

## John P. McCutcheon

Professor and Associate Director, Center for Mechanisms of Evolution  
Biodesign Institute and School of Life Sciences  
Arizona State University, Tempe, Arizona 85287, USA  
john.mccutcheon@asu.edu | +1-480-965-8759 | <http://mccutcheonlab.org>

### **Education:**

2006 Ph.D., Computational Biology, Washington University  
2000 M.S., Human Genetics, University of Utah  
1996 B.S., Biochemistry, University of Wisconsin at Madison

### **Academic appointments:**

2020-present Associate Director, Biodesign Center for Mechanisms of Evolution, Arizona State University  
2020-present Professor, School of Life Sciences, Arizona State University  
2018 Visiting Associate, Division of Biology and Biological Engineering, California Institute of Technology  
2016-2020 Associate Professor, Division of Biological Sciences, University of Montana  
2010-2016 Assistant Professor, Division of Biological Sciences, University of Montana

### **Honors and fellowships:**

2021 Fellow, American Academy of Microbiology  
2020 Fellow, American Association for the Advancement of Science  
2019 Presidential Early Career Award for Scientists and Engineers (PECASE)  
2014-2017 Fellow, Canadian Institute for Advanced Research (CIFAR), Integrated Microbial Biodiversity Program  
2012-2014 Associate Member, Canadian Institute for Advanced Research (CIFAR), Integrated Microbial Biodiversity Program  
2006-2010 Postdoctoral Excellence in Research and Teaching (PERT) Fellowship, NIH Division of Minority Opportunities in Research, University of Arizona  
1996 Mary Shrine Peterson Undergraduate Research Award, Department of Biochemistry, University of Wisconsin

### **Professional service:**

2021-2023 Treasurer, Society for Molecular Biology & Evolution  
2020-2025 External Advisory Board, University of Illinois NSF Biology Integration Institute on the Genomics and Eco-evolution of Multi-scale Symbioses  
2018-2022 External Advisory Committee, University of Hawaii NIH Center for Biomedical Research Excellence on Environmental Microbiomes and Human Health  
2018-present Advisory Board, *Current Biology*  
2015-2016 Chair, Division R of the American Society for Microbiology  
2014 Co-organizer, National Academy of Sciences Sackler Colloquium *Symbiosis Becoming Permanent*, 15-17 October 2014, Irvine, California  
2014-2015 Chair-Elect, Division R of the American Society for Microbiology  
2014, 2015 Top Reviewer for *Molecular Ecology*  
2013-2018 Associate Editor, *Genome Biology and Evolution*

NSF panelist for Division of Environmental Biology and Integrative Organismal Systems, multiple years

NIH panelist for the Genome Variation and Evolution study section (2015)

Ad hoc grant reviewer for: National Science Foundation, The Royal Society, Natural Science and Engineering Research Council of Canada, Netherlands Organisation for Scientific Research, Royal Society of New Zealand, Israel Science Foundation, M. J. Murdock Charitable Trust, among others.

Reviewer for articles submitted to: *Cell*, *Current Biology*, *eLife*, *Environmental Microbiology*, *Genome Biology and Evolution*, *ISME J*, *Molecular Biology and Evolution*, *Molecular Ecology*, *Molecular Microbiology*, *Nature*, *Nature Microbiology*, *Nature Reviews Genetics*, *Nucleic Acids Research*, *PLoS Genetics*, *Proceedings of the National Academy of Sciences USA*, *Science*, *Trends in Ecology and Evolutionary*, *Trends in Genetics*, among others.

