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ARBEITSVORHABEN

Biological Innovation and the Evolution of Birds

My research has long centered on evolutionary innovation. I am interested in how key traits of living organisms are assembled in deep time. My early research centered on traits related to locomotion, feathers, flight, and the co-option of a wing for underwater diving. More recently, I have focused on systems related to visual and vocal communication. For the past five years, I have led a group focused on the evolution of the avian vocal organ and co-led several projects around the acquisition of the most ubiquitous form of avian coloration. My career has so far afforded me little scope for review and synthesis.
My proposed research is driven by interests in the following questions: How do new structural solutions arise on ontogenetic and evolutionary timescales? Why do new structures arise for use contexts in which there are already structures fulfilling these functions? Is this indeed a special case of biological novelty? Are there trade-offs between structural complexity and neurological-control complexity determining a biological innovation solution space? Can acquisition of learned behaviors reduce the selective advantage of encoded function in peripheral organs? Is there a minimum complexity in a peripheral organ that must arise prior to the acquisition of related complex neural control functions? Does increasing use-contexts drive structural complexity or neural flexibility? Are these distinct selective trajectories?
During my stay, I would like to build on my work from the past 20 years and more than 130 publications on the evolution of complex traits in dinosaurs, including birds, and work to more deeply locate these findings in the broader schema of the literature on the nature of innovation and form-function relationships from diverse disciplines. Recent reviews of dinosaur evolution have been written by paleontologists focusing primarily on extinct non-avian dinosaurs without a strong research focus on living dinosaur (bird) anatomy and behavior. There has been so much new to discover in the evolution of birds by looking down into the deep history of dinosaurs from the tips of branches on which "perch" living bird species.

Recommended Reading

Clarke, Julia A., Daniel T. Ksepka, Rodolfo Salas-Gismondi, Ali J. Altamirano, Matthew D. Shawkey, Liliana D'Alba, Jakob Vinther, Thomas J. DeVries, and Patrice Baby (2010). "Fossil Evidence for Evolution of the Shape and Color of Penguin Feathers." Science 330: 954–957. https://doi.org/10.1126/science.1193604.
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Longtine, Charlie, Chad M. Eliason, Darcy Mishkind, ChangHee Lee, Michael Chiappone, Franz Goller, Jay Love, Evan P. Kingsley, Julia A. Clarke, and Clifford J. Tabin (2024). "Homology and the Evolution of Vocal Folds in the Novel Avian Voice Box." Current Biology 34: 461–472.e7. https://doi.org/10.1016/j.cub.2023.12.013.