



Advancing our industry through evidence-based research

Research summary overview

Our Research Grant Program actively supports research projects in a variety of fields at universities across Canada. Each research project is linked to at least one of Egg Farmers of Canada's research priorities. Below is an introduction to these research projects, as well as their status.

2025 EFC GRANT PROGRAM RESEARCH SUMMARY

| PROJECT NAME | STATUS | PAGE | RESEARCH PRIORITY AREA ADDRESSED | | | | | | | | | |
|--|----------|------|----------------------------------|---------------------------|-------------------------|--------------------------------|-------------|----------------------------|-------------------------|-----------------------------|--|---|
| | | | Animal care science | Bird nutrition and health | End of flock management | Environment and sustainability | Food safety | Human nutrition and health | Innovative uses of eggs | Public policy and economics | Research gaps identified by the Code of Practice | |
| Assessing hatchery related well-being | Complete | 5 | X | X | | | | | | | X | X |
| Development of novel and alternative approaches using small ribonucleic acid (RNA) based immune-stimulant molecules for control of avian infectious bronchitis virus (IBV) | Complete | 6 | | X | | | | | | | | |
| From potential to implementation: Evaluating alternatives to antibiotics in layers through coordinated in vivo experimental studies and barn-level surveillance with industry partners | Complete | 6 | | X | | | | | | | | |
| Antimicrobial peptides: A better alternative to antibiotics on egg farms | Complete | 7 | | X | | | | | | | | |

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| Sustainable composites from waste eggshells for practical applications | Complete | 7 | | | | X | | | | | |
| Expanding opportunities for Western Canadian faba bean (<i>Vicia faba</i>) as a feedstuff for laying hens | Complete | 8 | | X | | X | | | | | |
| Develop new application of egg protein ovotransferrin as a functional food ingredient for bone health | Complete | 8 | | | | | | X | | | |
| Eggs as a strategy to maintain retina health in people with diabetes | Complete | 9 | | | | | | X | | | |
| Eggs-actly what's required: Eggs as an appealing way to restore nutritional status after cancer treatment | Complete | 9 | | | | | | X | | | |
| Including egg protein as part of a plant-based dietary pattern improves cardiometabolic health by ameliorating fatty liver disease | Complete | 10 | | | | | | X | | | |
| The use of pecking blocks as foraging enrichment for improvement of feather condition in enriched colonies | In progress | 10 | X | | | | | | | X | |
| Pre-hatch sexing for chicks based on chorioallantoic membrane immune-interrogation | In progress | 11 | X | | | X | | | | | |
| Perching requirements for pullets and laying hens: Preferences for grasping and elevation | In progress | 11 | X | | | | | | | X | |
| Understanding feather pecking in laying hens: The gut-microbiome-brain connection II | In progress | 11 | X | X | | | | | | | |
| Aggressive and severe feather pecking in brown and white feathered Leghorn pullets: Will blue light during brooding and rearing cycle improve future egg production? | In progress | 11 | X | | | X | | | | X | |
| Advancing poultry welfare with artificial intelligence: Integrative multimodal analysis for laying hens | In progress | 12 | X | | X | | | | | X | |
| Precision pullet rearing strategies for optimal reproductive body condition | In progress | 12 | X | X | | | | | | X | |
| Functional feedstuffs to bolster performance and immunocompetence of pullets reared at different rearing densities in enriched colony housing systems | In progress | 12 | | X | | | | | | X | |
| Use of full-body imaging scans on live hens to develop a model describing the impact of body composition on sexual maturation | In progress | 12 | | X | | | | | | X | |

