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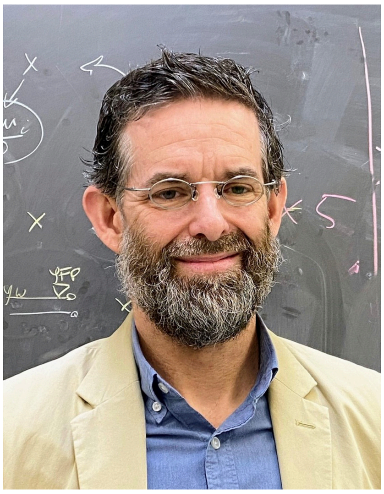

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ARBEITSVORHABEN

Meiotic Drive as an Evolutionary Force

Mendel's law of segregation tells us that genetic transmission is fair: a parent's two alternative gene copies enjoy equal probabilities of being transmitted to progeny. But the genomes of most organisms host a menagerie of "selfish" genetic elements that subvert the rules of transmission to advance their own evolutionary interests. Among these, the meiotic drive elements bias transmission to gain excess representation among progeny. In doing so, however, meiotic drive elements often have negative effects on host reproductive fitness. The resulting conflicts of interest between meiotic drive elements and their hosts can precipitate tit-for-tat molecular evolutionary arms races. Recurrent episodes of conflict can in turn have unexpected and wide-ranging consequences for transmission genetics, genome evolution, sex chromosomes, recombination, gametogenesis, the genetic engineering of natural populations, and even the origins of new species. With the recent explosion of new genome sequence data, meiotic drive has enjoyed a new surge of discovery and appreciation. The time is therefore right for an assessment: Is meiotic drive an occasional evolutionary curiosity or an underappreciated evolutionary force? To answer this question, my project aims to synthesize the history, theory, incidence, biology, consequences, implications, and applications of meiotic drive.

Recommended Reading

Presgraves, Daven C. (2010). "The Molecular Evolutionary Basis of Species Formation." Nature Reviews Genetics 11: 175–180. https://doi.org/10.1038/nrg2718.

Meiklejohn, Colin D., Emily L. Landeen, Kathleen E. Gordon, Thomas Rzatkiewicz, Sarah B. Kingan, Anthony J. Geneva, Jeffrey P. Vedanayagam, et al. (2018). "Gene Flow Mediates the Role of Sex Chromosome Meiotic Drive during Complex Speciation." eLife 7: e35468. https://doi.org/10.7554/eLife.35468.

Muirhead, Christina A., and Daven C. Presgraves (2021). "Satellite DNA-Mediated Diversification of a Sex-Ratio Meiotic Drive Gene Family in Drosophila." Nature Ecology & Evolution 5: 1604–1612. https://doi.org/10.1038/s41559-021-01543-8.

KOLLOQUIUM, 16.05.2023

Die evolutionstheoretischen Implikationen der Mendel'schen Vererbungslehre

Charles Darwins Buch „On the Origin of Species" überzeugte die Welt davon, dass die biologische Evolution ein historisches Faktum ist. Doch am Ende des 19. Jahrhunderts befand sich der von Darwin formulierte Evolutionsmechanismus – die natürliche Auslese – in einer schwachen Position, da er von profundem Unwissen und fehlgeleiteten Spekulationen über die Genetik behindert wurde. Schon Jahrzehnte zuvor hatte Gregor Mendel die grundlegenden Regeln der Genetik beschrieben, doch – eine der seltsamsten Episoden in der Geschichte der Wissenschaften – sein Werk wurde von einer Generation von Biologen nicht beachtet. Die spätere „Wiederentdeckung" Mendels war ausschlaggebend für den Verlauf des evolutionstheoretischen Denkens. In meinem Vortrag möchte ich die Wechselwirkung zwischen der Darwin'schen Theorie und der Mendel'schen Vererbungslehre aufarbeiten. Insbesondere beschreibe ich, wie die Mendel'sche Vererbungslehre Darwins Theorie der natürlichen Auslese rettete, zu einer genzentrierten Auffassung der Evolution führte und die Entdeckung der sogenannten „egoistischen Gene" vorwegnahm. Ich schließe mit der Betrachtung, wie die Darwin'sche Theorie ihrerseits die Evolution der Mendel'schen Regeln erklärt.

PUBLIKATIONEN AUS DER FELLOWBIBLIOTHEK

Presgraves, Daven (Cambridge,2018)

Gene flow mediates the role of sex chromosome meiotic drive during complex speciation

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=181431329X

Presgraves, Daven (London,2018)

Molecular evolution at a meiosis gene mediates specivies differences in the rate and patterning of recombination

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1814310630

Presgraves, Daven (1998)

Male eye span in stalk-eyed flies indicates genetic quality bymeiotic drive suppression

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