

WALDAN K. KWONG

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Education

2015	PhD, Ecology & Evolutionary Biology, Yale University
2012	MSc, Ecology & Evolutionary Biology, Yale University
2009	BSc, Biology (major) & Physics (minor), University of British Columbia

Positions Held

2024 – present	Group Leader – Microbial Genomics & Symbiosis Lab , Gulbenkian Institute of Molecular Medicine
2024 – present	Invited professor , Faculty of Medicine, University of Lisbon
2022 – 2024	Group Leader – Microbial Genomics & Symbiosis Lab , Instituto Gulbenkian de Ciência
2017 – 2021	Killam Research & NSERC Postdoctoral Fellow , Dept. of Botany, University of British Columbia <i>PI: Patrick J. Keeling</i>
2013 – 2016	Visiting scholar , Center for Computational Biology and Bioinformatics, University of Texas at Austin
2010 – 2015	Ph.D. candidate , Dept. of Ecology and Evolutionary Biology, Yale University <i>PI: Nancy A. Moran</i>
2008 – 2009	Research assistant , Centre for Molecular Medicine and Therapeutics, University of British Columbia
2006 – 2008	Research assistant , Dept. of Microbiology and Immunology, University of British Columbia

Selected Awards & Funding

Research grants and fellowships:

2025 – 2026	LS4FUTURE Seed Grant (€20,000) <i>Co-PI: Cecília Arraiano, ITQB-NOVA</i>
2023 – 2024	Fundação para a Ciência e a Tecnologia Exploratory Project Grant (€50,000)
2022 – 2027	European Research Council Starting Grant (€1,498,125)
2022 – 2027	Fundação para a Ciência e a Tecnologia Scientific Employment Stimulus (€268,000)
2022 – 2025	EMBO Installation Grant (€150,000)
2017 – 2019	Natural Sciences and Engineering Research Council of Canada Postdoctoral Fellowship (\$90,000)
2017 – 2019	Killam Postdoctoral Research Fellowship (\$104,000)
2015	Sigma Xi Grants-in-Aid of Research (\$700)
2014	Yale EEB Chair's Graduate Student Fund Award (\$2,800)
2012	Yale EEB Chair's Graduate Student Fund Award (\$1,800)
2012 – 2015	Natural Sciences and Engineering Research Council of Canada Postgraduate Scholarship (\$63,000)
2008	Child and Family Research Institute Summer Student Fellowship (\$3,750)
2006	Translational Research in Infectious Diseases Co-op Studentship (\$10,504)

Other awards:

2018	Gordon and Betty Moore Foundation Scholarship (\$500)
2017	Society of Molecular Biology and Evolution Conference Registration Award (\$570)
2014	International Union for the Study of Social Insects - North American Section (\$2,000)
2014	Yale Graduate Student Assembly Conference Travel Fellowship (\$700)
2012	Canadian Society of Microbiologists, Student Award Competition Travel Bursary (\$438)
2008	UBC Multidisciplinary Undergraduate Research Conference – Oral Presentation Winner
2005	J. Fred Muir Memorial Scholarship in Science (\$500)
2003 – 2005	UBC Undergraduate Scholar Program Scholarship (\$7,500)

Selected Conferences & Seminars

2025	Gordon Research Conference: Animal-microbe symbioses. Portland, ME, USA
2024	Symbiosis in Context meeting. Rothenburg ob der Tauber, Germany
2024	International Congress of Entomology, Kyoto, Japan
2024	International Union for the Study of Social Insects European meeting, Lausanne, Switzerland
2023	EMBO Young Scientists Forum, Lisbon, Portugal

