Jackson Champer

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https://jchamper.github.io

SIGNIFICANT ACADEMIC POSITIONS

Assistant Professor, Peking University 2021.5-Present
- School of Life Sciences, Center for Bioinformatics.
- Joint Peking-Tsinghua Center for Life Sciences.
- Experimental and computational gene drive research with flies and mosquitoes.

Postdoctoral Fellow, Cornell University 2016.5-2021.3
- Labs of Philipp Messer and Andrew Clark in the Department of Molecular Biology and Genetics and the Department of Computational Biology.
- Improved gene drive systems, designs and experiments.
- Computational modeling and genetic analysis of gene drives in realistic environments.

Graduate Researcher, City of Hope Beckman Research Institute 2011.6-2015.6
- Lab of Markus Kalkum in the Department of Immunology.
- Mass spectrometry and proteomics for antifungal vaccine development.
- Rotation on the immunological and proteomic analysis of breast cancer extracellular matrix with S. Emily Wang.

Researcher, University of California, Los Angeles 2008.6-2009.7, 2013.8-2014.9
- Lab of Jenny Kim in the Department of Dermatology.
- Immunological and proteomic analysis of *Propionibacterium acnes* phylotypes.
- Analysis of antimicrobial treatments for acne and *Staphylococcus aureus* infection.

Graduate Researcher, University of California, Los Angeles 2004.6-2004.9
- Lab of David Cline in the Department of Physics and Astronomy.
- Simulations, design, and construction of a dark matter detector.

Undergraduate Researcher, University of Oregon 2003.8-2004.6
- Lab of Russell Donnelley in the Department of Physics.
- Propagation of vortex rings in fluid and diffusion of a marker dye.

EDUCATION

Ph.D. in Biology, City of Hope Beckman Research Institute 2015.6
M.S. in Physics, University of California, Los Angeles 2006.12
B.S. in Physics and Mathematics, University of Oregon 2004.6

PUBLICATIONS

*Equal contribution
Italics indicate mentored lab member

Preprints

34. *Metzloff M, Wang E*, Dhole, S, Clark AG, Messer PW, **Champer J**. Experimental demonstration of tethered gene drive systems for confined population modification or suppression. *bioRxiv*, May 2021.

33. *Wang E, Metzloff M, Langmüller AM*, Clark AG, Messer PW, **Champer J**. A homing suppression gene drive with multiplexed gRNAs maintains high drive conversion efficiency and avoids functional resistance alleles. *bioRxiv*, May 2021.

32. *Langmüller AM**, **Champer J***, *Lapinska S, Xie L, Metzloff M, Liu J, Xu Y*, Clark AG, Messer PW. Fitness effects of CRISPR endonucleases in *Drosophila melanogaster* populations. *bioRxiv*, November 2020.

31. *Champer SE**, Oakes N*, Sharma R, Garcia-Diaz P, **Champer J**, Messer PW. Modeling CRISPR gene drives for suppression of invasive rodents. *bioRxiv*, May 2021.

Gene Drive Publications

30. **Champer J***, *Kim IK**, *Champer SE*, Clark AG, Messer PW. Suppression gene drive in continuous space can result in unstable persistence of both drive and wild-type alleles. *Mol Ecol*, 30(4), 1086-1101, 2021.

29. Long KC, Alphey L, Annas GJ, Bloss CS, Campbell KJ, **Champer J**, *et al*. Core commitments for field trials of gene drive organisms. *Science*, 370(6523), 1417-1419, 2020.

28. **Champer J***, *Champer SE**, *Kim IK*, Clark AG, Messer PW. Design and analysis of CRISPR-based underdominance toxin-antidote gene drives. *Evol Appl*, 14(4), 1052-1069, 2020.

27. **Champer J***, *Yang E**, *Lee E, Liu J*, Clark AG, Messer PW. A CRISPR homing gene drive targeting a haplolethal gene removes resistance alleles and successfully spreads through a cage population. *Proc Natl Acad Sci U S*, 117(39), 24377-24383, 2020.

26. **Champer J**, *Kim IK, Champer SE*, Clark AG, Messer PW. Performance analysis of novel toxin-antidote CRISPR gene drive systems. *BMC Biol*, 8(1), 27, 2020.

25. **Champer J**, *Zhao J, Champer SE, Liu J*, Messer PW. Population dynamics of underdominance gene drive systems in continuous space. *ACS Synth Biol*, 9(4), 779-792, 2020.

24. *Champer SE, Liu C, Oh SY, Wen Z,* Clark AG, Messer PW, **Champer J**. Computational and experimental performance of CRISPR homing gene drive strategies with multiplexed gRNAs. *Sci Adv*, 6(10), eaaz0525, 2020.

23. **Champer J**, *Lee E, Yang E, Liu C,* Clark AG, Messer PW. A toxin-antidote CRISPR gene drive system for regional population modification. *Nat Commu*, 11(1), 1082, 2020.