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| Supplementation strategies to protect layers from vitamin D deficiency and immunological stress | In progress | 13 | | X | | | | | X | | |
| Manipulation of maturity with light during incubation | In progress | 13 | | X | | | | | | | |
| Building a usable surveillance and monitoring tool for avian influenza outbreaks in Canada | In progress | 13 | | X | | | | | | | |
| Functional nutrients to support calcium metabolism and egg production in a context of extending laying period in modern hens | In progress | 13 | X | X | | X | | | | | |
| Evaluation of hemp seed products to ameliorate fatty liver disease and reduce cannibalism in laying hens in a modern group housing system and generation of efficacy and safety data | In progress | 14 | X | X | | | | | X | | X |
| The impact of synchronizing photoperiod with body weight and metabolic thresholds to optimize sexual maturation in free run layers | In progress | 14 | X | X | | | | | | | X |
| Nutraceuticals for hens and humans through polyphenol-enriched feeds and eggs | In progress | 14 | | X | | | | | X | | |
| Impact of body weight, age and strain on keel bone health and sexual maturity in layer pullets raised in commercial free run housing systems | In progress | 14 | X | X | | | | | | | X |
| Dietary strategies to improve calcium status in hens with extended laying cycles | In progress | 15 | | X | | X | | | | | |
| Evaluation of a novel multi-component protease to bolster dietary protein utilization for sustainable poultry production | In progress | 15 | | X | | X | X | | | | |
| The effect of dietary omega-3 polyunsaturated fatty acids on birds' response to immune challenge induced by vaccination against avian encephalomyelitis | In progress | 15 | | X | | | | | | | |
| Valorization of end-of-lay hens for a sustainable egg industry | In progress | 15 | | | X | X | | | | | |
| A novel approach to end-of-flock management and biomass valorization using ambient alkaline hydrolysis | In progress | 16 | | | X | X | | | | | |
| Towards circular manufacturing strategies for the egg industry using eggshells as value-added mortar filler material for large-scale additive manufacturing | In progress | 16 | | | | X | | | X | | |
| Global warming: Impact of cooling strategies on the air quality inside livestock buildings and environmental emissions of gas and bioaerosols | In progress | 16 | X | X | | X | X | X | | | |

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| Modelling of alternative ventilation designs in layer houses | In progress | 16 | X | | | X | | | | | |
| Sustainable and resilient management of egg supply chains using Internet of Things | In progress | 16 | | | X | X | X | X | | X | |
| Cleaner egg production: Conversion of manure to energy as a pathway for reduction of greenhouse gas (GHG) emission and production costs | In progress | 17 | | | | X | | | | X | |
| Canadian phytobiotics as natural alternatives to antibiotics to control Avian Pathogenic <i>E. Coli</i> (APEC) | In progress | 17 | | X | | | X | | | | |
| Developing a vaccine against APEC | In progress | 17 | | | | | X | X | | | |
| Metagenomic Assessment of Risk of <i>Salmonella</i> (MARS): Validation of a rapid diagnostic workflow to support <i>Salmonella</i> control and surveillance program in egg farming | In progress | 17 | | | | X | X | | | | |
| Optimizing relative humidity for superior shell cuticle to maintain egg quality and safety | In progress | 17 | | | | | X | | | | |
| A preliminary human study on bioavailability and efficacy of bioactive peptide Isoleucine-Arginine-Tryptophan (IRW) in egg white hydrolysate | In progress | 18 | | | | | | X | X | | |
| Additional daily intake of eggs for improving metabolic outcomes and choline levels in overweight and obese individuals: Phase I study | In progress | 18 | | | | | | X | | | |
| Egg-sploring the long-term impact of a low-carbohydrate egg-based breakfast for type 2 diabetes | In progress | 18 | | | | | | X | | | |
| Modified eggshell membrane formulations as a novel supplement to maintain gut health | In progress | 18 | | | | X | | X | X | | |
| Animal implant studies with nano-textured eggshell-based constructs for bone regeneration | In progress | 18 | | | | | | X | X | | |
| From eggshell wastes to key components in green energy storage and conversion | In progress | 18 | | | | | | | X | | |
| An integrated process for recovering calcium carbonate and collagen/collagen amino acids from waste shells | In progress | 19 | | | | X | | X | X | | |
| Bioprinting of eggshell membrane-based biomaterials for promotion of wound healing | In progress | 19 | | | | X | | X | X | | |
| Development of 3D printable self-powered biosensors for glucose monitoring from natural egg white | In progress | 19 | | | | | | | X | | |

