

# James Holehouse

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🌐 My Website

🐙 GitHub

🎓 Scholar

🌐 LinkedIn



## Biography

- I'm a postdoc at the Santa Fe Institute and completed my PhD in Mathematical Biology at the University of Edinburgh, specializing in the application of stochastic methods to study gene regulatory networks. I obtained a first-class honors degree in Theoretical Physics (MPhys) from the University of Edinburgh. I am interested in complexity and non-equilibrium statistical physics, particularly: **gene expression, enzyme kinetics, cross-situational learning and complexity economics/econophysics**. Most of my work has been interested in **constructing stochastic models, model reduction or time-dependent** analytic solutions of non-equilibrium problems.




## Employment History

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|-------------------------|---|
| October 2022 – Present  | ■ <b>Postdoc at the Santa Fe Institute.</b><br>Postdoc, supervised by Sidney Redner, Chris Kempes, Geoffrey West, Vicky Chuqiao Yang and Hyejin Youn (Northwestern University). Research topics are a mix of studies on principles of regulatory networks, but additionally on problems in non-equilibrium statistical physics. I organised 72 Hours of Science for the year 2023 on the topic "The Science of the Science of Science". |
| May 2021 – October 2021 | ■ <b>Economic Modelling Intern at Cambridge Econometrics.</b><br>An industrial internship in complexity economics alongside Hector Pollitt.   |
| Feb 2021 – Feb 2022     | ■ <b>Tutor at MyTutor.</b><br>I tutor Maths and Physics at GCSE and A-level to school students.   |
| Sept 2019 – June 2021   | ■ <b>Teaching Assistant at the University of Edinburgh.</b><br>I taught Python programming to 1st year Biology students.  |
| June 2017 – Aug 2017    | ■ <b>NERC Summer Researcher at the University of Edinburgh.</b><br>A climate science summer internship supervised by Simon Tett, answering the question: "Has climate change affected the risk of summer anticyclones in the UK?"   |







## Education

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|-------------|---|
| 2018 – 2022 | ■ <b>PhD, the University of Edinburgh</b> in <i>Mathematical Biology</i> .<br>Studying stochastic models of gene expression under Prof. Ramon Grima, co-supervised by Prof. Meriem El Karoui.   |
| 2021        | ■ <b>TensorFlow Certificates</b> in Coursera.<br>Achieved 99% in courses on <i>Introduction to TensorFlow for Artificial Intelligence, Machine Learning, and Deep Learning</i> and <i>Convolutional Neural Networks in TensorFlow</i> . |



## Education (continued)

- 2020 – 2021     **Centre for Open Learning, the University of Edinburgh** *Introduction to Philosophy*.  
I completed a night-school Philosophy course during my Ph.D. studies, achieving an overall mark of 67%. My assignments focused on the applications of Descartes method of doubt, Camus' conclusions on the story of Sisyphus, and Gilbert Ryle's criticism of Cartesian dualism.
- 2014 – 2018     **MPhys, the University of Edinburgh** in *Theoretical Physics*.  
I achieved a First Class Honours degree (1:1), with 78% in my Masters project (studying under Prof. Richard Blythe) and 76% overall degree mark. My course choices were tailored to mathematical and statistical physics modules, including advanced statistical physics (72%), quantum theory (84%) and Fourier analysis and statistics (87%).
- 2012 – 2014     **A-Levels, Scarborough Sixth Form College**.  
Obtained A\*A\*A in Mathematics, Physics and Chemistry respectively, and AS-Levels AA in Further Mathematics and Biology.


## Seminars and Invited Talks

- 2023     **Workshop talk** at *The Santa Fe Institute*.  
A unified mechanistic model of diversity in cities, cells and companies.
- 2022     **Seminar** at *Cambridge Econometrics*.  
Stochastic methods for binary decision models.
-  **Seminar** at *Scuola Superiore Sant'Anna*.  
Stochastic methods for binary decision models.
-  **Invited talk** at *The Santa Fe Institute*.  
Time-dependent solutions to master equations in chemical kinetics and opinion formation.
- 2021     **Seminar** at *The University of St. Andrews*.  
Stochastic time-dependent enzyme kinetics: Closed-form solution and transient bimodality.
- 2019     **Invited talk** at *The University of Edinburgh*.  
Using moment-based maximum likelihood inference to infer parameters from experimental data.