***Invited talks, conference presentations, etc. (only 2010 to present are listed):***

- 2021 American Association for the Advancement of Science annual meeting (online remote); University of Maryland (online remote); University of Alberta, Canada (online remote)
- 2020 Arizona State University; University of Texas at Austin; Cornell University; Max Planck Institute for Evolutionary Biology, Plön, Germany (online remote); University of Pennsylvania (online remote); Integrative Organismal Systems (IOS) CAREER Awardee Meeting, National Science Foundation (online remote); American Society for Cell Biology/EMBO (virtual) annual meeting
- 2019 University of Utah; Keynote address, Joint Genome Institute Symposium on New Lineages of Life, San Francisco, CA; University of North Carolina; University of Connecticut; Max Planck Institute for Chemical Ecology, Jena, Germany; MRC Laboratory of Molecular Biology, Cambridge, UK; Keynote address, Gordon Research Seminar on Animal-Microbe Symbiosis, Dover, VT; International Geobiology Course, California Institute of Technology; NIH NIAID Rocky Mountain Laboratories Symposium on the Bacterial Cell Envelope, Hamilton, MT; University of British Columbia; University of California San Francisco; Dalhousie University (student invited, online remote)
- 2018 INRA-CBGP, Montpellier, France; Institut de Ciències del Mar, CSIC, Barcelona, Spain; Instituto Gulbenkian de Ciência, Lisbon, Portugal; University of Exeter, UK; University of Groningen Research School of Ecology and Evolution, Frontiers in Microbial Ecology Graduate Course, Schiermonnikoog, Netherlands; HHMI/Janelia conference on New Opportunities to Study Origins of the Eukaryotic Cell, Ashburn, VA; Society for Molecular Biology and Evolution satellite meeting on Molecular Evolution and the Cell, Deer Valley, UT; University of Georgia; University of Arizona; University of Washington
- 2017 Biology Centre of the Czech Academy of Sciences, České Budějovice, Czech Republic; Keynote address, Montana State Science Fair, Missoula, MT; Symposium of the Microbial Diversity course, Woods Hole, MA; EMBO Workshop on comparative genomics of eukaryotic microbes, Sant Feliu de Guíxols, Spain; MRC Laboratory of Molecular Biology, Cambridge, UK; Johannes Gutenberg University Mainz, Germany; University of Edinburgh, UK
- 2016 Universidad de Chile; Stanford University; Ohio State University; Montana State University; Institut de Biologia Evolutiva, Barcelona, Spain; Genomics Days at the Université de Lausanne, Switzerland; California Institute of Technology; Colorado State University; Washington University in St. Louis (student invited); Oxford University, England
- 2015 National Institutes of Health Rocky Mountain Laboratories; University of Missouri; Washington University in St. Louis; Uppsala University, Sweden; Entomological Society of America Pacific Branch Annual Meeting; Duke University; American Society for

- Microbiology Annual Meeting; Gordon Research Conference on Animal-Microbe Symbioses
- 2014 Montana State University; Ohio State University; University of Washington; California Institute of Technology; Utah State University; National Academy of Sciences Sackler Colloquium *Symbiosis Becoming Permanent*; Reed College
- 2013 University of Utah; Georgia Institute of Technology; University of Miami; Drexel University; Canadian Institute For Advanced Research (CIFAR) Annual Meeting, Whistler, Canada; Society for Molecular Biology and Evolution Annual Meeting, Chicago, Illinois; The 12th International Colloquium on Endocytobiology and Symbiosis, Halifax, Canada; Indiana University; University of Illinois at Urbana-Champaign
- 2012 Portland State University; Canadian Institute For Advanced Research (CIFAR) Annual Meeting, Quebec, Canada; University of Arizona
- 2011 Society for General Microbiology Spring Conference, Harrogate, England; Emory University; Vanderbilt University; University of British Columbia
- 2010 University of Arizona NSF-IGERT Program in Comparative Genomics Symposium; Montana State University; Kansas State University; University of Montana; University of California, Riverside; Entomological Society of America Annual Meeting

### **Teaching:**

- 2020 Instructor, *SEA-PHAGES*, BIO 498, Arizona State University
- 2019, 2020 Instructor, *Diversity of Life*, BIOB 170, University of Montana
- 2013-2015 Instructor, *Programming for Biology*, BIOB 487, University of Montana
- 2012-2019 Instructor, *Genomics*, BIOB 486, University of Montana
- 2011, 2012 Instructor, *Microbial Div., Ecol., Evol.*, BIOM 415, University of Montana
- 2011 Instructor, *Microbial Genomics*, University of Montana
- 2008 Instructor, *Microbiology*, Pima Community College, Tucson, AZ

