



## Research summary

# Effects of maternal stress and strain differences in laying hens

## About the study

The behaviour of the laying hen is largely determined by the combination of her genotype, environment and early-life history. Research has shown that maternal effects can impact a large range of traits in the offspring, including body weight, behaviour and stress response. However, how these effects are passed on are still largely unknown. Since the experiences of layer breeders have the potential to influence the behaviour and stress response of millions of hens, this is an important subject to be explored.

Researchers at the University of Guelph sought to investigate how maternal stress affects offspring's behaviour and stress response in different strains of layer breeders. Additionally, they tested if corticosterone, a hormone secreted into the egg that helps to regulate stress responses, mediates maternal stress in laying hens. By exploring this subject, the researchers sought to clarify how the experiences of layer breeders can affect their daughters—future laying hens.



## Methods

Five genetic lines of layer breeders (two brown, two white, and one white heritage line) were reared and housed under identical conditions that allowed natural mating. Each strain was separated into two treatments: "Maternal Stress", in which layer breeders were subjected to stressors such as transportation, loud noise and physical restraint every day for eight consecutive days before egg collection; and "Control", in which layer breeders were only subjected to regular husbandry.

To test if corticosterone mediates maternal effects, additional eggs from the control group were collected and injected with either corticosterone hormone diluted in a vehicle solution or simply with the vehicle solution moments before incubation.

Fertilized eggs from all treatments were incubated, hatched and reared identically to 17 weeks of age so that the only difference was the experience of their parents and whether the eggs had been injected with corticosterone. During this rearing time, measures of physical development, fear and stress response were collected in the offspring.



## Findings

Layer breeders who were subjected to stress did not lead to increased fear or stress responses in their offspring. In fact, maternal stress showed no effects on development and stress response. Offspring from just one white commercial strain that was exposed to maternal stress actually showed less stress under social isolation. Offspring from eggs injected with both corticosterone and the vehicle solution consistently experienced impaired hatchability and body weight in all strains. No other effects of treatment were reported.

Many differences in the behaviour and stress response of brown and white strains were found. Overall, brown offspring hens were more fearful and anxious, while white offspring hens were more reactive to stress, both behaviourally, by flying away from a stressor instead of freezing, and physiologically, by producing more stress hormone.

## Conclusions

The minimal treatment effect on offspring shows that layer offspring were more resilient to maternal stress than expected and that some strains were more susceptible to maternal stress than others. Since both the injection of corticosterone and the vehicle solution into the egg impaired the development of offspring, these results are

more likely to be a consequence of the injections' invasive nature than maternal stress, and no conclusions should be drawn from these results.

Like the "fight, flight or freeze" response in humans, laying hens also have different responses to stress, and these responses may not be directly related to fear. For example, white birds flew away when startled but were less fearful and anxious in behaviour tests. On the other hand, brown birds showed higher levels of fear and anxiety during tests but froze when startled, which makes them appear to be calmer. As a result, the way a hen responds to stress should not be understood as her level of fear.

Researchers believe that these findings will open doors for future studies on maternal stress, especially in exploring the differences between brown and white strains. A better understanding of each strain's particularities will help farmers make more informed decisions and could improve the adaptability of a strain to a specific housing system.

## About the researchers

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