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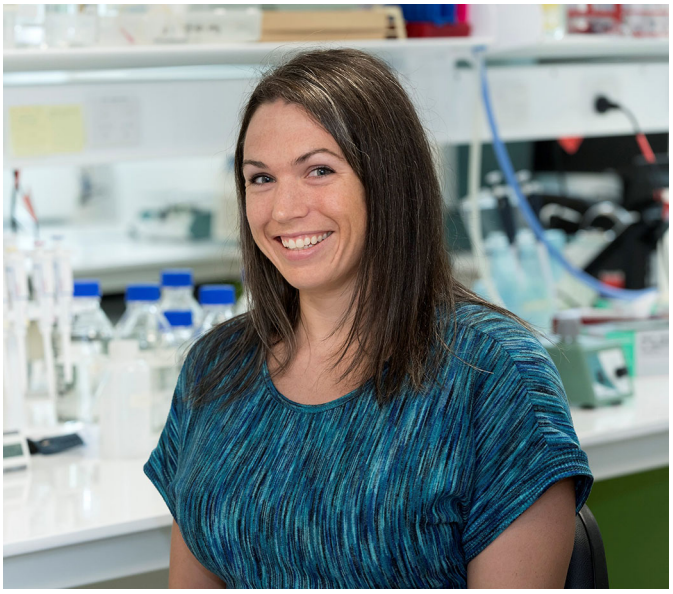
ECR SPOTLIGHT

ECR Spotlight – Rebecca Koch

ECR Spotlight is a series of interviews with early-career authors from a selection of papers published in Journal of Experimental Biology and aims to promote not only the diversity of early-career researchers (ECRs) working in experimental biology but also the huge variety of animals and physiological systems that are essential for the 'comparative' approach. Rebecca Koch is an author on 'Captivity affects mitochondrial aerobic respiration and carotenoid metabolism in the house finch (*Haemorhous mexicanus*)', published in JEB. Rebecca is a postdoctoral researcher in the lab of Matthew Toomey, Department of Biological Sciences, University of Tulsa, investigating how birds communicate information during courtship, particularly through the use of coloration.



Rebecca Koch

How did you become interested in biology?

I can trace my interest in biology back to two main sources: David Attenborough and the kitchen windows in my childhood home. The influence of the former hardly needs justification, as David Attenborough is well known for bringing humanity to nature documentaries while inserting himself directly on screen, amidst the action. The docuseries 'The Life of Birds' captured my imagination to such an extent that I recently dug up footage of dunnock courtship from this series for a lecture. At the same time as I learned of flight, song and the color of birds from David Attenborough, an excellent set of kitchen windows provided my young self a view of the bird behaviors occurring even within the space of a suburban backyard. Now, much of my research focuses on a finch species I commonly observed at my family's birdfeeders.

Describe your scientific journey and your current research focus

My recent work has focused on red, orange and yellow colored ornaments formed by carotenoid pigments, and I currently explore the mechanisms underlying variation in these colors in male house finches (*Haemorhous mexicanus*). It is perhaps fitting that my current study system is the house finch, as my first research experience was a basic test of whether the redness of house finch plumage correlates with the abundance of red-pigmented fruits and berries in the local vegetation. Interest in understanding bird courtship behaviors has been the underlying theme of my journey as a scientist, though the route has been scenic: from that small beginning in a common backyard bird, I journeyed to remote sage-brush plains to explore the displays of male greater sage-grouse, to aviaries of domestic canaries with rich coloration, and to a lab full of fruit flies to test fundamental evolutionary processes, before finally circling back to house finches (with a much broader perspective). Now, I work to understand the information that animals such as house finches communicate during courtship by gaining a deeper understanding of the mechanisms that underlie variation in courtship display performance.

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How would you explain the main findings/message of your paper to a member of the public?