### **Postdoctoral trainees**

- 2020- Paul Caccamo
- 2017- Maria Kupper
- 2016-2020 DeAnna Bublitz  
Current position: Senior Research Scientist, University of Montana
- 2015-2017 Stephanie Ray Weldon (NASA Postdoctoral Program Fellow)  
Current Position: Science Editor, Journal of Visual Experiments
- 2014-2018 Piotr Łukasik  
Current position: Assistant Professor, Jagiellonian University
- 2012-2017 Toby Spribille  
Current position: Assistant Professor, University of Alberta
- 2011-2013 Amada Brown  
Current position: Assistant Professor, Texas Tech University

### **Graduate Students**

- 2021- Amanda Abdelsamad (4+1 MS program, Arizona State University)
- 2020- Arkadiy Garber (Microbiology PhD program, Arizona State University)

- 2015-2017  
MS, 2017  
Tim Wheeler  
*Multilocus phylogeny of the lichen family Megasperaceae*  
Current position: Research Scientist, University of Montana
- 2013-2018  
PhD, 2018  
Dan Vanderpool (NSF Graduate Research Fellow)  
*Evolution and reproduction in ambrosia beetle fungal symbionts*  
Current position: Postdoc with Matt Hahn, Indiana University
- 2012-2018  
PhD, 2018  
Matt Campbell  
*Breaking down a genome: Degenerative genome evolution in the cicada endosymbiont Hodgkinia*  
Current position: Postdoc at New England Biolabs
- 2012-2017  
PhD, 2017  
Filip Husník (joint with the University of South Bohemia)  
*Genomic and cellular integration in the tripartite nested mealybug symbiosis*  
Current position: Assistant Professor at the Okinawa Institute of Science and Technology
- 2010-2015  
PhD, 2015  
James Van Leuven  
*The evolution of nutritional co-endosymbionts in cicadas*  
Current position: Research Assistant Professor, University of Idaho

### **Funding:**

- 2016-2021  
PI, *How does a bacterium become part of its host cell?*  
Gordon and Betty Moore Foundation
- 2016-2021  
PI, *CAREER: Evolution of genomic complexity in the endosymbionts of cicadas.*  
NSF Integrative Organismal Systems
- 2015-2016  
Co-PI, *The ecological genomics of symbiotic complexity in cicadas.*  
National Geographic Explorer Travel Grant
- 2014-2019  
Co-PI, *Experimental evolution of major transitions in the history of life.*  
NASA Astrobiology Institute
- 2013-2016  
PI, *Functional transitions in an insect-bacteria symbiosis.*  
NSF Integrative Organismal Systems
- 2014-2016  
Co-PI, *Establishing a genomics core at the University of Montana.*  
M.J. Murdock Charitable Trust
- 2011-2014  
Co-PI, *The adaptive potential of an introduced symbiosis: Megacocta cribraria and its bacteria.* USDA Agriculture and Food Research Initiative

### **Public outreach and media coverage:**

Our research papers have been covered at the *New York Times*, the *Los Angeles Times*, the *Washington Post*, the *BBC*, the *CBC*, the *Atlantic*, *National Geographic*, *Scientific American*, *Gizmodo*, *Quanta Magazine*, among other news outlets.

Our work was covered in Ed Yong's award-winning book, *I Contain Multitudes*.

My interview on Hank Green's SciShow TalkShow has been viewed 79,000+ times on YouTube (<https://youtu.be/V9VhtWolwpQ>). I am a frequent guest on podcasts, including *Big Biology*, *The Biology of Superheroes*, and *A New Angle*.

