New guide for finding genes linked with behavior

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Sarah Bengston. Credit: Kathleen Bengston

Scientists interested in finding specific genes that influence the behavior of humans and animals have a new tool, thanks to a two-year research effort aimed at describing how to apply the latest techniques of

molecular genomics to the study of complex behavior.

"There's a really steep learning curve when you get into genomics, and if you're starting from a place of very little knowledge, it's incredibly intimidating," said Sarah Bengston, a Rice University behavioral ecologist and lead author of a new review article about genomic tools for behavioral scientists.

"I am the person who needed this paper," said Bengston, a Huxley Faculty Fellow in Ecology and Evolutionary Biology in Rice's Department of BioSciences. "I needed a novice-level introduction to how genomic tools could help me answer research questions. For example, was my experimental setup an appropriate system to use for genomic sequencing or any kind of molecular techniques? I couldn't find that kind of reference, so I worked with a group of really smart people to write one."

The article, which appears online this week in *Nature Ecology and Evolution*, is designed to guide behavioral scientists from any discipline with specific recommendations about whether genomics tools are appropriate for their research, and if so, which tools are likely to best work in their labs.

Bengston said she began struggling with how to incorporate genomic studies into her own research program shortly after finishing graduate school in 2015. She had won a National Science Foundation (NSF) postdoctoral fellowship at the University of Rochester and was trying to establish her own research program.

"Behavior connects so many fields," she said. "If you are an evolutionary biologist, an ecologist, a neurobiologist or a psychologist, then behavioral variations are inherently interesting to you. For example, why are some individuals more aggressive than others? Why do we often see higher

levels of aggression in individuals who are also more exploratory? We've studied these kinds of questions for years, and we know that many of these are heritable traits, but we tend to stop there."

Bengston heard about an NSF workshop on genomics and behavioral ecology at the University of Illinois, Urbana-Champaign.

"I already basically knew what didn't work for me because I had tried so many times and just failed," she said. "I walked into that workshop hoping that someone could point me toward this paper, this novice-level primer."

Instead she found a room full of like-minded experts in both behavior and genomics who were committed to applying their expertise to understanding behavioral variation. The group decided to tackle the problem systematically.

"We dug deep into the field of genomics, broke down the available tools into categories and paired the tools with some of the big behavioral questions that come up over and over," Bengston said. "We generated 30 or so hypotheses of exactly how these tools can be applied, and then we suggested ways to go about addressing those hypotheses using the available tools."

The group also found that behaviorists need to become more active in annotating genomes and in collaborating with nonbehaviorists who are annotating genomes.

"There aren't behavior-friendly gene banks because it's not behaviorists who are annotating these genomes," she said. "If a behaviorist does transcription sequencing and goes to one of these gene banks and says, 'I'm getting hits on all these genes,' the search is liable to come back as a list of several dozen genes that are involved with a cell function like

membrane transfer.

"That's probably because the person who annotated the genome was only looking at cell function. There will be nothing there to help a behaviorist understand, 'OK, that may be a cell function gene, but it also has major implications for behavior.'"

Bengston said the review of genomic tools for behavioral ecologists is already paying dividends in her own lab.

"I'm using it as my own guide to go forward," she said. "I've used our table of hypotheses, for example. It's been really nice to have this guide in front of me as I consider research questions. There's no shortage of interesting or important questions, but this helps me see which ones I might have a chance of answering."

More information: Sarah E. Bengston et al, Genomic tools for behavioural ecologists to understand repeatable individual differences in behaviour, *Nature Ecology & Evolution* (2018). DOI: 10.1038/s41559-017-0411-4

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