Ecology, evolution, and growing baby birds!

Sarah Winnicki, graduate student at Kansas State University

Imagine your siblings, or perhaps a classmate and their siblings. Do they all look alike? In what ways did those siblings grow and develop differently, even if they were raised in the same home and are genetically related? Like humans, baby animals of other species grow and develop in different ways. Some grow faster than others. Others grow a particular body part first, such as prioritizing the growth of their muscles before their bone growth, or vice versa. But unlike human siblings, who will hopefully all go on to live long and fulfilling lives, many other baby animals face steep odds the moment they are born—think baby wildebeest getting devoured by a lion in a nature documentary. The ways these animals grow can be the difference between life and death!

Baby wildebeest (left) must grow quickly to avoid hungry lions!

Open access photos by Carole Henderson and Monika P

Understanding growth and development is important—the ways in which an animal grows not only affects its ability to escape predators, but also its potential to reproduce, its lifespan, its ability to catch food, and more. The factors that dictate baby animal growth are often a combination of care from the parents (like the amount of food a parent sparrow brings to the babies while they are growing) and a genetic "plan," genes that are passed from a parent to offspring before it is born. An organism cannot change the genes it is born with, but over many generations, natural selection can act on the genes present in a population if those genes hurt or help organisms' chances of success. In areas of high lion predator risk, for example, the baby wildebeest with genes that allow them to grow quickly and run away at a very young age will survive lion attacks more frequently than wildebeest with genes that make them grow more slowly. Since more fast-growing wildebeest will survive to produce their own baby wildebeest and will pass those genes for fast growth along, eventually those genes will become more and more common in the population. The ecological interaction—the presence of lion predators—can lead to the evolution of wildebeest growth and development!

My name is Sarah Winnicki, and I am an evolutionary ecologist particularly interested in understanding animal growth and development. I love birds, so in 2014 I started studying Grasshopper Sparrows, a tiny brown grassland songbird native to much of North America. We found the sparrows' nests and monitored them to see if the adults were successful in their nesting attempts. While visiting these nests, I noticed that the sparrow nestlings grew and developed in very different ways. In one nest, the baby birds grew very large very quickly,

reaching adult size in five days while sparrows in a neighboring nest did not reach adult size until they were eight days old. In another nest, the sparrows waited until they were completely covered in feathers before they left the nest, while their neighbors fledged (left the nest) before their feathers were completely developed. These birds are members of the same species, living in the same population, yet they grew and developed in very different ways. Why? If we can figure out the reasons why these birds are growing differently (if we can identify the "lion" in this system) we can identify the important ecological factors driving the evolution of baby birds. Knowing this relationship between ecology and evolution is important—the prairies in which these birds live are rapidly changing due to habitat loss and climate change, and we need to know what these changes will do to the evolution of these threatened birds!


How do we study growth and development? Every year we put together an amazing team of students willing to wake up at 4 AM every morning to get out to the prairie before sunrise.


We search for adult Grasshopper Sparrows, Eastern Meadowlarks, and Dickcissels, listening to males sing. When we know the location of males' territories, we drag a giant rope across that portion of the prairie, trying to "flush" the female off her nest. When we see a female fly off her nest, we search the grass to find the hidden nest cup. We monitor the nest every other day, waiting for the eggs to hatch. Once the nestlings have hatched, we put up a hidden camera to record how frequently the parents are feeding and to identify any predators that visit the nest. Every other day, we return to the nest and gently measure the nestlings—how long their legs and beaks are, how much they weigh, how much their feathers have developed, and up to

twenty-five other metrics of growth. Sometimes we even scan the birds using a Quantitative Magnetic Resonance machine, which acts like an MRI machine you might see in a doctors' office. Just like doctors use MRIs to take internal scans, we use our QMR to safely scan the baby birds and calculate how their fat and muscle is developing. When the birds get old enough to leave the nest, we take measurements of the plants around the nest cup to see how well-protected the babies were.

Our beautiful study site at the Konza Prairie Biological Station in Northeast Kansas, USA

We are still in the process of analyzing all of our data, but we have identified some interesting preliminary results. It turns out there are lots of "lions" in our system! Nine out of every ten nests are eaten by predators—mostly snakes but occasionally mammals and other birds. Maybe some baby birds grow very quickly to escape these predators. But these predators are not the only ecological pressure in this system. All three of our study species are affected by the Brown-headed Cowbird, a common native brood parasite. These neat birds do not build their own nests but instead lay their eggs in other species' nests and force those birds to raise the large, competitive baby cowbirds. In some cases the presence of these cowbirds can lead to the host species' babies not getting enough food. Maybe some of these baby birds are growing in ways that could help them better compete with these hungry cowbirds (like growing large beaks to get more food). We are looking forward to analyzing all of our data so we better understand what affects the growth and development of grassland songbird nestlings!

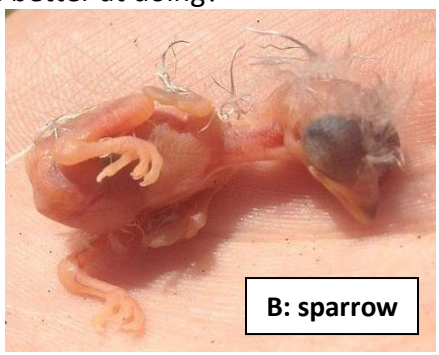
On the left, a large cowbird begs next to its Dickcissel siblings (yellow mouths). On right, a Speckled Kingsnake attacks a nest with three Dickcissel and one cowbird egg.

Discussion Questions:

1. Why study animal growth and development?

2. Think of ways different humans grow and develop. Scientists hypothesize that humans evolved on the open plains of Africa. What ecological pressures could lead to different growth and development strategies? For example, what type(s) of predators would lead to humans that are small and agile (like a runner) or large and powerful (like a body-builder)?

   Here are two baby birds. Make some hypotheses: what might Bird A be good at doing that Bird B is not? What might Bird B be better at doing?



4. What would your favorite part of our data collection be? Check out https://tinyurl.com/y7xk2aaq to see our Konza Crew in action.

5. Which body parts would help a baby bird best escape a snake or other predator (to see footage of predation check out https://tinyurl.com/y79gpxrn)? Which body parts would help a baby bird best compete against its siblings or the parasitic cowbirds? Could a baby bird grow and develop in a way that helps it escape well and compete well?

6. What qualities would make a good evolutionary ecologist (scientist studying evolutionary ecology)?

7. With what organisms would you research questions about growth and development? Why?

8. What questions would you ask an evolutionary ecologist?