Wissenschaftskolleg zu Berlin

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Leonie C. Moyle, Ph.D.

Professor of Biology

Indiana University Bloomington

Born in 1971 in Melbourne, Australia

B.Sc. (Honours) in Biology, Australian National University, B.A. (Honours) in Philosophy, Monash University, Ph.D. in Biology, Duke University

PROJECT

Mechanisms of Speciation in the 21st Century

Speciation—the biological process through which all new species arise—has received more than a century and a half of scrutiny since the publication of Charles Darwin's On the Origin of Species in 1859. Over that time, the study of the speciation process has itself evolved, as new theoretical and empirical advances have resolved some questions and opened additional ones. Contemporary speciation research is in the throes of another such transition. The causes of this transition are diverse, but one substantial factor is the vast increase in our access to "genomic" information: we now can characterize the complete set of DNA sequence variation in almost any organism, on a scale and level of detail unprecedented even two decades ago. The consequences of this empirical shift have been widespread across biology—influencing both the way that researchers ask and answer biological questions, and how they conceptualize foundational processes. This is equally true of studies of the process of speciation specifically, but our foundational concepts, questions, and texts have lagged behind these changes. As a Fellow at the Wissenschaftskolleg zu Berlin, my goals are to clarify and synthesize these new empirical advances in speciation biology. This will entail clarifying the conceptual implications of genomic data for how we think about the formation of species, how we make inferences about the speciation process from empirical data, and even about the nature of species themselves. I anticipate that this project will involve three major synthesis and writing projects, one of which will be a book prospectus.

Recommended Reading

Moyle, Leonie C., and Takuya Nakazato (2010). "Hybrid Incompatibility 'Snowballs' between Solanum Species." Science 329: 1521–1523. https://doi.org/10.1126/science.1193063.

Pease, James B., David C. Haak, Matthew W. Hahn, and Leonie C. Moyle (2016). "Phylogenomics Reveals Three Sources of Adaptive Variation during a Rapid Radiation." PLoS Biology 14: e1002379. https://doi.org/10.1371/journal.pbio.1002379.

Gibson, Matthew J. S., María de Lourdes Torres, Yaniv Brandvain, and Leonie C. Moyle (2021). "Introgression Shapes Fruit Color Convergence in Invasive Galápagos Tomato." eLife 10: e64165. https://doi.org/10.7554/eLife.64165.

COLLOQUIUM, 02.12.2025

Speciation in the 21st century: How is genomics changing the origin of species (and is this a good thing)?

Speciation—the biological process through which all new species arise—has attracted more than a century and a half of scrutiny since Charles Darwin's 1859 book On the Origin of Species. Over that time, the study of speciation has itself evolved, as new theoretical and empirical advances have resolved some questions and opened additional ones. Major innovations in 20th-century speciation biology drew upon the discovery of and integration of genetics into evolutionary biology, and the development and testing of conceptual and analytical theory about the process of speciation. Contemporary 21st-century speciation research seems to be in the throes of another such transition, fueled by a new empirical revolution: genomics. We now can characterize the complete set of DNA sequence variation in almost any organism, at a scale and level of detail unprecedented even two decades ago. The consequences of this empirical shift have been widespread across biology—influencing both the way that researchers ask and answer biological questions and how they conceptualize foundational processes.

My goal at Wiko is to examine (and possibly even problematize) these genomics-driven changes in my own field of evolutionary biology, especially in studies of diversification and speciation.

In my colloquium talk, I'll outline key elements of this work, drawing on several framing questions I'm currently exploring: Why genomics? (What features of these data align especially well with evolutionary questions?) What has changed? (Which canonical ideas about diversification have already been upended by genomics?) What needs to change? (What, if any, conceptual revisions are demanded by these empirical revisions?) What are the risks? (Are "genomic" views of diversification impoverished in important ways?)

Most of these questions don't yet have answers, but I'll explore some provisional thoughts that address the first few. To do so, I'll draw upon examples from my own (and others') empirical work (in real organisms, not just genomes!) at micro- and macroevolutionary scales.

PUBLICATIONS FROM THE FELLOW LIBRARY

Moyle, Leonie C. (Cambridge,2021)

Introgression shapes fruit color convergence in invasive Galápagos tomato

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1931463689

Moyle, Leonie C. (Lawrence, KS,2016)

Phylogenomics reveals three sources of adaptive variation during a rapid radiation

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1931461309

Moyle, Leonie C. (2016)

Assortative mating and self-fertilization differ in their contributions to reinforcement, cascade speciation, and diversification

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1019659866