2023	Department of Microbiology and Ecosystem Science, University of Vienna
2023	Insect Models for Infection Biology, Jacques Monod Conference, Roscoff, France
2022	Entomological Society of America/Canada joint meeting, Vancouver, BC, Canada
2022	EMBO YIP Annual Meeting, Heidelberg, Germany
2022	Laboratory of Microbiology, University of Wageningen
2022	EU Horizon 2020 SymbNET Seminar Series
2021	1 st Microbiome Portugal Summit
2020	School of Biological Science, Monash University
2020	Department of Biology, University of Victoria
2020	HiLife Institute of Biotechnology, University of Helsinki
2019	Department of Biology, University of Toronto, Mississauga
2019	Invaio Sciences, Cambridge, MA, USA
2018	Entomological Society of America/Canada joint meeting, Vancouver, BC, Canada
2018	Meeting of the International Society of Protistologists, Vancouver, BC, Canada
2018	Department of Microbiology and Immunology, University of British Columbia
2017	Society of Molecular Biology and Evolution meeting, Austin, TX, USA
2017	Biodiversity Internal Seminar Series, University of British Columbia
2016	XXV International Congress of Entomology, Orlando, FL, USA
2016	Society for the Study of Evolution/American Society of Naturalists, Austin, TX, USA
2014	15 th International Symposium on Microbial Ecology, Seoul, South Korea
2014	International Union for the Study of Social Insects 17 th Congress, Cairns, Australia
2014	Keystone Symposium: Invertebrate-Microbe Interactions, Tahoe City, CA, USA
2013	Society of Molecular Biology and Evolution meeting, Chicago, IL, USA
2013	2 nd Annual Connecticut Symbiosis Symposium, University of Connecticut - Storrs
2012	14 th International Symposium on Microbial Ecology, Copenhagen, Denmark

Invention Disclosures & Patents

2022	Moran NA, Leonard S, Kwong WK, Powell EJ. Bee gut microbial formulation for use as a probiotic for improved bee health and pathogen resistance. US Patent App. 17/431,813.
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Teaching & Supervision

Postdocs & visitors:

- 3 postdoctoral researchers
- 1 PhD student visitor
- 1 sabbatical faculty
- 1 ERASMUS+ visitor

Graduate students:

- 1 PhD as main advisor; 1 PhD as co-advisor
- 2 MSc, as main advisor
- 3 PhD, as committee member
- 2 PhD, as defense jury member

Undergraduate students & interns:

2022 – 2024	4 students, Instituto Gulbenkian de Ciência (incl. 2 ERASMUS+ recipients)
2017 – 2021	3 students, University of British Columbia (UBC SURE and NSERC Fellowship recipients)
2013 – 2016	4 students, University of Texas at Austin (incl. 2 UT Research Fellowship recipients)
2012	1 student, Yale University

Teaching:

2021 – 2024	Contributing lecturer in Host-microbe Interactions; Evolution; Ecology. Instituto Gulbenkian de Ciência
2019	Guest lecturer, Evolutionary Cell Biology, University of British Columbia
2015	Guest lecturer, Entomology, University of Texas at Austin
2013	Teaching assistant, Lab for Principles of Evolution, Ecology & Behavior (EEB 223L), Yale University
2012	Teaching assistant, Evolutionary Biology (EEB 225), Yale University
2012	Guest lecturer, General Biology, Common Ground High School, New Haven, CT, USA

2011 Teaching assistant, Diversity of Life (EEB 160), Yale University
 2011 Teaching assistant, Principles of Ecology, Evolution, and Behavior (EEB 122), Yale University
 2003 – 2010 Private tutor, for undergraduate and high school level math and science.

Service, Outreach, & Other Activities

Conference organization:

2024 SymbNet Final Meeting, Olhão, Portugal
 2018 Microbiome Network Symposium, University of British Columbia

Academic service:

2024 IBB Ecology course (co-organizer)
 2022–2024 PhD student recruitment, IGC (evaluator)
 2023 IGC Bioinformatics committee
 2022 Group leader search, IGC (evaluator)
 2022 EMBO YIP Sustainability in Science (speaker)
 2022 IGC Scientific Advisory Board symposium (speaker)

Outreach & education:

2022, 2023, 2025 Host-Microbe Symbiosis Summer School, Oeiras, Portugal (lecturer)
 2023–2024 Citizen Science – Oeiras City council
 2022 IGC Undergraduate Summer School Roundtable, IGC. July 26. (panelist)
 2022 IGC Open Day
 2020–2021 Life Sciences Undergraduate Q&A, University of British Columbia
 2018, 2020 Bee Master Course, Province of British Columbia (lecturer)
 2018 Michigan Beekeepers Association meeting, Lansing, MI, USA (speaker)
 2013 Connecticut Beekeepers Association meeting, Windsor, CT, USA (speaker)
 2011 – 2013 Yale EEB Graduate Student & Post-doc Colloquium (organizing committee)
 2012 Careers in Scientific Research – Yale College Junior Class Council (panelist)