### **Publications:**

54. McCutcheon JP. (2021) The genomics and cell biology of host-beneficial intracellular infections. *Annu Rev Cell Dev Biol*, in press.
53. Tagirdzhanova G, McCutcheon JP, Spribille T. (2021) Lichen fungi do not depend on the alga for ATP production. *bioRxiv*, <https://doi.org/10.1101/2021.03.17.435722>.
52. Garber AI, Kupper M, Laetsch DR, Weldon SR, Ladinsky MS, Bjorkman PJ, McCutcheon JP. (2021) The evolution of interdependence in a four-way mealybug symbiosis. *bioRxiv*, <https://doi.org/10.1101/2021.01.28.428658>.
51. Milhaven M, Hastings E, Brister D, Cevallos L, Chilukuri S, Diyya A, Garg A, Hernandez R, Kelly D, Lazo K, Le J, Maag G, Marfatia PD, Mehta R, Nejad A, Porche J, Queiroz A, Sackett D, Santos Molina P, Slade T, So M, Thakur K, Urquidez Negrete A, Wackett S, Weiss S, McCarthy L, Wheaton K, Rudner AD, McCutcheon JP, Pfeifer SP. (2021) Complete genome sequence of *Microbacterium* Bacteriophage Erla. *Microbiol Resour Announc* 10:e01354-20.
50. Simon C, Gordon ERL, Moulds MS, Cole JA, Haji D, Lemmon AR, Moriarty-Lemmon E, Kortyna M, Nazario K, Wade EJ, Meister RC, Goemans G, Chiswell SM, Pessacq P, Veloso C, McCutcheon JP, Łukasik P. (2019) Off-target capture data, endosymbiont genes and morphology reveal a relict lineage sister to all other singing cicadas. *Biol J Linnean Soc* 128:865–886.
49. Bublitz DC, Chadwick GL, Magyar JS, Sandoz KM, Brooks DM, Mesnage S, Ladinsky MS, Garber AI, Bjorkman PJ, Orphan VJ, McCutcheon JP. (2019) Peptidoglycan production by an insect-bacterial mosaic. *Cell* 179:703–712.
48. Van Leuven JT, Mao M, Bennett GM, McCutcheon JP. (2019) Cicada endosymbionts have tRNAs that are correctly processed despite having genomes that do not encode all of the tRNA processing machinery. *mBio* 10:e01950-18.
47. McCutcheon JP and Lekberg Y. (2019) Symbiosis: fungi as shrewd trade negotiators. *Curr Biol* 29:R570-R572.
46. McCutcheon JP, Boyd B, Dale C. (2019) The life of an insect endosymbiont from the cradle to the grave. *Curr Biol* 29:R485–R495.
45. Richards TA and McCutcheon JP. (2019) Coral symbiosis is a three-player game. *Nature* 568:41-2.
44. Łukasik P, Chong RA, Nazario K, Matsuura Y, Bublitz D, Campbell MA, Meyer M, Van Leuven JT, Pessacq P, Veloso C, Simon C, McCutcheon JP. (2018) One hundred mitochondrial genomes of cicadas. *J Hered* 110:247–56.
43. Campbell MA, Łukasik P, Meyer MM, Buckner M, Simon C, Veloso C, Michalik A, McCutcheon JP. (2018) Changes in endosymbiont complexity drive host-level compensatory adaptations in cicadas. *mBio* 9:e02104-18.