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| Use of adeno-associated virus for production of monoclonal antibodies in eggs | In progress | 19 | | | | | | | X | | |
| Environmentally and economically optimal lay cycle in aviaries and enriched colony housing systems in Canada | In progress | 19 | | | | X | | | | X | |
| Effects of microclimate on the airborne dust concentration in layer houses in Ontario | In progress | 19 | | | | | | | | X | |
| Phage therapy to decrease <i>E. coli</i> mortality in laying hens | Upcoming | 20 | | X | | X | | | | | |
| Exploring the potential role of surface coating and ultraviolet (UV) irradiation against aerosol based highly pathogenic avian influenza (HPAI) virus transmission | Upcoming | 20 | | X | | | | | | X | |
| Lay facility disinfection using gaseous aqueous ozone applications | Upcoming | 20 | X | | X | X | X | | | | |
| Green approaches to enhance anticancer bioactivities of partialized eggshell membranes | Upcoming | 20 | | | | X | | X | X | | |

Completed research 2024-2025

Animal care science

Assessing hatchery related well-being

Dr. Karen Schwean-Lardner, University of Saskatchewan

Also covers: Bird nutrition and health, public policy and economics, research gaps identified by the Code of Practice.

Objective

The researchers provide evidence-based information to assist hatcheries with decision-making around equipment and transportation practices that promote chick welfare. Three studies were completed. One study tested three chick holding devices for beak trimming and vaccination. The other two studies used simulated transportation to assess stocking density (80, 100, and 120 chicks per box) and feed access at different time points (0, 8, 16, and 24 hours) with or without a probiotic.

Results

The results showed that the Hatchling Support System with modified feet was the optimal holding device helping lower stress, fear, disorientation, and inflammation in chicks. The second study revealed higher stocking density was associated with increased internal temperature and humidity; however, chicks were still able to maintain effective thermoregulation without adverse effects on body weight or stress levels. Lower transport box densities lead to microclimate variability and increased chick energy demands during extended transport period. The final study found 24-hour feed access during the simulated transport combined with probiotic treatment improved chick gut development and health. It is important to note that chicks fed at 8 and 16 hours had the poorest gut development compared to no feed access.

All three studies underscore the importance of post-hatch management practises and address key knowledge gaps for chick welfare and health. Researchers recommend further studies under real commercial transport conditions to support chick welfare.



Bird nutrition and health

Development of novel and alternative approaches using small RNA based immune-stimulant molecules for control of IBV

Dr. Faizal Careem, University of Calgary

Objective

This project aimed to identify small RNA sequences that provide immune protection for pullets against avian IBV. To do this, the researchers assessed small RNA genetic sequences in the tissues of trachea, spleen, kidney, ovary, and oviducts of pullets at 4 and 11 days following IBV infection.

Results

Several small RNA sequences were identified with potential immune protection against IBV in the trachea tissues compared to the other tissues analyzed. The small RNA sequences were extracted from the trachea tissues and tested in three types of environments including lab setting (in vitro), tissues outside the body (ex vivo), and in laying hens (in vivo). Two small RNA strains gga-miR-133b and gga-miR-155a, identified in the trachea tissues, lowered infection, hampered IBV's ability to multiple, and enhanced the natural immune

response of laying hens against the DMV/1639 IBV strain. It was also observed that small RNA sequences were able to counter IBV in the respiratory tissues, significantly lowering clinical signs of infection.

The researchers concluded small RNA sequences could be an effective way to enhance pullets' immune response, lowering the incidence of IBV infection.

From potential to implementation: Evaluating alternatives to antibiotics in layers through coordinated in vivo experimental studies and barn-level surveillance with industry partners

Dr. Nicole Ricker, University of Guelph

Objective

Shifting laying hens' diet to omega-enriched feed at peak egg production is a common practice. However, this may lead to stress in hens that coincides with a period of increased vulnerability to infectious diseases such as APEC. For this study, the researchers looked at how feed and water acidification combined with omega-3 supplementation, affected egg productivity, gut microbial communities, and resistance to APEC colonization in hens housed in an aviary system.

Results

Water acidification improved egg production and egg weight during the transition to omega-3 feed, suggesting that introducing acidified water before the transition may help support overall production. Additionally, the gut microbial analysis found both good and harmful bacteria lowered significantly with acidification and returned to normal levels following transition to omega-3 feed. The impact of acidification was clearly detectable in fecal samples, and fecal monitoring was effective for tracking changes in gut microbial communities. Acidification had no improvement on APEC levels in laying hens, which may be due to certain APEC strains having a greater acid tolerance. Overall, the findings highlight the potential of using water acidification at the beginning of the transition to omega-3 feed as a strategy to help maintain egg production and support flock health.