22. **Champer J***, *Wen Z**, *Luthra A, Reeves R, Chung J, Liu C, Lee YL, Liu J, Yang E,* Messer PW, Clark AG. CRISPR Gene drive efficiency and resistance rate is highly heritable with no common genetic loci of large effect. *Genetics*, 212(1), 334-341, 2019.

21. **Champer J**, *Chung J, Lee YL, Liu C, Yang E, Wen Z,* Clark AG, Messer PW. Molecular safeguarding of CRISPR gene drive experiments. *Elife*, 8, e41439, 2019.

20. *Liu J**, **Champer J***, *Langmüller AM, Liu C, Chung J, Reeves R, Lee YL, Luthra L,* Clark AG, Messer PW. Maximum likelihood estimation of fitness components in experimental evolution. *Genetics*, 211(3), 1005-1017, 2019.

19. **Champer J***, *Liu J**, *Oh SY, Reeves R, Luthra L, Oakes N,* Clark AG, Messer PW. Reducing resistance allele formation in CRISPR/Cas9 gene drive. *Proc Natl Acad Sci U S A*, 115(21), 5522-5527, 2018.

18. **Champer J**, *Reeves R, Oh SY, Liu C, Liu J,* Clark AG, Messer PW. Novel CRISPR/Cas9 gene drive constructs reveal insights into mechanisms of resistance allele formation and drive efficiency in genetically diverse populations. *PLoS Genetics*, 13(7), e1006796, 2017.

17. **Champer J**, Buchman A, Akbari OS. Cheating evolution: Engineering gene drives to manipulate the fate of wild populations. *Nat Rev Genet*, 17, 146-159, 2016.

Other Publications

16. *Yu Y,* Dunway S, **Champer J**, Kim J, Alikhan A. Changing our microbiome: Probiotics in dermatology. *Br J Dermatol*, 182(1), 39-46, 2019.

15. *Champer M, Wong AM,* **Champer J**, Brito IL, Messer PW, Hou JY, Wright JD. The role of the vaginal microbiome in gynaecological cancer. *BJOG*, 125(3), 309-315, 2018.

14. **Champer J**, Ito JI, Clemons KV, Stevens DA, Kalkum M. Proteomic analysis of pathogenic fungi reveals highly expressed conserved cell wall proteins. *J. Fungi*, 2(1), 6, 2016.

13. *Yu Y**, **Champer J***, Agak GW, Kao S, Modlin RL, Kim J. Different *Propionibacterium acnes* phylotypes induce distinct immune responses and express unique surface and secreted proteomes. *J Invest Dermatol*, 136(11), 2221-2228, 2016.

12. *Yu Y,* **Champer J**, Kim J. Analysis of the surface, secreted, and intracellular proteome of *Propionibacterium acnes*. *EuPA Open Proteom*, 9, 1-7, 2015.

11. *Yu Y*, **Champer J**, Beynet DP, Kim J, Friedman AJ. The role of the cutaneous microbiome in skin cancer: Lessons learned from the gut. *J Drugs Dermatol*, 14(5), 461-465, 2015.

10. *Yu Y*, **Champer J**, Garbán H, Kim J. Typing of *Propionibacterium acnes*: A review of methods and comparative analysis. *Br J Dermatol*, 172(5), 1204-1209, 2015.

9. Schmidt NW, Agak GW, Deshayes S, *Yu Y*, Blacker A, **Champer J**, Xian W, Kasko AM, Kim J, Wong GC. PenTobra: An aminoglycoside with robust antimicrobial & membrane activity against *Propionibacterium acnes*. *J Invest Dermatol*, 135(6), 1581-1589, 2015.

8. Chow A, Zhou W, Liu L, Fong MY, **Champer J,** Van Haute D, Chin AR, Ren X, Gugiu BG, Meng Z, Huang W, Ngo V, Kortylewski M, Wang SE. Macrophage immunomodulation by breast cancer-derived exosomes requires Toll-like receptor 2-mediated activation of NF-κB. *Sci Rep*, 4, 5750, 2014.

7. *Taylor EJM*, *Yu Y*, **Champer J**, Kim J. Resveratrol demonstrates antimicrobial effects against *Propionibacterium acnes*. *Dermatol Ther*, 4, 249-257, 2014.

6. Lehrnbecher T, Kalkum M, **Champer J**, Tramsen L, Schmidt S, Klingebiel T. Immunotherapy in invasive fungal infection-focus on invasive aspergillosis. *Curr Pharm Des*, 19(20), 3689-3712, 2013.

5. **Champer J**, *Patel J*, *Fernando N*, *Salehi E*, *Wong V*, Kim J. Chitosan against cutaneous pathogens. *AMB Express*, 3(1), 37, 2013.

4. Friedman AJ, Phan J, Schairer DO, **Champer J**, Qin M, Pirouz A, Blecher-Paz K, Oren A, Liu PT, Modlin RL, Kim J. Antimicrobial and anti-inflammatory activity of chitosan-alginate nanoparticles: a targeted therapy for cutaneous pathogens. *J Invest Dermatol*, 133(5), 1231-1239, 2013.