42. Matsuura Y, Moriyama M, Łukasik P, Vanderpool D, Tanahashi M, Meng X-Y, McCutcheon JP, Fukatsu T. (2018) Recurrent symbiont recruitment from fungal parasites in cicadas. *Proc Natl Acad Sci USA* 115:E5970-E5979.
41. McCutcheon JP. (2018) Nancy A. Moran: The Winding Path of a Brilliant Scientific Life, p 213-217. In Whitaker RJ, Barton HA (ed), *Women in Microbiology*. American Society for Microbiology, Washington, DC.
40. Łukasik P, Nazario K, Van Leuven JT, Campbell MA, Meyer M, Michalik A, Pessacq P, Simon C, Veloso C, McCutcheon JP. (2017) Multiple origins of interdependent endosymbiotic complexes in a genus of cicadas. *Proc Natl Acad Sci USA* 115:E226–E235.
39. Vanderpool D, Bracewell R, McCutcheon JP. (2017) Know your farmer: ancient origins and multiple independent domestications of ambrosia beetle fungal cultivars. *Mol Ecol* 27:2077–2094.
38. Husník F, McCutcheon JP. (2017) Functional horizontal gene transfer from bacteria to eukaryotes. *Nat Rev Microbiol* 16:67–79.
37. Campbell MA, Łukasik P, Simon C, McCutcheon JP. (2017) Idiosyncratic genome degradation in a bacterial endosymbiont of periodical cicadas. *Curr Biol* 27:3568–3575.
36. Keeling PJ, McCutcheon JP. (2017) Endosymbiosis: the feeling is not mutual. *J Theor Biol* 434:75–79.
35. Spribille T, McCutcheon JP. (2016) Principles of systems biology, No. 8: Inferring the microbial building blocks of the lichen symbiosis. *Cell Syst* 3:111.
34. Husník F, McCutcheon JP. (2016) Repeated replacement of an intrabacterial symbiont in the tripartite nested mealybug symbiosis. *Proc Natl Acad Sci USA* 113: E5416–E5424.
33. Spribille T, Tuovinen V, Resl P, Vanderpool D, Wolinski H, Aime MC, Schneider K, Toome-Heller M, Mayrhofer H, Thor G, Johannesson H, McCutcheon JP. (2016) Basidiomycete yeasts in the cortex of ascomycete macrolichens. *Science* 353:488–492.
32. McCutcheon JP. (2016) From microbiology to cell biology: when an intracellular bacterium becomes part of its host cell. *Curr Opin Cell Biol* 41:132–136.
31. Bennett GM, McCutcheon JP, McDonald BR, Moran NA. (2015) Lineage-specific patterns of genome deterioration in obligate symbionts of sharpshooter leafhoppers. *Genome Biol Evol* 8:296-301.
30. Keeling PJ, McCutcheon JP, Doolittle WF. (2015) Symbiosis becoming permanent: survival of the luckiest. *Proc Natl Acad Sci USA* 112:10101-10103.
29. Campbell MA, Van Leuven JT, Meister RC, Carey KM, Simon C, McCutcheon JP. (2015) Genome expansion via lineage splitting and genome reduction in the cicada endosymbiont *Hodgkinia*. *Proc Natl Acad Sci USA* 112:10192-10199.
28. Hallam SJ and McCutcheon JP. (2015) Microbes don't play solitaire: how cooperation trumps isolation in the microbial world. *Environ Microbiol Rep* 7: 26-28.

27. Bennett GM, McCutcheon JP, McDonald BR, Romanovicz D, Moran NA. (2014) Differential genome evolution between companion symbionts in an insect-bacteria symbiosis. *mBio* 5: e01697-14.
26. Van Leuven JT, Meister RC, Simon C, McCutcheon JP. (2014) Sympatric speciation in a bacterial endosymbiont results in two genomes with the functionality of one. *Cell* 158: 1270-1280.
25. McCutcheon JP and Keeling, PJ. (2014) Endosymbiosis: protein targeting further erodes the organelle/symbiont distinction. *Curr Biol* 24: R654–R655.
24. Duncan RP, Husnik F, Van Leuven JT, Gilbert D, Davalos, L, McCutcheon JP, Wilson ACC. (2013) Dynamic recruitment of amino acid transporters to the insect-symbiont interface. *Mol Ecol* 23: 1608–1623.
23. McCutcheon JP. (2013) Genome evolution: a bacterium with a Napoleon complex. *Curr Biol* 23: R657–R659.
22. Brown AMV, Nelson K, Bolender C, McCutcheon JP. (2013) Population genomics of a symbiont in the early stages of a pest invasion. *Mol Ecol* 23: 1516–1530.
21. Husnik F, Nikoh N, Koga R, Ross L, Duncan RP, Fujie M, Tanaka M, Satoh N, Bachtrog D, Wilson ACC, von Dohlen CD, Fukatsu T, McCutcheon JP. (2013) Horizontal gene transfer from diverse bacteria to an insect genome enables a tripartite nested mealybug symbiosis *Cell* 153: 1567–1578.
20. Van Leuven JT and McCutcheon JP (2012) An AT mutational bias in the tiny GC-rich endosymbiont genome of *Hodgkinia*. *Genome Biol Evol* 4: 24-27.
19. McCutcheon JP and Moran NA (2012) Extreme genome reduction in symbiotic bacteria. *Nat Rev Microbiol* 10: 13-26.
18. McCutcheon JP and von Dohlen CD (2011) An interdependent metabolic patchwork in the nested symbiosis of mealybugs. *Curr Biol* 21: 1366-72.
17. McCutcheon JP and Moran NA (2010) Functional convergence in reduced genomes of bacterial symbionts spanning 200 million years of evolution. *Genome Biol Evol* 2: 708-718.
16. Woyke T, Tighe D, Mavromatis K, Clum A, Copeland A, Schackwitz W, Lapidus A, Wu D, McCutcheon JP, McDonald BR, Moran NA, Bristow J, Cheng J. (2010) One bacterial cell, one complete genome. *PLoS ONE* 5: e10314.
15. International Aphid Genomics Consortium (2010) Genome sequence of the pea aphid *Acyrtosiphon pisum*. *PLoS Biol* 8: e1000313.
14. Nikoh N, McCutcheon JP, Kudo T, Miyagishima S, Moran NA, Nakabachi A. (2010) Bacterial genes in the aphid genome: absence of functional gene transfer from *Buchnera* to its host. *PLoS Genet* 6: e1000827.
13. McCutcheon JP (2010) The bacterial essence of tiny symbiont genomes. *Curr Opin Microbiol* 13: 73-8.
12. McCutcheon JP, McDonald BR, and Moran NA (2009) Convergent evolution of metabolic roles in bacterial co-symbionts of insects. *Proc Natl Acad Sci USA* 106: 15394-9.
11. McCutcheon JP, McDonald BR, and Moran NA (2009) Origin of an alternative genetic code in the extremely small and GC-rich genome of a bacterial symbiont. *PLoS Genet* 5: e1000565.
10. Moran NA, McCutcheon JP, and Nakabachi A (2008) Genomics and evolution of heritable bacterial symbionts. *Annu Rev Genet* 42: 165-90.