In many animal courtship displays, some individuals present more extravagant and complex displays than others, and these individuals appear to be more successful. In house finches, for example, the redness of a male's plumage has been found to indicate his health, and female finches appear to prefer to pair with redder males. Despite decades of study, however, it has proven difficult to explain why a trait such as redness in feathers should relate to health and mate quality. In this experiment, my coauthors and I tested a hypothesis that red feather color in male house finches depends on their performance at a very basic level: the mitochondria. Mitochondria are best known as the 'powerhouses of the cell' for their role in harnessing energy to fuel cellular processes. We discovered patterns linking performance of these 'powerhouses' to the abundance of red pigments in male house finches held in aviary cages, suggesting that bright red finches may have differences in their mitochondria compared with dull yellow finches. I find these results exciting because if the redness of a male finch's plumage reflects his performance in something as fundamental to the cell (and organism) as mitochondria, then it makes sense why females may benefit from raising their young with redder males.

What is the hardest challenge you have faced in the course of your research and how did you overcome it?

The hardest challenge I've faced in my career came early in my career as a graduate student: I had planned my disseration experiments around canaries that I would keep in the university's aviary facility, but that facility suddenly required unexpected and unavoidable renovations that would delay the start of my projects indefinitely. So, as I neared the end of my first year as a PhD student, I found myself without a research platform. This experience provided a crash course in improvisation. Working with my supervisor and assembling teams of undergraduate researchers, I

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Four male house finches show off individual variation in amounts of red and yellow pigments in ornamental plumage. Photo credit: Geoffrey Hill.

pivoted to several projects on museum specimens as well as samples we had stored in the freezer. This time ended up providing valuable experience in analyzing data and preparing manuscripts for publication.

What is the most important piece of equipment for your research, what does it do and what question did it help you address?

Because my current research specializes in understanding animal coloration, one of the most important tools I use is a high performance liquid chromatography (HPLC) system that separates and characterizes colored pigments from samples. With HPLC, I can move beyond guesswork that, for example, redder feathers contain greater amounts of red pigments than do yellow feathers, and I can instead pinpoint the exact concentrations of each pigment. Analyzing the pigments contained in a sample using HPLC is a bit like using a highly specialized filter and spectrophotometer (a color measurement tool) at the same time; under the right conditions, the HPLC system separates the pigments present in a sample from each other and provides information on their abundance as well as light absorbance properties (related to color). I use information from HPLC analyses to make inferences about the types of pigments birds such as house finches have circulating through their bodies, and how those pigments may be modified before use as colorants in feathers.

What is your favourite animal, and why?

It's nearly impossible for me to pick a single favorite animal as a biologist, since the more I learn about any particular critter, the more I respect and admire it. Yet one of my consistent favorites is one of our North American tits, the chickadee (which comes in several flavors of species in my home of the USA, like black-capped and chestnut-backed). Chickadees are communicative and charismatic, learning to approach novel feeding stations (and humans) and expressing complex calls that appear to be listened to by a variety of other species for information about potential threats. Their social nature and the cognitive complexity required by their foraging style make them an especially personable little bird, and a delight at bird feeders. If my local chickadees had carotenoid-pigment-based coloration, I would surely find a way to work them into my research!

Do you have a top tip for others just starting out at your career stage?

My top tip for new postdoctoral researchers is to practice enjoying the current moment, even as our careers are barreling us always toward the future – the next grant, the next job, the next step forward. Postdocs tend to be relatively short research experiences, and they can be exciting opportunities to live someplace unexpected and learn new research perspectives. We are under such astronomical pressure to meet the benchmarks required for us to land jobs in the future that it can be easy to lose sight of the joys and benefits of the present.

Reference

Koch, R. E., Okegbe, C., Ramanathan, C., Zhu, X., Hare, E., Toomey, M. B., Hill, G. E. and Zhang, Y. (2024). Captivity affects mitochondrial aerobic respiration and carotenoid metabolism in the house finch (*Haemorhous mexicanus*). *J. Exp. Biol.* **227**, jeb246980. doi:10.1242/jeb.246980