Field work:

2018, 2019, 2021 Curaçao
 2014 Australia, Malaysia, Singapore, Hong Kong, South Korea

Reviewer for journals:

The American Naturalist	Journal of Apicultural Research
Animal Microbiome	Journal of Invertebrate Pathology
Apidologie	Journal of Thermal Biology
Applied and Environmental Microbiology	mBio
Biofilms and Microbiomes	Microbiome
Biology Letters	Molecular Ecology
BMC Evolutionary Biology	Nature Communications
BMC Microbiology	Nature Ecology and Evolution
Current Biology	Nutrients
Ecology Letters	Parasitology
eLife	PCI Microbiology
Environmental Entomology	PeerJ
Environmental Microbiology	PLoS Biology
FEMS Microbial Ecology	PLoS ONE
Frontiers in Microbiology	PLoS Pathogens
Genome Biology and Evolution	Philippine Journal of Science
Insect Molecular Biology	Proceedings of the National Academy of Sciences USA
Insect Science	Scientific Reports
Insects	Symbiosis
Int. Journal of Molecular Sciences	Trends in Microbiology
Int. Journal of Systematic and Evolutionary Microbiology	Trends in Parasitology
The ISME Journal	

Reviewer for funding agencies:

American University of Beirut
Deutsche Forschungsgemeinschaft
Eva Crane Trust
National Fund for Scientific Research (FNRS) Belgium

National Science Centre Poland
U.S. National Science Foundation
Xi'an Jiaotong-Liverpool University

Media interviews:

American Bee Journal, BioTechniques, Daily Texan, Nature, Nature Reviews Microbiology, La Recherche, Live Science, Science in the City, The Scientist, UBC Science News, Ubyssy

Publications

* equal contribution; † alphabetical authorship; ‡ student supervisee

42. Lax G, Kwong WK, Na I, Jacko-Reynolds VKL, Trznadel M, House CSE, Mathur V, Wakeman KC, Keeling PJ. 2025. **Divergent plastid genomes in the deepest-branching apicomplexan parasites**. *Genome Biology and Evolution*. In press.
41. Jacko-Reynolds VKL, Kwong WK, Livingston SJ, Trznadel M, Bonacolta AM, Lax G, Shivak J, Irwin NAT, MJA Vermeij, del Campo J, Keeling PJ. 2025. **Phylogenomics of coral-infecting coralicollids reveal multiple independent losses of chlorophyll biosynthesis in apicomplexan parasites**. *Current Biology*. 35(5): p1156-1163.e4. [\[LINK\]](#) [Mar. 2025 issue cover](#) [Trends in Parasitology Commentary](#)
40. Barradas A, Kwong WK. 2024. **Implications of gen(om)e duplications on the expansion and evolution of the GPCR signalling pathway**. *bioRxiv*. [\[PREPRINT\]](#)
39. Lax G, Park E, Na I, Jacko-Reynolds V, Kwong WK, House CSE, Trznadel M, Wakeman K, Leander BS, Keeling P. 2024. **Phylogenomic diversity of archigregarine apicomplexans**. *Open Biology*. 14: 240141. [\[LINK\]](#)
38. Kwong WK, Raymann K. 2024. Is it me or is it you? **Physiological effects of the honey bee microbiota may instead be due to host maturation**. *mBio*. doi.org/10.1128/mbio.02107-24. [\[LINK\]](#)
37. Trznadel M‡, Holt CC, Livingston SJ, Kwong WK, Keeling PJ. 2024. **Coral-infecting parasites in cold marine ecosystems**. *Current Biology*. 34(8):1810–1816.e4. [\[LINK\]](#) [Apr. 2024 issue cover](#) [Current Biology Commentary](#)
36. Na I, Campos C, Lax G, Kwong WK, Keeling PJ. 2024. **Phylogenomics reveals Adeleorina are an ancient and distinct subgroup of Apicomplexa**. *Molecular Phylogenetics and Evolution*. 195:108060. [\[LINK\]](#)
35. Acheampong SA‡, Polat MF‡, Kwong WK. 2024. **Complete genome sequences of 12 bacterial strains from the honey bee gut, resolved with long-read nanopore sequencing**. *Microbiology Resource Announcements*. e00775-23. [\[LINK\]](#)
34. Mathur M, Salomaki ED, Wakeman KC, Na I, Kwong WK, Kolisko M, Keeling PJ. 2023. **Reconstruction of plastid proteomes of apicomplexans and close relatives reveals the main evolutionary outcomes of cryptic plastids**. *Molecular Biology and Evolution*. msad002. [\[LINK\]](#)
33. Motta EVS, Gage A, Smith TE, Blake KJ, Kwong WK, Riddington IM, Moran NA. 2022. **Host-microbiome metabolism of a plant toxin in bees**. *eLife*. 11:e82595. [\[LINK\]](#)
32. George EE, Tashyreva D, Kwong WK, Okamoto N, Horák A, Husnik F, Lukeš J, Keeling PJ. 2022. **Gene transfer agents in bacterial endosymbionts of microbial eukaryotes**. *Genome Biology and Evolution*. 14(7):evac099. [\[LINK\]](#)
31. Keeling PJ, Mathur V, Kwong WK. 2021. **Coralicollids: The elusive coral-infecting apicomplexans**. *PLoS Pathogens*. 17(9):e1009845. [\[LINK\]](#)