Antimicrobial peptides: A better alternative to antibiotics on egg farms

Dr. Inanc Birol, Michael Smith Genome Science Centre

Objective

This project tested whether antimicrobial peptides (AMPs), small proteins that form part of the body's first line of defense against infection, could provide an effective alternative to antibiotics in poultry. The researchers administered selected AMPs to fertilized eggs shortly before hatching and then exposed the birds to two important bacterial pathogens, *Salmonella* Enteritidis (SE) and APEC. Health indicators including survival body weight, bacterial colonization of key tissues, and immune response markers were monitored in the first week after hatch to assess safety and efficacy.

Results

The researchers screened 21 different AMPs and identified several candidates with promising effects *in vivo*. One peptide, TeBi1, consistently helped birds maintain growth and reduce bacterial detection following APEC challenge, with higher doses associated with larger improvements in weight gain and lower infection rates, all without compromising hatchability. Other peptides, including AmMa1T5K and CLIBdenovo6, showed encouraging early signals in SE challenge trials by lowering bacterial loads in some tissues during the first days after infection, although additional studies with larger groups are needed to confirm and refine these findings.

The results show that AMPs can improve bird health and early resilience under experimental conditions, while avoiding concerns about drug residues and offering a lower risk of resistance development than conventional antibiotics. These findings support AMPs as a promising, science based approach to reducing reliance on traditional antibiotics in egg production and provide a strong foundation for future work on dose optimization, longer-term studies, and eventual commercial application.

Environment and sustainability

Sustainable composites from waste eggshells for practical applications

Dr. Duncan Cree, University of Saskatchewan

Objective

Polylactic acid, a biodegradable polymer derived from natural sources has many applications from the automotive industry to biomedical products; however, improvements in polylactic acid's resistance to heat and mechanical properties is needed. Calcium carbonate, a component of eggshells, shows promise to improve certain polylactic acid properties. This study assessed if using eggshells, with or without the eggshell membrane as fillers, improves heat and structural properties of polylactic acid. The researchers also conducted an economic and environmental assessment for adding eggshells to polylactic acid.

Results

To test this, the researchers combined polylactic acid and eggshells—either with or without the inner membrane—and in some cases, added stearic acid or a plasticizer. Test specimens were made by injecting the blends into a plastic mold or a 3D printer. The combination of eggshells with the membrane, and stearic acid using the injection plastic molding technique significantly improved strength, toughness, and stiffness, and lowered water absorption of polylactic acid, while the addition of the plasticizer had the opposite effect. Stabilizing polylactic acid with eggshells using the plastic molding method also lowered both environmental impact and production costs.

The researchers found that using eggshells containing membrane, along with stearic acid, was beneficial to stabilize polylactic acid. The study highlighted that there is no necessity to remove the eggshell membrane when added as a filler to polylactic acid which omits an extra cleaning step. In addition, using the plastic molding method would not only reduce environmental impact but reduce production costs of polylactic acid parts.

Expanding opportunities for Western Canadian faba beans (*Vicia faba*) as a feedstuff for laying hens

Dr. Doug Korver, University of Alberta

Also covers: Bird nutrition and health.

Objective

This project sought to understand the productivity and bird health impacts of incorporating Canadian faba beans into feeding programs for laying hens. The researchers assessed egg production, egg weight, nutrient profile and digestibility and feed-associated GHG emission intensity of production.

Results

Analysis of 66 faba bean samples were collected in 2022 from sites in Alberta, Saskatchewan and Manitoba revealed that starch and protein content were generally consistent across varieties and sites. A digestibility study that used 25 randomly sourced samples further suggested that faba beans can serve a dual purpose role in poultry diets as a moderately concentrated source of both energy and digestible amino acids. In this test, the average digestibility of most essential amino acids in faba beans was similar to that reported for soybean meal, while the measured metabolizable energy density in these samples was similar to that of oats, pears and barley.

Feeding hens diets containing up to 36% of faba beans for 12-weeks had no adverse effects on hen performance or egg quality, and GHG emissions were lowered by 20% compared to the control diet. At 36% inclusion, it is noteworthy that soybean meal was completely displaced from layer rations. The researchers also determined that moderate levels of tannins present in some faba bean varieties do not appear to exert any significant negative effect on hen productivity.

In summary, the findings from this study demonstrated the utility and potential of faba bean inclusion in laying hen diets to achieve key program objectives, while supporting high productivity and maintaining egg quality.