9. McCutcheon JP and Moran NA (2007) Parallel genomic evolution and metabolic interdependence in an ancient symbiosis. *Proc Natl Acad Sci USA* 104: 19392-7.
8. Shendure J, Porreca GJ, Reppas NB, Lin X, McCutcheon JP, Rosenbaum AM, Wang MD, Zhang K, Mitra RD, and Church GM (2005) Accurate multiplex polony sequencing of an evolved bacterial genome. *Science* 309: 1728-32.
7. McCutcheon JP and Eddy SR (2003) Computational identification of non-coding RNAs in *Saccharomyces cerevisiae* by comparative genomics. *Nucleic Acids Res* 31: 4119-28.
6. Clemons WM Jr, Brodersen DE, McCutcheon JP, May JL, Carter AP, Morgan-Warren RJ, Wimberly BT, and Ramakrishnan V (2001) Crystal structure of the 30 S ribosomal subunit from *Thermus thermophilus*: purification, crystallization and structure determination. *J Mol Biol* 310: 827-43.
5. Clemons WM Jr, Wimberly BT, May JL, McCutcheon JP, Capel MS, and Ramakrishnan V (1999) Structure of a bacterial 30S ribosomal subunit at 5.5 Angstrom resolution. *Nature* 400: 833-40.
4. Wimberly BT, Guymon R, McCutcheon JP, White SW, and Ramakrishnan V (1999) A detailed view of a ribosomal active site: the structure of the L11-RNA complex. *Cell* 97: 491-502.
3. McCutcheon JP, Agrawal RK, Philips SM, Grassucci RA, Gerchman SE, Clemons WM Jr, Ramakrishnan V, and Frank J. (1999) Location of translational initiation factor IF3 on the small ribosomal subunit. *Proc Natl Acad Sci USA* 96: 4301-6.
2. Gamble TR, Yoo S, Vajdos FF, von Schwedler UK, Worthylake DK, Wang H, McCutcheon JP, Sundquist WI, and Hill CP (1997) Structure of the carboxyl-terminal dimerization domain of the HIV-1 capsid protein. *Science* 278: 849-53.
1. Felden B, Himeno H, Muto A, McCutcheon JP, Atkins JF, and Gesteland RF (1997) Probing the structure of the *Escherichia coli* 10Sa RNA (tmRNA). *RNA* 3: 89-103.