Max Wilkinson

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Education

University of Cambridge, Cambridge, UK — 2015 – 2019
PhD in Biological Sciences at the **MRC Laboratory of Molecular Biology**
Thesis title: *Structural studies of spliceosome activation and catalysis.*
Supervisor: Kiyoshi Nagai
Degree awarded November 30, 2019.

University of Otago, Dunedin, New Zealand — 2011 – 2014
BSc (Hons) majoring in Biochemistry, minoring in Chemistry
First Class Honours (ranked 1st amongst all university undergraduates)
Honours supervisors: Peter Fineran and Kurt Krause

Positions

Massachusetts Institute of Technology | Broad Institute — 2021 – present
HHMI Helen Hay Whitney Postdoctoral Fellow
Supervisor: Feng Zhang

MRC Laboratory of Molecular Biology, Cambridge, UK — 2019 – 2021
Career Development Fellow

Publications

Highlighted papers (* = equal contributions)

1. Faure, G.*, Saito, M.*, **Wilkinson, M.E.***, Quinones-Olvera, N., Xu, P., Flam-Shepherd, D., Kim, S., Reddy, N., Zhu, S., Evgeniou, L., Koonin, E.V., Macrae, R.K., Zhang, F. (2025) TIGR-Tas: A family of modular RNA-guided DNA-targeting systems in prokaryotes and their viruses. *Science* eadv9789.
2. **Wilkinson, M.E.**, Li, D., Gao, A., Macrae, R.K., Zhang, F. (2024) Phage-triggered reverse transcription assembles a toxic repetitive gene from a noncoding RNA. *Science* eadq3977.
3. **Wilkinson, M.E.**, Frangieh, C.J., Macrae, R.K., Zhang, F. (2023) Structure of the R2 non-LTR retrotransposon initiating target-primed reverse transcription. *Science* **380**, 301 – 308.
4. Gao, L.A.*, **Wilkinson, M.E.***, Strecker, J.*, Makarova, K., Macrae, R.K., Koonin, E.V., Zhang, F. (2022) Prokaryotic innate immunity through pattern recognition of conserved viral proteins. *Science* **377**, eabm4096.
5. **Wilkinson, M.E.***, Fica, S.M.*, Galej, W.P.*, Nagai, K. (2021) Structural basis for conformational equilibrium of the catalytic spliceosome. *Mol. Cell* **81**, 1358-1362.
6. **Wilkinson, M.E.***, Charenton, C.*, Nagai, K.* (2020) RNA Splicing by the Spliceosome. *Annu. Rev. Biochem.* **89**.
7. Charenton, C.*, **Wilkinson, M.E.***, Nagai, K. (2019) Mechanism of 5' splice site transfer for human spliceosome activation. *Science* **364**, 362–367.
8. **Wilkinson, M.E.**, Fica, S.M., Galej, W.P., Norman, C.M., Newman, A.J., Nagai, K. (2017) Postcatalytic spliceosome structure reveals mechanism of 3'-splice site selection. *Science* **358**, 1283–1288.
9. Galej, W.P., **Wilkinson, M.E.**, Fica, S.M., Oubridge, C., Newman, A.J., Nagai, K. (2016) Cryo-EM structure of the spliceosome immediately after branching. *Nature* **537**, 197–201.

Other papers

10. Edmonds, K.K., **Wilkinson, M.E.**, Strebinger, D., Chen, H., Lash, B., Schaefer, C.C., Zhu, S., Liu, D., Zilberzwige-Tal, S., Ladha, A., Walsh, M.L., Frangieh, C.J., Vaz Reay, N.A., Macrae, R.K., Wang, X.,

Zhang, F. (2025) Structure and biochemistry-guided engineering of an all-RNA system for DNA insertion with R2 retrotransposons. *Nature Communications* **16**, 6079.

