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Julia A. Clarke, Ph.D.

Professor and John A. and Katherine G. Jackson Chair in Geobiology

The University of Texas at Austin

Born in 1973 in San Francisco, Cal., USA

B.A. in Geology-Biology from Brown University, Ph.D. in Geology from Yale University

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-lead 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>.

Clarke, Julia A., Sankar Chatterjee, Zhiheng Li, Tobias Riede, Federico Agnolin, Franz Goller, Marcelo P. Isasi, Daniel R. Martinioni, Francisco J. Mussel, and Fernando E. Novas (2016). "Fossil Evidence of the Avian Vocal Organ from the Mesozoic." *Nature* 538: 502–505. <https://doi.org/10.1038/nature19852>.

Longtine, Charlie, Chad M. Eliason, Darcy Mishkind, ChangHee Lee, Michael Chiappone, Franz Goller, Jay Love, Evan

KOLLOQUIUM, 11.02.2025

Finding a Voice: an Excavation of Concepts of Human and Non-Human Songs and Singers

Where is the voice located? Who has a voice? What is the relationship between voice, song, and language? How do we track the evolution of the instruments of voice and their acoustic products? The last of these questions has motivated my study of vocal organs primarily in reptiles including birds. In this colloquium, I first share how "song" is used in the contemporary literature on animal vocalization. I then trace its history. Song was long discussed exclusively as a feature of some birds and humans. Scientific literature now also uses it to describe selected vocalizations in some mice, whales, bats, primates, insects, and frogs. Birdsong over the past 50+ years has also been a key system for illuminating primarily the neural bases of vocal production learning—of which the most studied instance is the acquisition of language in humans. In tracing the history of animal singing, I attempt to destabilize the naturalness and utility of naming some vocalizations "song" and others "not song" in the context of the study of evolution. I argue that the arc of most prior work on bird vocal production, and the identification of song more generally, has been strongly influenced by select conceptions of song from very human, European contexts. I close by showing what we may be missing by treating song and non-song as useful natural categories. Finally, I close by presenting how this affects specifically the inference of the evolution of vocal production in reptiles in concrete ways.

PUBLIKATIONEN AUS DER FELLOWBIBLIOTHEK

Clarke, Julia A. (Washington, DC, 2025)

High melanosome diversity exhibits weak correlation with color and environmental variables in the early evolution of therian mammals

<https://kxp.k1oplus.de/DB=9.663/PPNSET?PPN=1945009462>

Clarke, Julia A. (London, 2024)

Homology and the evolution of vocal folds in the novel avian voice box

<https://kxp.k1oplus.de/DB=9.663/PPNSET?PPN=1895542189>

Clarke, Julia A. (Amsterdam [u.a.], 2023)

New records of Theropoda from a Late Cretaceous (Campanian–Maastrichtian) locality in the Magallanes–Austral Basin, Patagonia, and insights into end Cretaceous theropod diversity

<https://kxp.k1oplus.de/DB=9.663/PPNSET?PPN=1899162755>

Clarke, Julia A. (Washington, DC, 2021)

Bird neurocranial and body mass evolution across the end-Cretaceous mass extinction : the avian brain shape left other dinosaurs behind

<https://kxp.k1oplus.de/DB=9.663/PPNSET?PPN=1899164545>

Clarke, Julia A. (Oxford, 2021)

Estimating the distribution of carotenoid coloration in skin and integumentary structures of birds and extinct dinosaurs

<https://kxp.k1oplus.de/DB=9.663/PPNSET?PPN=1899160485>

Clarke, Julia A. (Washington, DC [u.a.], 2020)

Cassowary gloss and a novel form of structural color in birds

<https://kxp.k1oplus.de/DB=9.663/PPNSET?PPN=191520142X>

Clarke, Julia A. (London [u.a.], 2020)

New mammalian and avian records from the late Eocene La Meseta and Submeseta formations of Seymour Island, Antarctica

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Clarke, Julia A. (London [u.a.],2018)

Elaborate plumage patterning in a Cretaceous bird

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Clarke, Julia A. (Washington, DC,2018)

Identity and novelty in the avian syrinx

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Clarke, Julia A. (New York, NY [u.a.],2016)

Comparison and evaluation of the effectiveness of two approaches of diffusible iodine-based contrast-enhanced computed tomography (diceCT) for avian cephalic material

<https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1915206782>