30. Kwong WK, Irwin NAT, Mathur V, Na I‡, Okamoto N, Vermeij MJA, Keeling PJ. 2021. **Taxonomy of the apicomplexan symbionts of coral, including *Corallicolida* ord. nov., reassignment of the genus *Gemmocystis*, and description of new species *Corallicola aquarius* gen. nov. sp. nov. and *Anthozoaphila gnarlus* gen. nov. sp. nov.** Journal of Eukaryotic Microbiology. e12852. ([bioRxiv](#)). [[LINK](#)] [Jul./Aug. 2021 issue cover](#)
29. Mathur V, Kwong WK, Husnik F, Irwin NAT, Kristmundsson A, Gestral C, Freeman M, Keeling PJ. 2020. **Phylogenomics identifies a new major subgroup of apicomplexans, *Marosporida* class. nov., with extreme apicoplast genome reduction.** Genome Biology and Evolution. 13(2):evaa244. [[LINK](#)]
28. Kwong WK. 2020. **Microbiome evolution: Having the guts to be different.** Current Biology. 30(13):R766-R768. [[LINK](#)]
27. Kwong WK. 2020. **Bee microbiomes go viral.** Proceedings of the National Academy of Sciences of the United States of America. 117(21):11197–11199. [[LINK](#)]
26. George EE*, Husnik F*, Tashyreva D*, Prokopchuk G*, Horák A, Kwong WK, Lukeš J, and Keeling PJ. 2020. **Highly reduced genomes of protist endosymbionts show evolutionary convergence.** Current Biology. 30(5):925-933.e3. ([bioRxiv](#)). [[LINK](#)]
25. Zheng H*, Perreau J*, Powell JE, Zhang W, Du Y, Kwong WK, Tringe SG, and Moran NA. 2019. **Division of labor in honey bee gut microbiota for plant polysaccharide digestion.** Proceedings of the National Academy of Sciences of the United States of America. 116(51):25909–25916. [[LINK](#)]
24. Kwong WK, del Campo J, Mathur V, Vermeij MJA, and Keeling PJ. 2019. **A widespread coral-infecting apicomplexan with chlorophyll biosynthesis genes.** Nature. 568(7750):103–107. ([bioRxiv](#)). [[LINK](#)] F1000 Recommended, [Nature News & Views Commentary](#)
23. Romero S*, Nastasa A*, Chapman A, Kwong WK, and Foster L. 2019. **The honey bee gut microbiota: Strategies for study and characterization.** Insect Molecular Biology. 28(4):455–472. [[LINK](#)]
22. Mazel F, Davis KM, Loudon A, Kwong WK, Groussin M, and Parfrey LW. 2018. **Is host filtering the main driver of phylosymbiosis across the tree of life?** mSystems. 3:e00097-18. [[LINK](#)]
21. Bean BDM, Dziurdzik SK, Kolehmainen KL, Fowler CMS, Kwong WK, Grad LI, Davey M, Schluter C, and Conibear E. 2018. **Competitive organelle-specific adaptors recruit Vps13 to membrane contact sites.** Journal of Cell Biology. 217(10):3593–3607. [[LINK](#)] [JCB Spotlight](#)
20. Kwong WK, Steele MI, and Moran NA. 2018. **Genome sequences of *Apibacter* spp., gut symbionts of Asian honey bees.** Genome Biology and Evolution. 10(4):1174–1179. [[LINK](#)]
19. Mockler BK‡, Kwong WK, Moran NA, and Koch H. 2018. **Microbiome structure influences infection by the parasite *Crithidia bombi* in bumble bees.** Applied and Environmental Microbiology. 84(7):e02335-17. [[LINK](#)]
18. Steele MI, Kwong WK, Whiteley M, and Moran NA. 2017. **Diversification of Type VI Secretion System toxins reveals ancient antagonism among bee gut microbes.** mBio. 8(6):e01630-17. [[LINK](#)]
17. Kwong WK, Zheng H, and Moran NA. 2017. **Convergent evolution of a modified, acetate-driven TCA cycle in bacteria.** Nature Microbiology. 2:17067. [[LINK](#)] [Behind the Paper](#)
16. Kwong WK, Medina LA‡, Koch H, Sing KW, Soh EJY, Ascher JS, Jaffé R, and Moran NA. 2017. **Dynamic microbiome evolution in social bees.** Science Advances. 3(3):e1600515. [[LINK](#)] News coverage by The Scientist, BioTechniques, the Daily Texan, Phys.org, BioscienceTechnology, and Sci-News.com
15. Kwong WK*, Mancenido AL‡*, and Moran NA. 2017. **Immune system stimulation by the native gut microbiota of honey bees.** Royal Society Open Science. 4(2):170003. [[LINK](#)] [Nature Research Highlight](#), featured by La Recherche