11. Zilberzwige-Tal., S., Altae-Tran, H., Kannan, S., **Wilkinson, M.E.,** Vo., S.C-D-T., Strebinger, D., Edmonds, K.H.K., Yao, C-C.J., Mears, K.S., Shmakov, S.A., Makarova, K.S., Macrae, R.K., Koonin, E.V., Zhang, F. (2025) Reprogrammable RNA-targeting CRISPR systems evolved from RNA toxin-antitoxins. *Cell* **188**, 1–16.
12. Senn, K., Lipinski, K., Zeps, N.J., Griffin, A.F., **Wilkinson, M.E.,** Hoskins, A. (2024) Control of 3'-splice site selection by the yeast splicing factor Fyv6. *eLife* **13**, RP100449.
13. Xu, P., Saito, M., Faure, G., Maguire, S., Vo, S.C.D.R., **Wilkinson, M.E.,** Kuang, H., Wang, B., Rice, W.J., Macrae, R.K., Zhang, F. (2024) Structural insights into the diversity and DNA cleavage mechanism of Fanzor. *Cell* **187**, 5238–5252.
14. Birkholz, N., Kamata, K., Feussner, M., **Wilkinson, M.E.,** Samaniego, C.C., Migur, A., Kimanius, D., Ceelen, M., Went, S.C., Usher, B., Blower, T.R., Brown, C.M., Beisel, C.L., Weinberg, Z., Fagerlund, R.D., Jackson, S.A., Fineran, P.C. (2024) Phage anti-CRISPR control by an RNA-and DNA-binding helix-turn-helix protein. *Nature* **631**, 670–677.
15. Frangieh, C.J., **Wilkinson, M.E.,** Strebinger, D., Strecker, J., Walsh, M.L., Faure, G., Yushenova, I., Macrae, R.K., Arkhipova, I.R., Zhang, F. (2024) Internal initation of reverse transcription in a Penelope-like retrotransposon. *Mobile DNA* **15**, 12.
16. Madigan, V., Zhang, Y., Raghavan, R., **Wilkinson, M.E.**, Faure, G., Puccio, E., Segel, M., Lash, B., Macrae, R.K., Zhang, F. (2024) Human paraneoplastic antigen Ma2 (PNMA2) forms icosahedral capsids that can be engineered for mRNA delivery. *Proc. Natl. Acad. Sci. U. S. A.* **121**, e2307812120.
17. Garcia-Rodriguez, F.M., Martinez-Abarca, F., **Wilkinson, M.E.**, Toro, N. (2024) Similar mechanisms of retron-mediated anti-phage defense for different families of tailed phages. *bioRxiv* 2024.02.09.579579
18. Kimanius, D., Jamali, K., **Wilkinson, M.E.**, Lövestam, S., Velazhahan, V., Nakane, T., Scheres, S.H.W. (2024) Data-drive regularisation lowers the size barrier of cryo-EM structure determination. *Nature Methods* **21**, 1216–1221.
19. Strecker, J., Demircioglu, F.E., Li, D., Faure, G., **Wilkinson, M.E.**, Gootenberg, J.S., Abudayyeh, O.O., Nishimasu, H., Macrae, R.K., Zhang, F. (2022) RNA-activated protein cleavage with a CRISPR-associated endopeptidase. *Science* **378**, 874 – 881.
20. Hirano, S., Kappel, K., Altae-Tran, H., Faure, G., **Wilkinson, M.E.**, Kannan, S., Demircioglu, F.E., Yan, R., Shiozaki, M., Yu, Z., Makarova, K., Koonin, E.V., Macrae, R.K., Zhang, F. (2022) Structure of the OMEGA nickase IsrB in complex with ωRNA and target DNA. *Nature* **610**, 575 – 581.
21. **Wilkinson, M.E.***, Kumar, A.*, Casañal, A. (2019) Methods for merging data sets in electron cryo-microscopy. *Acta Crystallogr. D* **75**, 782–791.
22. Fica, S.M., Oubridge, C., **Wilkinson, M.E.**, Newman, A.J., Nagai, K. (2019) A human postcatalytic spliceosome structure reveals essential roles of metazoan factors for exon ligation. *Science* **363**, 710–714.
23. **Wilkinson, M.E.***, Lin, P.C.*, Plaschka, C.*, Nagai, K. (2018) Cryo-EM studies of pre-mRNA splicing: from sample preparation to model visualization. *Annu. Rev. Biophys.* **47**, 175–199.
24. Fagerlund, R.D.*, **Wilkinson, M.E***, Klykov, O.*, Barendregt, A., Pearce, F.G., Kieper, S.N., Maxwell, H.W.R, Capolupo, A., Heck, A.J.R., Krause, K.L., Bostina, M., Scheltema, R.A., Staals, R.H.J., Fineran, P.C. (2017) Spacer capture and integration by a type I-F Cas1-Cas2-3 CRISPR adaptation complex. *Proc. Natl. Acad. Sci. U. S. A.* **114**, E5122–E5128.
25. Fica, S.M., Oubridge, C., Galej, W.P., **Wilkinson, M.E.**, Bai, X.C., Newman, A.J., Nagai, K. (2017) Structure of a spliceosome remodeled for exon ligation. *Nature* **542**, 377–380.
26. **Wilkinson, M.E.**, Nakatani, Y., Staals, R.H., Kieper, S.N., Opel-Reading, H.K., McKenzie, R.E., Fineran, P.C., Krause, K.L. (2016) Structural plasticity and in vivo activity of Cas1 from the type I-F CRISPR-Cas system. *Biochem. J.* **473**, 1063–1072.

