

# Harrison Steel

**E-mail:** harrison.steel@eng.ox.ac.uk    **Web:** <https://steel.ac>

## I. Professional Experience

- Oct 2020 – present    *University of Oxford*: Associate Professor (permanent post) and leader of research group composed of 14 PhD students and post-docs in Department of Engineering Science; Tutorial Fellow of Harris Manchester College; Co-director of Synthetic Biology Centre for Doctoral Training.
- Mar 2019 – present    *Chi.Bio*: Founder and inventor of the open-source Chi.Bio experimental automation platform, used by ~100 academic and industrial laboratories, <https://chi.bio>.
- Mar 2020 – Sep 2020    *OxVent*: Chief Technology Officer and electronics team leader; pitched to HMG Cabinet and received £6M to produce emergency ventilators for Covid-19 patients.
- Jul 2019 – Sep 2020    *University of Oxford*: Postdoctoral researcher in Department of Engineering Science, focusing on synthetic biology, control theory, and experimental robotics.
- Nov 2015 – Aug 2016    *Quantum Nanoscience Laboratory, University of Sydney*: Quantum systems engineer, building electronic control systems and hardware for quantum dot technologies.
- Dec 2014 – Mar 2015    *Deutsches Elektronen-Synchrotron (DESY), Germany*: Engineer and research assistant, working on next-generation particle acceleration technologies.
- Jan – Aug 2014    *NASA Ames Research Center, California*: Research scientist, working on Antarctic environment projects, and interplanetary missions to Mars and Europa.

## II. Education

- University of Oxford*    2016 – 2019  
Doctor of Philosophy in Engineering; research at the intersection of Control Theory and Synthetic Biology. Monash Scholar.
- Massachusetts Institute of Technology*    2018  
Visiting Researcher, Department of Mechanical Engineering.
- University of Sydney*    2011 – 2015  
Bachelor of Mechanical (Space) Engineering (First-Class Honours and the University Medal), and Bachelor of Science (Advanced).

## III. Selected Awards and Funding

- 2022 *Philip Leverhulme Prize*: UK National prize awarded to five engineers every three years; recognises early-career researchers whose work has already attracted international recognition. (~£100k).
- 2022 *EPSRC New Horizons Award*: Research grant to develop new techniques to robotic microscopy for control of cellular evolution (PI, ~£250k).
- 2022 *Schmidt Futures - International Strategy Forum Fellow*: One year fellowship to work with leaders across fields on practical solutions to contemporary European challenges.
- 2022 *John Fell Fund, University of Oxford*: Awarded to support building of custom robotic experimental technology for biotechnology. (PI, ~£50k).
- 2022 *BBSRC Breakthrough Award*: One year grant to develop high-speed biological light sensors and control hardware (Co-I, ~£100k).
- 2021 *Department of Engineering Science Silver Teaching Award*: Awarded for outstanding graduate teaching.
- 2021 *EPSRC New Investigator Award*: Three year grant to develop new robotic tools for control of microbial communities (PI, ~£400k).
- 2020 *E&T Innovation Award - Global Challenge*: Awarded to the OxVent team for innovation in response to the Covid-19 pandemic.
- 2017 *North Senior Scholarship*: Awarded based on excellence in research to two students at St John's College.
- 2016 *Roden Cutler General Sir John Monash Scholarship*: Awarded to Australians with outstanding academic and leadership potential who wish to undertake postgraduate study overseas.
- 2015 *The University of Sydney University Medal*: Awarded by the University Senate to graduates of outstanding merit.

#### IV. Service and Other Leadership

- Reviewer for >15 academic journals including Science, Nature Communications, PLoS journals, ACS journals, Royal Society Interface, IEEE Transactions.
- Grant/prize reviewer for UKRI, NSF, Swiss National Science Foundation, French National Research Agency.
- Engineering and Physical Sciences Research Council (EPSRC) early-career forum (2021-present) board member.
- Member of UK Bioindustry Association (BIA) Engineering Biology Advisory Council Committee; contributor to industry responses to DEFRA and government policy.
- Science advisor for three Oxford-based start-ups companies in biotechnology.
- John Monash Foundation scholars' advisory committee and application reviewer (2019 - present).

