

RESEARCH INTERESTS

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We are at the beginning of an era of research on avian cognition: exciting discoveries are occurring in laboratories that demonstrate non-human animals possess sophisticated cognitive abilities. By expanding this research to explore these abilities in the wild, we can learn about their evolution and function in the context of the system that developed them. We know that large-brained birds and mammals are capable of advanced cognition because they solve tasks that require reasoning, flexibility in learning, and they can recognize and track others' social relationships (Shettleworth 2010). What we do not know is whether such cognition is restricted to species with large brains. Outside of the large-brained birds, there is one genus, *Quiscalus*, that has exceptionally high innovation rates for its relatively small brain size, making it the best candidate in which to look for advanced cognition (Lefebvre & Sol 2008). The number of novel foraging techniques are a measure of innovation and they positively correlate with brain size, when corrected for body size, across species. In collaboration with Professor Stephen Rothstein (Department of Ecology, Evolution, and Marine Biology at the University of California, Santa Barbara), I will establish a field site in the Santa Barbara, CA area to examine whether innovativeness in great-tailed grackles (*Quiscalus mexicanus*) is driven by exploration or sophisticated cognition. Grackles are abundant and easily accessible in the Santa Barbara area and I will catch and individually colour-mark flocks to identify study subjects.

My proposed research aims to generate answers to the following questions:

1. ***Are grackles capable of sophisticated reasoning?*** I will set grackles a task involving pulling up a string in different contexts to get a reward. This requires either learning rules and applying them to new situations, or understanding the underlying principles of gravity and the connection of the string to food.
2. ***Do grackles remember and update information about social networks?*** I will test the grackles' ability to recognize third-party relationships by playing the song of a female's mate in his absence when she is soliciting attention from another male. She and the sneaking male should break contact upon the playback of her partner's call, but not the call of a neighbor.
3. ***Do grackles learn by observing others?*** I will test for social learning by training demonstrators to access a reward via one of two methods. If social learning occurs, flocks exposed to demonstrators should copy their method of reward acquisition.
4. ***Is grackle cognition positively correlated with brain size and innovativeness?*** Within-species innovativeness will be quantified by the number of different foraging techniques per flock and individual propensity for exploration. Cranial size will serve as a proxy for brain size to determine if innovation and cognition scores correlate with brain size.
5. ***Are levels of cognition and innovation differentially distributed according to social status?*** Individual grackles have different roles: females lay on nests inside a residential male's territory and bachelor males without territories sneak copulations with females. I predict that males will have more advanced cognitive abilities, which may have developed to facilitate sneaking copulations and potential counterstrategies by resident males.

If successful, this investigation will elucidate whether grackles are innovative simply because they exhibit a high degree of exploratory behavior, or whether their innovativeness results from sophisticated cognition such as causal reasoning (the ability to infer that one thing causes another without having to manipulate the system to find out). If grackles are capable of sophisticated cognition, then this ability will be more prevalent in non-human animals than we assume and should spur research on this topic in species with a range of brain sizes. If grackles do not show

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indications of advanced cognition, then this indicates that high innovation rates across species may be a convergent behavior driven by differing mechanisms (i.e., cognitive capabilities or exploratory behavior can result in the same behavioral innovations). Either result will be interesting and a worthy contribution to the fields of zoology and psychology.

My research is complimentary to the goals of the SAGE Center because it focuses on the connection between the brain and mind, and is interdisciplinary. My proposed project examines the relationship between brain size and cognitive capabilities (i.e., the mind) through the disciplines of evolutionary biology, ecology, and psychology, as well as incorporating tools from genetics and mathematics through collaborations. My collaborators include: Dr. Rick Grosberg (Center for Population Biology, University of California, Davis) who has offered to train me and allow me to access his genetics lab to analyze the grackle blood samples for sexing and parentage purposes, and Dr. Will Hoppitt (Centre for Social Learning and Cognitive Evolution, University of St. Andrews) who will apply a social learning model to the grackle data to determine which learning mechanisms are employed. I look forward to continuing to develop this project with feedback from other SAGE Center faculty members, which should facilitate innovative ways for advancing our understanding of grackle cognition and provide additional tools for the study of the brain and mind in other species.

References

- Lefebvre L, Sol D. 2008. Brains, lifestyles and cognition: are there general trends? *Brain, Behavior and Evolution* 72:135-144.
- Shettleworth SJ. 2010. Cognition, Evolution, and Behavior (2nd ed). Oxford University Press.

NOTE: Corina Logan submitted this statement of research interests in April 2012 as part of her successful application for a Junior Research Fellowship at the SAGE Center for the Study of the Mind at the University of California Santa Barbara.