Understanding preterm infant development helps ease their entrance into the world

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Every week, 150 bobwhite quail eggs arrive in the mail for Robert Lickliter, professor and director of graduate studies in the Psychology Department at FIU.

The eggs go immediately into an incubator set at 99.5 degrees and rotate on a regular basis to mimic a mother bird's movements. In exactly 23 days, they will hatch.

After spending a brief period of time in the lab, the bobwhite quails, a species native to the state of Florida, will move further south and live out their days on a quail preserve. And Lickliter and his team will have more data for their work on studying premature human infants and their sensory development. "With the bobwhite quail, we've developed a good animal model of sensory development of premature infants," Lickliter says. Premature human babies, that is.

Lickliter is a developmentalist – someone who works on the process of development and how it progresses. He began his academic career asking the question: How do we get from a single fertilized cell to a fully actualized human being? And just like developmentalists have since the field began, he ran up against an age-old conundrum.

"How do you ask questions that can't be answered? Going back to the beginning is impossible. Anything you do with a fetus is invasive, so your knowledge is going to be limited," he notes.

By using the bobwhite quail as an animal model, decades of research have made it possible for Lickliter and his research team to note certain patterns that have also been empirically applied to preterm infants.

It's important work. Lickliter's findings have helped hospital neonatal intensive care units introduce modifications, such as chairs for mothers to hold the babies in the unit and tents to minimize direct light exposure. With 12 percent of all births in the U.S. occurring before the fetus reaches 36 weeks, it is critically important to see what could impact the overall development of these babies – and even more important – to see what we can do to minimize that impact.

Asking Precocious Questions

What does an eight-inch bird – known primarily for its distinctive whistle – have in common with a human infant born 14 weeks early?

Not much, on the surface of it.

There are two kinds of infants in nature: precocial and altricial. Altricial infants, like newborn mice, "are not very finished – they don't look anything like an adult. An altricial animal is incapable of moving around on its own after birth," explains Lickliter.

But precocial animals, like a duckling, are born resembling miniaturized adults. They are able to move right after birth. Humans, of course, are neither precocial nor altricial but are a hybrid of both.

"With a precocial infant, it is possible to 'ask' questions to see if perception has changed," says Lickliter.

Because birds come in eggs, which are not grown inside the mother's body and have thin, translucent shells, they are ideal for developmental

studies. Using candling, a method in which a bright light source is held up to view the growth and development inside an egg, researchers can "trace the origin of how things start; we are able to track the embryo throughout the prenatal experience," says Lickliter.

And because Lickliter could now see what was happening in the embryonic process, he began to wonder about specific factors that may impact the outcome of development.

"What are the experiences prenatally that can integrate or synthesize internal or external factors, and how can we influence the development of the sensory systems to the degree that these kinds of changes can be made?" he wondered.

Measuring a Shock to the System

All babies experience a shock to the system when they are born. But that experience is intensified for preterm infants.

"The NICU environment is wildly different than that normally available in utero, where sensory stimulation is buffered by mom," says Lickliter. "Preemies go from having regular movement, and relative silence and darkness, to complete stillness, constant visual stimulation and constant noise. And the question becomes – what is the impact of these changes in experience on their development? We have younger and younger infants that are being born preterm – they tend to have more visual problems and are at risk for a host of problems. Do those problems begin before birth or as a result of the changes in experience associated with preterm birth?"

Lickliter's lab has explored these questions by conducting experiments, such as scoring the tip of the bobwhite quail's egg to enable more light to come in, or exposing the eggs and/or newborn chicks to unusual light

patterns to note the impact on their vision. The team has also tested sound patterns and noted where increased noise might impact development.

"Perhaps the biggest finding we have made is that when you change experience in one sensory system, it results in changes in the other sensory systems," says Lickliter. "So if you accelerate visual experience, the other systems will show changes in function as well."

With Lickliter and others' sensory development work as a foundation, researchers are now looking at different ways of building an environment that has the least impact on a preterm infant's future growth. In turn, Lickliter uses their results to test other hypotheses in bobwhite quail about sensory development.

But, as Lickliter points out, "If you want to study human development, you have to study humans. Animal-based research informs human-based research."

"We are scouts on the frontier, and that's why it's important to have these animal models."

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