#### V. Selected Publications

1. T. Lee, H. Steel. *Cybergenetic control of microbial community composition*, Frontiers in Bioengineering and Biotechnology (2022) DOI:10.3389/fbioe.2022.957140
2. A. Sootla et al. *Dichotomous Feedback: A Signal Sequestration-based Feedback Mechanism for Biocontroller Design*, Journal of the Royal Society Interface (2022) DOI:10.1101/2021.12.27.474252
3. R. Beale et al. *OxVent: Design and evaluation of a rapidly-manufactured Covid-19 ventilator*, Lancet eBioMedicine (2022) DOI:10.1016/j.ebiom.2022.103868
4. J. Chen, B. Lim, H. Steel et al. *Redesign of ultrasensitive and robust RecA gene circuit to sense DNA damage*, Microbial Biotechnology (2021) DOI:10.1111/1751-7915.13767
5. L. Zillig, H. Steel. *Cells and computers, better together*, Nature Reviews Microbiology (2021) DOI:10.1038/s41579-021-00616-6
6. P.J. Rutten, H. Steel et al. *Multiple sensors provide spatiotemporal oxygen regulation of gene expression in a Rhizobium-legume symbiosis*, PLoS Genetics (2021) DOI:10.1371/journal.pgen.1009099
7. H. Steel, R. Habgood, C. Kelly, A. Papachristodoulou. *Chi.Bio: An open-source automated experimental platform for biological science research*, PLoS Biology (2020) DOI: 10.1371/journal.pbio.3000794
8. H. Steel, A. Papachristodoulou. *The effect of spatiotemporal antibiotic inhomogeneities on the evolution of resistance*, Journal of Theoretical Biology (2019) DOI: j.jtbi.2019.110077
9. H. Steel, A. Papachristodoulou. *Low-burden biological feedback controllers for near-perfect adaptation*, ACS Synthetic Biology (2019) DOI: 10.1021/acssynbio.9b00125.
10. H. Steel et al. *Improving Orthogonality in Two-Component Biological Signalling Systems using Feedback Control*, IEEE Control Systems Letters (2019) DOI: 10.1109/LCSYS.2018.2871663.
11. H. Steel, A. Sootla, N. Delalez, A. Papachristodoulou. *Mitigating Biological Signalling Cross-talk with Feedback Control*, Proceedings of the European Control Conference (2019) DOI: 10.1109/LCSYS.2018.2871663
12. J. Chen<sup>†</sup>, H. Steel<sup>†</sup>, Y.H. Wu<sup>†</sup> et al. *Development of Aspirin-Inducible Biosensors in Escherichia coli and SimCells*, Applied Environmental Microbiology (2019) DOI: 10.1128/AEM.02959-18 (<sup>†</sup>joint first-authors).
13. C. Kelly<sup>†</sup>, A. Harris<sup>†</sup>, H. Steel<sup>†</sup> et al. *Synthetic negative feedback circuits using engineered small RNAs*, Nucleic Acids Research (2018) DOI: 10.1093/nar/gky828 (<sup>†</sup>joint first-authors).
14. H. Steel, A. Papachristodoulou. *Probing Inter-Cell Variability using Bulk Measurements*, ACS Synthetic Biology (2018) DOI: 10.1021/acssynbio.8b00014
15. H. Steel, A. Papachristodoulou. *Design constraints for biological systems that achieve adaptation and disturbance rejection*, IEEE Transactions on Control of Network Systems (2018) DOI: 10.1109/TCNS.2018.2790039
16. H. Steel et al. *Challenges at the interface of control engineering and synthetic biology*, 2017 IEEE Conference on Decision and Control (2017) DOI: 10.1109/CDC.2017.8263791
17. T. Folliard, B. Mertins, H. Steel et al. *Ribo-attenuators: novel elements for reliable and modular riboswitch engineering*, Scientific Reports (2017) DOI: 10.1038/s41598-017-04093-x
18. T. Folliard, H. Steel et al. *A synthetic recombinase-based feedback loop results in robust expression*, ACS Synthetic Biology (2017) DOI: 10.1021/acssynbio.7b00131