Fellowships, scholarships, and awards

HHMI Helen Hay Whitney Fellowship *postdoctoral funding*	2022 –
RNA Society/Scaringe Young Scientist Award *worldwide, for significant contributions to RNA research*	2019
Max Perutz Student Prize *for outstanding PhD work at the MRC LMB*	2018
Trinity College Krishnan-Ang Studentship	2015
Cambridge-Rutherford Memorial Scholarship *full PhD funding for three New Zealanders at the University of Cambridge*	2014
Prince of Wales Prize *for top undergraduate student at the University of Otago*	2014
Edson Prize in Biochemistry (Fourth Year)	2014
Sir George Grey Senior Scholarship for the top science graduate	2013
Edson Prize in Biochemistry (Third Year)	2013
F G Soper Prize in Chemistry	2012
New Zealand Institute of Chemistry prize	2011
University of Otago Leaders of Tomorrow Scholarship	2011
New Zealand Qualifications Authority Premier Scholarship *for top ten high school students nationwide*	2010
Papanui High School Dux	2010

Conference presentations

2024 Symposium on the Immune System of Bacteria, 16–18 April 2024. *Selected talk*
6th International Conference on CRISPR Technologies, 17–19 October 2023. *Invited talk*
Microsymposium on RNA Biology, Vienna, Austria, 3–5 May 2023. *Oral presentation*
IUBMB/FEBS/PABMB Global Biochemistry Summit, Lisbon, Portugal, 9–14 July 2022. *Oral presentation*
British Crystallographic Association Spring Meeting, Leeds, 11–14 April 2022. *Invited talk*
Cryo-electron microscopy in structural biology, Rome, Italy, 10–11 October 2019. *Invited talk*
24th Annual Meeting of the RNA Society, Krakow, Poland, 11–15 June 2019. *Invited talk*
84th Cold Spring Harbor Symposium on Quantitative Biology: RNA Control & Regulation, Cold Spring Harbor, NY, USA, 29 May to 3 June 2019. *Oral presentation*
6th UK RNA Splicing Workshop, Rydal Hall, Cumbria, UK, 25–27 January 2019. *Oral presentation*
14th Nucleic Acids Forum, Royal Society of Chemistry, London, UK, 6 July 2018. *Invited talk*
23rd Annual Meeting of the RNA Society, Berkeley, USA, 29 May to 2 June 2018. *Poster presentation*
1st BioPharma Expo, Tokyo, Japan, 28–30 June 2017. *Invited talk*
EMBO Conference – Molecular Machines: Integrative Structural and Molecular Biology, Heidelberg, Germany, 20–23 November 2016. *Oral presentation*.
21st Annual Meeting of the RNA Society, Kyoto, Japan, 28 June to 2 July 2016. *Poster presentation*
Queenstown Molecular Biology Meeting**,** Queenstown, New Zealand, 29 August to 4 September 2015. *Poster presentation*

Other invited talks

Memorial Sloan Kettering Cancer Centre, USA Topic: Reverse transcription	January 2025
University of Michigan, USA Topic: Reverse transcription	December 2024
Johns Hopkins Univeristy, USA Topic: Reverse transcription	September 2024
IMBA, Vienna BioCenter, Vienna, Austria Topic: Reverse transcription	September 2024
The Rockefeller University, USA Topic: LINE retrotransposons	February 2024
MRC LMB, Cambridge, UK Topic: LINE retrotransposons	June 2023
University of Wisconsin-Madison, USA Topic: LINE retrotransposons	April 2023
University of Otago, Dunedin, New Zealand Topic: phage defence systems	April 2022
Trinity Graduate Biologists seminar Topic: spliceosomes	October 2019
BA Seminar, Trinity College, Cambridge Topic: spliceosomes	January 2019
MRC LMB Lab Talks Topic: spliceosomes	October 2018
SciLifeLab, Stockholm, Sweden Topic: spliceosomes	September 2018
MRC LMB Structural Studies Colloquium Topic: spliceosomes	March 2018

University of Otago, Dunedin, New Zealand Topic: spliceosomes	February 2018
University of Cambridge RNA club Topic: spliceosomes	January 2018
University of Tokyo Topic: spliceosomes	June 2017
First Trinity Forum Topic: spliceosomes. **Prize** for best 1 minute talk.	June 2017
Trinity Graduate Biologists seminar Topic: spliceosomes	January 2017
Osaka University Topic: spliceosomes	July 2016

Teaching and mentoring

Undergraduate Research Opportunities Programme mentor, MIT	2022 – 2025
MRC LMB student parent programme	2017 – 2018
Trinity College Cambridge student parent programme	2016 – 2017
Tutor at Carrington College, University of Otago	2012 – 2013

References

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Postdoctoral Advisor

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Group leader at MRC LMB, PhD mentor, can provide reference in lieu of my deceased PhD supervisor Kiyoshi Nagai

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Professor of Molecular Microbiology at University of Otago, undergraduate supervisor and current collaborator