3. **Champer J**, Diaz-Arevalo D, *Champer M*, Hong TB, *Wong M*, *Shannahoff M*, Ito JI, Clemons KV, Stevens DA, Kalkum M. Protein targets for broad-spectrum mycosis vaccines: quantitative proteomic analysis of *Aspergillus* and *Coccidioides* and comparisons with other fungal pathogens. *Ann N Y Acad Sci*, 1273, 44-51, 2012.

2. Chandra M, Zang S, Li H, Zimmerman L, **Champer J**, Chow A, Zhou W, Tsuyada A, Yu Y, Gao H, Ren X, Lin RJ, Wang SE. Nuclear translocation of type I TGF-β receptor confers a novel function in RNA splicing. *Mol Cell Biol*, 32(12), 2183-2195, 2012.

1. Bungau C, Camanzi B, **Champer J**, Chen Y, Cline DB, Luscher R, Lewin JD, Smith PF, Smith NJT, Wang H. Monte Carlo studies of combined shielding and veto techniques for neutron background reduction in underground dark matter experiments based on liquid noble gas targets. *Astroparticle Physics*, 23, 97-115, 2005.

RESEARCH SUPPORT

Startup Funds Champer 2021.5-Present
Peking University School of Life Sciences and Center for Life Sciences lab startup funding

NIH/NIAID K22AI146276 ~$250,000 Champer award declined*
Engineering and modeling improved CRISPR gene drive systems
*award only available for new faculty at domestic institutions

NIH/NIAID F32AI138476 ~$200,000 Champer 2018.4 – 2021.3

Dynamics of gene drives in natural populations

NIH/NIAID R21AI130635 ~$250,000 Messer, Clark, Champer 2017.9 – 2020.9
Improved CRISPR gene drive systems with reduced resistance allele formation

TEACHING EXPERIENCE

Research Students Mentored
Cornell University: Anisha Luthra, Anna Langmuller, Chen Liu, Emily Yang, Isabel Kim, Jingxian Liu, Joan Chung, Joanna Zhao, Lin Xie, Matt Metzloff, Nathan Oakes, Phoebe Conley, Riona Reeves, Sam Champer, Sandra Lapinska, Suh Yeon Oh, Yineng Xu, Esther (formerly Yoo Lim) Lee, Zhaoxin Wen.
University of California, Riverside: Jennifer Shyong, Kenneth Truong.
University of California, Los Angeles: Elaheh Salehi, Julie Patel, Nathalie Fernando, Sam Ngo, Victoria Wong, Yang Yu.
City of Hope: Jason Yu, Mayyen Wong, Miriam Champer, Molly Shannahoff.

Classroom Teaching
Guest Lecturer, Population Genetics and CRISPR classes, Cornell University 2017.9 - 2020.3
Teaching Fellow, Current Topics in Biology graduate class, City of Hope 2014.3 - 2014.4
Physics Teaching Assistant, University of California, Los Angeles 2004.9 - 2006.12

OTHER EXPERIENCE

Conference Seminars
Interdisciplinary Workshop on Synthetic Gene Drives, 2021 (invited)
Canadian Conference For Fisheries Research, 2021 (invited)
Entomological Society of America, Conference, 2019
Sea Lamprey International Symposium, 2019 (invited)
EMBO Vector Conference, 2019
Society for the Study of Evolution Annual Meeting, 2019 (invited)
Entomological Society of America, Joint Annual Meeting, 2018 (invited)
Genetics Society of America, Drosophila Research Conference, 2018
Cold Spring Harbor, Genome Engineering: The CRISPR-Cas Revolution, 2017

Workshops
Target Malaria Plausible Pathways to Potential Harm Workshop, 2021
FNIH Data Needs and Assay Design for Decision Making on Gene Drive Mosquitoes, 2019
ILSI Gene Drive Modeling Conference, 2019

Patents
Yu Y, **Champer J**, Kim J. Compositions and Methods for Treating Skin and Mucus Membrane Diseases. US 20170065647. Published November 2015.
Taylor E, **Champer J**, Kim J. Treatment of inflammatory and infectious skin disorders. US 20140018437 A1. Published January 2014.

Journal Referee: Bioscience, Ecological Modelling, Ecological Psychology, eLife, European Journal of Dermatology, Ecological Psychology, Evolutionary Applications, Infection Genetics and Evolution, Journal of Functional Foods, Journal of Fungi, Journal of Great Lakes Research, Journal of Theoretical Biology, Molecular Ecology, NAR Genomics and Bioinformatics, Nature Communications, PeerJ, PLOS Genetics, Proceedings of the Royal Society B, Scientific Reports

Other Referee
National Carp Control Plan for Australia "Synergistic genetic biocontrol options for common carp (*Cyprinus carpio*)"
United Nations Environment Programme: Frontiers, Emerging Issues of Environmental Concern, Synthetic Biology