Human nutrition and health

Develop new application of egg protein ovotransferrin as a functional food ingredient for bone health

Dr. Jianping Wu, University of Alberta

Objective

The current treatment of osteoporosis is very costly for Canadians. By looking into the functional capabilities of food, experts may identify alternative means to improve bone health while reducing treatment costs. Ovotransferrin, a bioactive protein found in egg whites, possesses antioxidant and antimicrobial capabilities, promoting immunity, improved bone health, and reducing inflammation. This study aimed to develop new uses for egg whites as a functional food ingredient to improve bone health and type 2 diabetes.

Results

For this study, ovotransferrin was extracted from egg whites, and the leftover egg whites with no ovotransferrin were prepared into an ovotransferrin-depleted egg white hydrolysate. Forty rodents with postmenopausal osteoporosis were divided into five groups. Three groups received low, medium, or high doses of ovotransferrin orally for 12 weeks, while two groups served as controls. The highest dose (1%) lowered bone loss, stabilized bone mineral density, and improved urinary calcium. A second study tested the ovotransferrin-depleted egg white hydrolysate. After eight weeks, rodents had both blood glucose and insulin signaling (i.e. cells' response to insulin which is critical for managing blood sugar) improvements.

From the findings, ovotransferrin and egg white hydrolysate could be useful in improving bone health, as well as glucose and insulin signaling in individuals with osteoporosis and type 2 diabetes, respectively.



Eggs as a strategy to maintain retina health in people with diabetes

Dr. Miyoung Suh, University of Manitoba

Objective

Diabetes Mellitus is a common chronic disease reducing an individual's quality of life. One serious complication of diabetes is diabetic retinopathy, which can impair vision. Lutein and the omega-3 fatty acid docosahexaenoic acid (DHA) are antioxidants and structural component of retina. This project investigated the effects of consuming lutein and omega-3 DHA-enriched eggs on retina health in people with type 2 diabetes (T2DM).

Results

For this study, 30 adults with T2DM and 30 adults without diabetes, consumed two lutein and omega-3 enriched eggs daily for six weeks. The researchers found no negative impact of egg consumption on retina function or on health markers including cholesterol, blood pressure, glucose, and body weight. DHA was significantly increased at three weeks and maintained the level till the end of study. Lower skin carotenoid scores,

which indicates consumption of carotenoids (i.e. fruits and vegetables), was also noted in the T2DM group both before and after the treatment. The researchers concluded egg consumption for six weeks did not significantly alter the carotenoid levels and retina health in adults with or without diabetes. Future research is needed to explore whether egg consumption over a longer period may provide retinal health benefits for individuals with diabetes.

Eggs-actly what's required: Eggs as an appealing way to restore nutritional status after cancer treatment

Dr. Vera Mazurak, University of Alberta

Objective

Treatment for cancer challenges a patient's ability to consume adequate amounts of dietary protein. For this project, the researchers looked at food satisfaction, dietary intake, and identified protein foods that are accepted among cancer patients.

Results

A survey was completed by 300 cancer patients, averaging 50 years of age, to gain an understanding of their food preferences. The researchers found cancer patients struggled with eating food due to low energy, loss of appetite, feeling full quickly, taste changes and pain, during or after chemotherapy. The survey revealed chicken and eggs as the top preferred proteins. Eggs were viewed positively as a versatile, easy to cook, healthy, filling, and food that offers comfort and social connection, and lower purchase cost. Roughly 93% of patients consistently consumed eggs and egg products, including whole eggs, omelets, egg salad, and egg sandwiches. The researchers also found 33% of patients were consuming eggs one to two times per week.

Based on the survey findings, eggs were shown to be a preferred protein source due to its versatility and nutritional value in cancer patients. These findings will pave the way for future clinical trials looking at how egg consumption will improve protein intake.



Including egg protein as part of a plant-based dietary pattern improves cardiometabolic health by ameliorating fatty liver disease

Dr. Carla Taylor, University of Manitoba

Objective

Fatty liver disease, excessive fat accumulation in the liver, leads to an increased risk of cardiometabolic diseases (type 2 diabetes and cardiovascular disease), and liver cancer. The researchers used several high protein diets containing egg white protein, individually or in combination with plant-based protein, and compared the effects of these to a solely plant-based protein diet. The effects of these diets on liver fat accumulation, body fat, insulin resistance, blood pressure and the gut microbiome were examined with a rodent model of fatty liver and cardiometabolic disease.

