Research offers insights to ease transition to aviary systems

As more of Canada's laying hen population transitions to a new housing systems, it's clear the switch is about much more than the physical surroundings. Tina Widowski has been studying how new housing systems impact a bird's behaviour, and how to minimize the challenges and optimize the opportunities for birds to thrive in new aviary systems.

"Consumers expect a very quick transition, but the sheer magnitude of moving Canada's 27 to 30 million laying hens from conventional cages to enriched colonies and non-cage housing is enormous," says Widowski, professor of animal biosciences at the University of Guelph, and Egg Farmers of Canada chair in poultry welfare. "Some of the biggest challenges are about the complex environment that aviary systems create. Hens have to find food and water and nest boxes on different tiers. They may be kept in groups of upwards of 15,000. And more freedom means more opportunity to get in trouble."

"You need a calm, smart and physically fit bird to thrive in an aviary system."

The chicken or the egg

Since both genetic selection and management were customized for laying hens living in confined environments for decades, Widowski is interested in how to create a laying hen that can adapt to the new systems that bring new risks for injury, piling and smothering. "You need a calm, smart and physically fit bird to thrive in an aviary system," she says.

To find that kind of bird, Widowski and research team members Leanne Cooley and Mariana Roedel Peixoto, started at the very beginning, in the layer breeder flock. "We are interested in how the experience of the mother can change the composition of the egg, the developing embryo, and ultimately the behaviour, physiology and health of the new laying hen for her entire life," says Widowski. "When you consider that every breeder hen produces 150 laying hens, it is surprising that no one has really studied this before."

Breeder age matters

The biggest differences Cooley found were related to the age of the mother. "We know that egg composition changes with the age of the mother – the amount of yolk, hormones and nutrients in the eggs change as a hen gets older – and these changes affect the developing embryo," says Widowski. "We found that the eggs of younger hens had less yolk, more albumen and more testosterone. Their offspring were more anxious, and responded differently to tests for fear and stress than offspring from older mothers."

It's not practical, actionable advice at this point but Widowski says it's the first time they've looked at the impact of the age of breeder hens. She knows farmers often have multiple barns that are all managed the same but the flocks don't all perform as well – it could have to do with the age of the breeder hens.

"We have initial findings that indicate maternal age affects a hen's fearfulness. But if we have farmers keeping track of breeder flock age, it would really help us understand some of the behavioural problems that impact laying hens – and how well they can adapt to new housing."

Testing stress

Stresses the breeding hen experiences – from feed to psychological stresses – can also change the composition of the egg, change the developing embryo and affect the behaviour of the laying hen. But the effects might be different for different genotypes of hens. Mariana Peixoto's research is providing insights for genetics companies to develop more resilient lines of laying hens that will thrive in more complex housing systems.

Working with genetics companies, Peixoto studied five different genetic strains of breeder flocks to see how exposing them to stressors affected their offspring. "Surprisingly, there was more difference in offspring behaviour between the strains of birds, than from the stressors their mothers were exposed to during the experiment," says Widowski. "This showed us there were inherent differences in fear and stress response based on genetics and all strains of breeder hens were more resilient to the stressors than we expected."

Does brown or white matter?

"We know that genetics have a big impact on the way hens respond to fear," says Widowski. "Brown and white birds respond very differently in behavioural tests. Brown chicks produce more distress calls when they are in isolation and remain immobile longer (appear more afraid) when physically restrained. When startled by a sudden event, white hens tend to be flightier and brown hens tend to freeze. White hens also have a bigger hormonal stress response."

Better bone health

Widowski has moved on from prenatal effects and is now looking at the early experience of pullets in different rearing aviary systems that offer different levels of environmental complexity and types of exercise – continuing the search for a calm, fit bird that will thrive in a non-cage environment. She's leading a large, multi-disciplinary research team looking to identify practices for housing and managing different strains of pullets that will help birds adapt to a complex housing system and stay healthy until the end of lay.

Osteoporosis and the associated welfare problems for hens is one of the areas Widowski and her research team are focused on. It's a given that hens develop osteoporosis with the constant depletion of calcium from laying that can't be replaced in the diet, so Widowski is looking at the impact of exercise during skeletal development on bone health.

"We're trying to figure out how to alleviate keel bone fractures and osteoporosis in hens, and we've teamed up with human medicine experts," she says. "We know that bones grow differently – bigger and stronger – if hens are raised in an environment that provides a lot of exercise. And we know in humans that osteoporosis is generally considered a pediatric problem and that more exercise as a child leads to better bone strength as an adult."

Widowski is collaborating with researchers Bettina Willie and Svetlana Komarova at Shriner's Hospital in Montreal – specialists in human bone diseases – to look at early exercise in pullets and the impact on bone strength for hens. "I am rearing pullets in different housing environments with varying levels of exercise. Colleagues at Shriner's are then analyzing live birds to see the differences in bone responses to mechanical loading based on their genetic strain and activity level in the different environments."

She's expecting to find that the early impact of jumping down in tiered housing will help birds develop stronger bones. "Adding perches and providing more space and opportunity for running and flight during the first few weeks of life might improve bone strength in adults and be an important consideration in barn design," says Widowski.

The ultimate success of housing hens in non-cage systems depends on how well they function in a more complex environment that appears to be as much about genetics as the opportunity for different types of movements – running, perching, climbing and flying – at different stages of development to build calm and healthy birds from pullets to laying hens.

For layer breeders and egg farmers, paying more attention to early life experiences – especially pullet housing and management – is turning out to be as important as the experiences for birds in adult housing.

This research was funded by Agriculture and Agri-Food Canada, Canadian Poultry Research Council, Egg Farmers of Canada, Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), and in-kind contributions from Hendrix Genetics and Lohmann Tierzucht.