14. Powell JE*, Leonard SP*, Kwong WK*, Engel P, and Moran NA. 2016. **Genome-wide screen identifies host colonization determinants in a bacterial gut symbiont.** Proceedings of the National Academy of Sciences of the United States of America. 113(48):13887–13892. [\[LINK\]](#)
13. Zheng H, Nishida A, Kwong WK, Koch H, Engel P, Steele MI, and Moran NA. 2016. **Metabolism of toxic sugars by strains of the bee gut symbiont *Gilliamella apicola*.** mBio. 7(6):e01326-16. [\[LINK\]](#)
12. Kwong WK and Moran NA. 2016. **Gut microbial communities of social bees.** Nature Reviews Microbiology. 14(6):374–384. [\[LINK\]](#) [Jun. 2016 issue cover](#), featured by Bee Culture Magazine
11. Engel P, Kwong WK, McFrederick Q, Anderson KE, Barribeau SM, Chandler JA, Cornman RS, Dainat J, de Miranda JR, Doublet V, Emery O, Evans JD, Farinelli L, Flenniken ML, Granberg F, Grasis JA, Gauthier L, Hayer J, Koch H, Kocher S, Martinson VG, Moran N, Munoz-Torres M, Newton I, Paxton RJ, Powell E, Sadd BM, Schmid-Hempel P, Schmid-Hempel R, Song SJ, Schwarz RS, vanEngelsdorp D, and Dainat B. 2016. **The bee microbiome: Impact on bee health and model for evolution and ecology of host-microbe interactions.** mBio. 7(2):e02164-15. [\[LINK\]](#)
10. Kwong WK and Moran NA. 2016. ***Apibacter adventoris* gen. nov., sp. nov., a member of the phylum Bacteroidetes isolated from honey bees.** International Journal of Systematic and Evolutionary Microbiology. 66:1323–1329. [\[LINK\]](#)
9. Kwong WK and Moran NA. 2015. **The evolution of host specialization in gut microbes: the bee gut as a model.** Gut Microbes. 6(3):214–220. [\[LINK\]](#)
8. Kwong WK, Mancenido AL‡, and Moran NA. 2014. **Genome sequences of *Lactobacillus* spp. strains wkB8 and wkB10, members of the ‘Firm-5’ clade, from honey bee guts.** Genome Announcements. 2(6) pii:e01176-14. [\[LINK\]](#)
7. Kwong WK, Engel P, Koch H, and Moran NA. 2014. **Genomics and host specialization of honey bee and bumble bee gut symbionts.** Proceedings of the National Academy of Sciences of the United States of America. 111(31):11509–11514. [\[LINK\]](#) [PNAS Featured Article](#), [Nature Reviews Microbiology Commentary](#)
6. Engel P†, James RR†, Koga R†, Kwong WK†, McFrederick Q†, and Moran NA†. 2013. **Standard methods for research on *Apis mellifera* gut symbionts.** In V Dietemann, JD Ellis, P Neumann (Eds) *The COLOSS BEEBOOK, Volume I: Standard Methods for Apis mellifera Research.* Journal of Apicultural Research. 52(4):doi 10.3896. [\[LINK\]](#)
5. Engel P, Kwong WK, and Moran NA. 2013. ***Frischella perrara* gen. nov., sp. nov., a gammaproteobacterium isolated from the gut of the honey bee, *Apis mellifera*.** International Journal of Systematic and Evolutionary Microbiology. 63:3646–3651. [\[LINK\]](#)
4. Kwong WK and Moran NA. 2013. **Cultivation and characterization of the gut symbionts of honey bees and bumble bees: description of *Snodgrassella alvi* gen. nov., sp. nov., a member of the family Neisseriaceae of the Betaproteobacteria, and *Gilliamella apicola* gen. nov., sp. nov., a member of Orbaceae fam. nov., Orbales ord. nov., a sister taxon to the order ‘Enterobacteriales’ of the Gammaproteobacteria.** International Journal of Systematic and Evolutionary Microbiology. 63:2008–2018. [\[LINK\]](#) IJSEM Jun. 2013 issue cover, featured by the National Collection of Industrial, Food and Marine Bacteria
3. Yim G*, Kwong W*, Davies J, and Miao V. 2012. **Complex integrons containing *qnrB4-ampC* (*blaDHA-1*) in plasmids of multidrug resistant *Citrobacter freundii* from wastewater.** Canadian Journal of Microbiology. 59(2):110–116. [\[LINK\]](#)
2. Tian B, Fadhill NH, Powell JE, Kwong WK, and Moran NA. 2012. **Long-term exposure to antibiotics has caused accumulation of resistance determinants in the gut microbiota of honey bees.** mBio. 3(6):e00377-12. [\[LINK\]](#) [ASM Commentary](#), [mBio Nov./Dec. 2012 issue cover](#), featured by news@JAMA, Voice of America, Science Daily, Science News, Yale Daily News, and 10+ other news outlets