## Mentoring


- 2023     **Anish Pandya (The University of Texas at Austin)** at *The Santa Fe Institute*.  
Volume Dependence in Stochastic Gene Expression.
-  **Nathan Hasegawa (Harvey Mudd College)** at *The Santa Fe Institute*.  
Island Growth Models with Preferential Attachment.

## Grants

- 2020     **Scottish Mathematical Biology Forum (SMBF) 2020 Research Collaboration Prize** for £500 alongside Jochen Kursawe of the University of St. Andrews.  
The physical meaning and application of Hill functions in gene regulatory networks.

## Research Publications

### Articles

-  **Holehouse, J.** (2023). Recurrence and eigenfunction methods for non-trivial models of discrete binary choice. *Entropy*, 25(7), 996.

- 2 **Holehouse, J.,** & Redner, S. (2023). First-passage on disordered intervals. *arXiv preprint arXiv:2307.08879*. Submitted.
- 3 Weidemann, D. E., **Holehouse, J.,** Singh, A., Grima, R., & Hauf, S. (2023). The minimal intrinsic stochasticity of constitutively expressed eukaryotic genes is sub-poissonian. *Science Advances*, 9(32), eadh5138.
- 4 **Holehouse, J.,** & Moran, J. (2022). Exact time-dependent dynamics of discrete binary choice models. *Journal of Physics: Complexity*. **Corresponding author paper.**
- 5 **Holehouse, J.,** & Pollitt, H. (2022). Non-equilibrium time-dependent solution to discrete choice with social interactions. *PLOS ONE*. **Corresponding author paper.**
- 6 Braichenko, S., **Holehouse, J.,** & Grima, R. (2021). Distinguishing between models of mammalian gene expression: Telegraph-like models versus mechanistic models. *Journal of the Royal Society Interface*. **Joint first author publication.**
- 7 **Holehouse, J.,** Cao, Z., & Grima, R. (2020). Stochastic modeling of autoregulatory genetic feedback loops: A review and comparative study. *Biophysical journal*, 118(7), 1517–1525.
- 8 **Holehouse, J.,** Gupta, A., & Grima, R. (2020). Steady-state fluctuations of a genetic feedback loop with fluctuating rate parameters using the unified colored noise approximation. *Journal of Physics A: Mathematical and Theoretical*, 53(40), 405601.
- 9 **Holehouse, J.,** Sukys, A., & Grima, R. (2020). Stochastic time-dependent enzyme kinetics: Closed-form solution and transient bimodality. *The Journal of Chemical Physics*, 153(16), 164113.
- 10 **Holehouse, J.,** & Grima, R. (2019). Revisiting the reduction of stochastic models of genetic feedback loops with fast promoter switching. *Biophysical journal*, 117(7), 1311–1330.
- 11 **Holehouse, J.,** & Blythe, R. A. (2018). Cross-situational learning of large lexicons with finite memory. See pre-print at <https://arxiv.org/pdf/1809.11047.pdf>.

## Educational Resources

- 1 **Holehouse, J.,** & Cameron MBE, B. (2017). Meteorological visibility observations: A user's guide. <https://www.tes.com/teaching-resource/meteorological-visibility-observations-a-user-s-guide-11694814?theme=0>. Accessed: 22/09/2021, Published in *Times Educational Supplement* (TES).

## Skills

Languages	■ Native English speaker, basic Italian and BSL language skills.
Coding	■ Julia, Python, Mathematica, $\text{\LaTeX}$ , TensorFlow (basic).
Misc.	■ Stochastic modelling, non-equilibrium statistical mechanics, master equations, teaching and organising group social events.

## Miscellaneous Experience

### Awards and Achievements


2012	■ <b>Gold Award</b> , The Duke of Edinburgh's Award.
2020–present	■ <b>Reviewer</b> for Mathematical Biosciences.
2021–present	■ <b>Reviewer</b> for PLoS One.
	■ <b>Reviewer</b> for Physical Review E.
2023–present	■ <b>Reviewer</b> for Physical Review Letters.
	■ <b>Reviewer</b> for Biophysical Journal.

## Miscellaneous Experience (continued)

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- 2022      **Winner of the Reinhart Heinrich award from the European Society for Mathematical Biology 2022.**

## Certification

- 2014      **Sign Language Level 1 Certification.** Awarded by The Institute of British Sign Language.

## References

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Available on Request