Research shows evolution in real time

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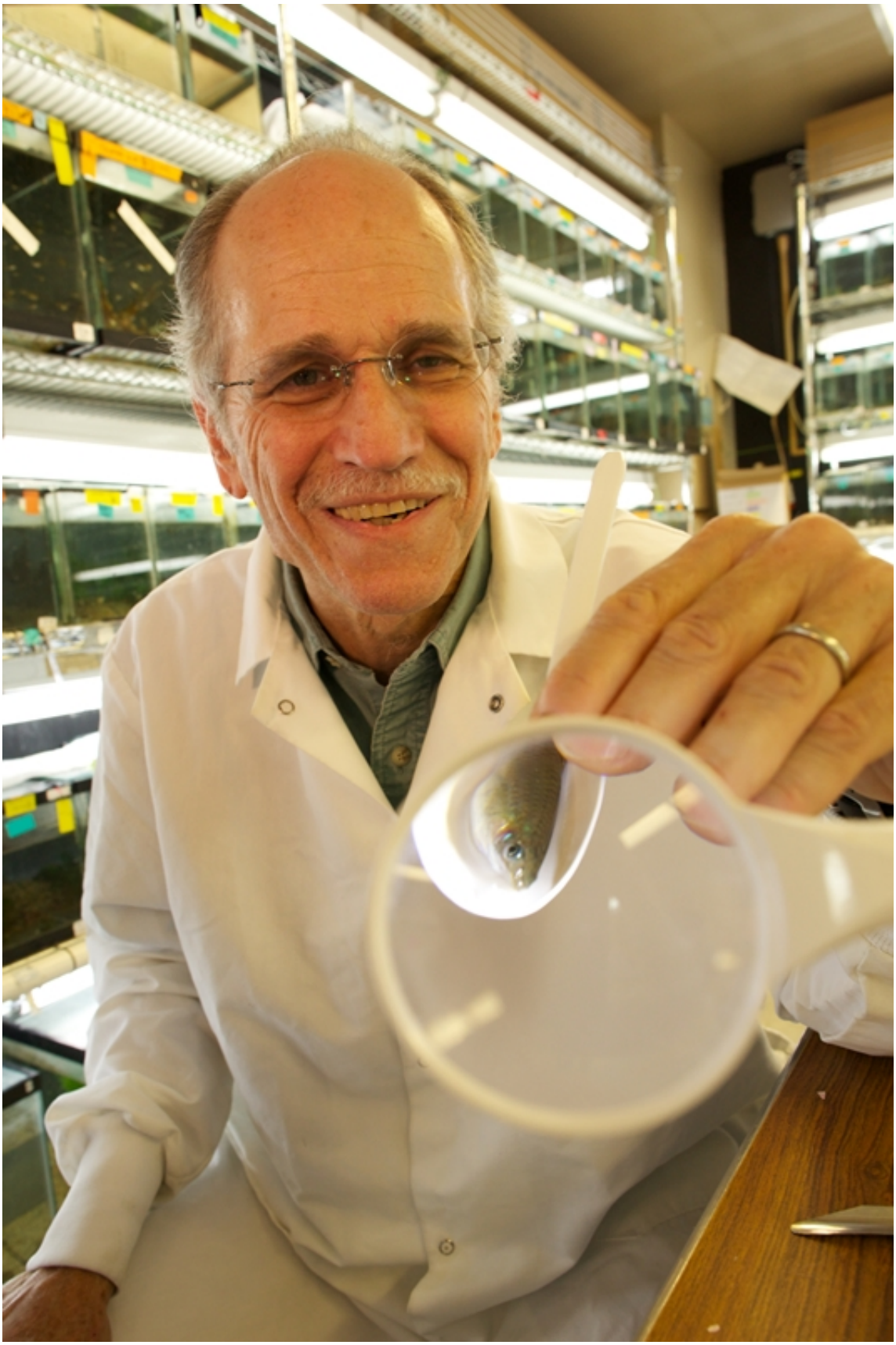

David Reznick is a distinguished professor of biology at UC Riverside. Credit: L. Duka.

In ongoing research to record the interaction of environment and evolution, a team led by University of California, Riverside biologist David Reznick has found new information illustrating the evolution of a population of guppies.

Working in a river in Trinidad, the researchers determined which male guppies would contribute more offspring to the population as well as which would live longer and which would have a shorter lifespan.

"We're detailing how evolution happens," Reznick, a distinguished professor of biology, said. "Usually people look at evolution as change over time but they don't know the details of how it changes."

The new work is part of research that Reznick has been doing since 1978. It involved transplanting guppies from a river with a diverse community of predators into a river with no predators - except for one other fish species, an occasional predator - to record how the guppies would evolve and how they might impact their environment.

To do this, the team, which includes Reznick's former graduate student Swanne P. Gordon and two undergraduates working in his lab, used scales from the guppies to archive their DNA. When they returned the guppies to the river and new unmarked guppies showed up, the latter were marked and samples of their scales were taken for study. In this way the team tracked the guppies' differential success in making babies and surviving.

"We could look at their appearance and see how male color pattern

affected their ability to make babies or to survive," Reznick said. "We used the DNA from the scales to identify who their parents were. That means we could reconstruct their pedigree and eventually know over time their success for contributing offspring."

The research also found that males with more or larger orange and black spots produce more offspring; males with black spots also have a higher risk of mortality.

The findings, which appeared online Aug. 19 in the *Proceedings of the Royal Society B*, show how real time evolution can be resolved into differences among fathers in siring sons, which could be attributed to how successful the father is in finding mates or how long he lives. It also shows how evolution can link these differences to heritable individual attributes.

"People think of evolution as historical. They don't think of it as something that's happening under our nose. It is a contemporary process. People are skeptical; they don't believe in evolution because they can't see it. Here, we see it. We can see if something makes you better able to make babies and live longer," Reznick said.

"People look at the genetics of aging in mice and apply that to humans," he added. "But those mice are in a lab. Results from studying animals in captivity may not be the same as you get when you look at an animal in nature."

Results from the new work could also be used in biological conservation or anywhere researchers are looking at change overtime because these methods can reveal the attributes of individuals that enhance survival and reproduction. Another important goal of Reznick's research program is detailing how the animals are evolving and influencing their environment.

"We call this the 'interaction between ecology and evolution,'" he said. "Animals can change their environment around them and that change can adapt to how they evolve. The idea of ecology and evolution interacting is a different view. If you look at ecological evolution, it treats animals as a constant. But this research has recorded the guppies evolving and how they change their environment as they evolve. An interaction between ecology and evolution could yield entirely different results from what you would expect if you modeled the process without the interaction."

Reznick emphasized that evolution is not a linear process.

"It's a series of episodes," he said. "What we set out to do is watch and get a real sense of how evolution happens. The path is unpredictable and it is happening now."

More information: Selection analysis on the rapid evolution of a secondary sexual trait, Published 19 August 2015.DOI: 10.1098/rspb.2015.1244

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