1. Xu H, Miao V, Kwong W, Xia R, and Davies J. 2011. **Identification of a novel fosfomycin resistance gene (*fosA2*) in *Enterobacter cloacae* from the Salmon River, Canada.** Letters in Applied Microbiology. 52(4):427–429. [\[LINK\]](#)

Other:

Azenha S‡, Figueiredo C‡, Kwong WK. 2022. **Leben im Darm.** Deutsches Bienen-Journal. 3/2022. (in German)

Keeling PJ, Boscaro V, Bardell F, Burki F, Cho A, Cooney EC, del Campo J, Fast NM, Fiorito R, Gavelis GS, Gawryluk RMR, George EE, Gomm-Kolisko RN, Grisdale CJ, Heger T, Hehenberger E, Herranz M, Hidakawa Y, Husnik F, Imanian B, Irwin NAT, James ER, Janouskovec J, Karnkowska A, Kolisko M, Kwong W, Leander BS, Mathur V, Nawar F, Okamoto N, Parfrey L, Pittis A, Pan J, Pombert J, Sabetrasekh M, Saldarriaga JF, Sanders R, Singh RA, Smith DR, Strassert JJH, Stephenson I, Syberg-Olsen MJ, Tai V, Tikhonenkov DV, Van Steenkiste NWL, Whalen M, Whelan TA, Wong DK. 2020. **A letter to Denis Lynn.** Aquatic Ecosystem Health & Management. 23:17–18. [\[LINK\]](#)

Kwong WK. 2015. **Evolution and Specialization of the Gut Microbiota of Eusocial Bees.** PhD Dissertation. Yale University. Proquest 10009966. [\[LINK\]](#)