010-2016 American Society of Primatologists

## **CERTIFICATIONS**

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Wilderness First Aid (2016)  
USA Driving License (2002-present)

## **REFERENCES**

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Prof Innes Cuthill (postdoc PI): [I.Cuthill@bristol.ac.uk](mailto:I.Cuthill@bristol.ac.uk)  
Prof Nick Scott-Samuel (postdoc Co-PI): [N.E.Scott-Samuel@bristol.ac.uk](mailto:N.E.Scott-Samuel@bristol.ac.uk)  
Dr Roland Baddeley (postdoc Co-PI): [Roland.Baddeley@bristol.ac.uk](mailto:Roland.Baddeley@bristol.ac.uk)  
Prof James P. Higham (PhD advisor): [jhigham@nyu.edu](mailto:jhigham@nyu.edu)  
Prof Tamra Mendelson (PhD committee member): [tamram@umbc.edu](mailto:tamram@umbc.edu)  
Prof Martin Stevens (PhD committee member): [martin.stevens@exeter.ac.uk](mailto:martin.stevens@exeter.ac.uk)

## **CONTACT INFORMATION**

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