



2023

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### Recommended Citation

Boyle, Michael J.; Arledge, Scott; Thomas, Brian; Tomkins, Jeffrey P.; and Guliuzza, Randy J. (2023) "Testing the Cavefish Model: An Organism-focused Theory of Biological Design," *Proceedings of the International Conference on Creationism*: Vol. 9, Article 78.

DOI: 10.15385/jpicc.2023.9.1.60

Available at: [https://digitalcommons.cedarville.edu/icc\\_proceedings/vol9/iss1/78](https://digitalcommons.cedarville.edu/icc_proceedings/vol9/iss1/78)

## TESTING THE CAVEFISH MODEL: AN ORGANISM-FOCUSED THEORY OF BIOLOGICAL DESIGN

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### ABSTRACT

The Institute for Creation Research (ICR) is experimentally testing an engineering-based model of rapid biological adaptation: Continuous Environmental Tracking (CET). This model infers that organisms actively track conditions within specific environments to self-adjust through internal mechanisms and initiate adaptive functionality. The animal under investigation is *Astyanax mexicanus* (Mexican tetra), a freshwater fish with well-differentiated, interfertile morphotypes: eyed surface-dwelling fish (surface fish) with distinct pigmentation patterns, and eyeless cave-dwelling fish (cavefish) with minimal pigmentation. Aquaria within our newly established laboratory contain breeding pairs of cavefish exposed to either (A) cyclical light/dark patterns of full-spectrum high-intensity light, (B) minimal light combined with high CO<sub>2</sub>(low pH) levels or (C) deionized water. Preliminary results show that (1) cavefish rapidly increase pigmentation when exposed to high-intensity light, and (2) do not exhibit injurious behavior or physiology in low pH water; (3) surface fish lose pigmentation across their body in low pH or deionized water conditions; (4) adult cavefish and surface fish respond rapidly within weeks-to-months of experimental treatments. Thus far, preliminary results imply that high-intensity light may stimulate the induction of latent melanin synthesis pathways in adult cavefish. Second, pre-acclimation of cavefish to acidic water chemistry likely reflects conditions within their native cave environments. Third, comparative loss of pigmentation in adult surface fish exposed to darkness and low pH or deionized water suggests they actively self-adjust, and that adaptive traits are reversible. Fourth, in contrast to cavefish, surface fish indicate non-acclimation to a simulated cave environment. Lastly, all responses by *A. mexicanus* to experimental treatments occur without undergoing multigenerational cycles of death and survival. These implications do not support the conventional view that beneficial adaptations arise through random mutation, unregulated genomic recombination, or accumulation of unguided genetic variation – regardless of time scales. Therefore, organisms are the agents in control of adaptations and diversification. If correct, hypotheses attributing the exquisite fit of organisms to environments through the agency of nature are mistaken. We present a new direction in experimental science for the ICR, and Creation Science, that sees every organism as a divinely engineered creation with adaptive capacity across multiple environmental conditions.

### KEYWORDS

Cavefish, CET, adaptation, environment, *Astyanax mexicanus*

### THE AUTHORS

Michael J. Boyle earned a B.Sc. in Biology (Marine) from Humboldt State University (2003), and a Ph.D. in Zoology from the University of Hawaii at Manoa (2010). Scientific specializations include molecular, genetic, developmental and microscopical research on embryonic and larval life histories of marine invertebrates. Michael completed Postdoctoral Research Fellowships at the Smithsonian Marine Station (SMS) in Florida, and the Smithsonian Tropical Research Institute of Panama. He became a staff Biologist at the SMS (2016–2022), and joined the Institute for Creation Research as a research scientist in March, 2022. Dr. Boyle has produced over 30 peer-reviewed academic research papers.

Scott Arledge was employed as a laboratory technician with the Institute for Creation Research from 2019 to 2023. During that time, he managed the aquaculture and husbandry of the *Astyanax mexicanus* cavefish model, and performed preliminary experiments.

Brian Thomas received a M.S. in Biotechnology in 1999 from Stephen F. Austin State University, Nacogdoches, Texas, and a Ph.D. in paleobiochemistry in 2019 from the University of Liverpool. He has worked for the Institute for Creation Research since 2008, contributing to magazine, book, and online content while specializing in fossil proteins. Dr. Thomas is a research scientist at the ICR.

Jeffrey Tomkins earned a B.S. in Agriculture Education from Washington State University (1985), a M.S. in plant science from the University of Idaho (1990), and a Ph.D. in genetics from Clemson University (1996). After completing post-doctoral research in genomics, he became a faculty member in the Department of Genetics and Biochemistry at Clemson and director of the Clemson University Genomics Institute. In 2009, he joined the Institute for Creation Research as a research scientist and was appointed Director of Research in 2020. He has authored 66 secular journal papers, 42 creation science journal papers, and 6 books.

Dr. Randy Guliuzza has a B.S. in Engineering from the South Dakota School of Mines and Technology, a B.A. in theology from Moody Bible Institute, an M.D. from the University of Minnesota, and a Master of Public Health from Harvard University. Dr. Guliuzza served nine years in the Navy Civil Engineer Corps and is a registered Professional Engineer. In 2008, he retired as a lieutenant colonel from the Air Force, where he served as 28th Bomb Wing Flight Surgeon and Chief of Aerospace Medicine, and joined ICR as National Representative. He was appointed President of ICR in 2020.