Results

After eight weeks, rodents fed egg white protein alone or mixed with plant proteins (i.e. soy and pea protein), had reduced fatty liver disease, compared to rodents

only fed casein protein. Both oxidative stress and fibrosis occur with fatty liver disease, resulting in damage to cells and tissues. In this study, lower fat accumulation in the liver significantly reduced both oxidative stress and fibrosis, thus reducing liver damage. While no changes were observed with body weight, muscle mass, blood pressure, ammonia, or urea, there were improvements in blood sugar levels and lower insulin resistance. Gut microbiome analysis showed diets containing egg white protein alone or mixed with plant proteins promoted the growth of certain strains of *Clostridia* and *Streptococcus* genera, correlating to improvements of fatty liver disease.

The researchers concluded high protein diets containing egg white protein alone or in combination with plant proteins, could be used as a therapeutic treatment for managing fatty liver disease, thus improving overall cardiometabolic health.

Research in progress

Animal care science

The use of pecking blocks as foraging enrichment for improvement of feather condition in enriched colonies

Dr. Tina Widowski, University of Guelph

Also covers: Research gaps identified by the Code of Practice.

Objective

This project looks to determine the effect of pecking blocks on foraging behaviour, feather pecking, feather damage and beak shape, while also identifying the most effective placement of pecking blocks within an enriched colony housing system. The researchers will also note individual differences in frequency and duration of pecking block use among hens and will match this behaviour to health outcomes, including keel fractures, feather damage and eggshell quality. Finally, this study will establish whether the attraction to pecking blocks is related to its nutritional composition.

Pre-hatch sexing for chicks based on chorioallantoic membrane immune-interrogation

Dr. Maxwell Hincke, University of Ottawa

Also covers: Environment and sustainability.

This research project is currently underway and an update will be provided in a future research summary.

Perching requirements for pullets and laying hens: Preferences for grasping and elevation

Dr. Tina Widowski, University of Guelph

Also covers: Research gaps identified by the Code of Practice.

Objective

There is limited information available on the structural requirements (e.g. shape, height, material type, etc.) of perches for pullets and laying hens. This is particularly relevant for structures where hens cannot fully wrap their toes around the perch to maintain balance. To provide greater context to perching requirements, this study aims to explore different perching structures assessing hens' motivation for grasping and elevation, as well as how motivation for perching develops in pullets and if health conditions in older birds affects their roosting preferences. Additionally, the researchers will determine if strain differences affect these preferences.

Understanding feather pecking in laying hens: The gut-microbiome-brain connection II

Dr. Alexandra Harlander, University of Guelph

Also covers: Bird nutrition and health.

Objective

The researchers seek to identify a simple, practical prebiotic nutraceutical that can prevent or reduce feather pecking in laying hens on Canadian farms. To do this, they will use a galacto-oligosaccharide prebiotic and investigate its efficacy, effectiveness, and its potential mode of action.

Aggressive and severe feather pecking in brown and white feathered Leghorn pullets: Will blue light during brooding and rearing cycle improve future egg production?

Dr. Karen Schwean-Lardner, University of Saskatchewan

Also covers: Environment and sustainability, research gaps identified by the Code of Practice.

Objectives

Aggressive feather pecking and cannibalism are significant issues affecting animal welfare and egg production. This study will determine whether the use of blue light alters behaviour in brown and white feathered Leghorn pullets, resulting in reductions in aggressive pecking compared to birds reared under white light. In addition, the researchers will assess if using blue light during the brooding and rearing period close to the age of sexual maturation has a lingering effect on egg production when birds transition to white light at either 15 or 17 weeks of age.



Advancing poultry welfare with artificial intelligence: Integrative multimodal analysis for laying hens

Dr. Suresh Neethirajan, Dalhousie University

Also covers: End of flock management, research gaps identified by the Code of Practice.

This project will look at the simultaneous use of a variety of sensors (e.g. cameras, microphones, environmental sensors) to assess the welfare of hens in free run housing systems.

Bird nutrition and health

Precision pullet rearing strategies for optimal reproductive body condition

Dr. Martin Zuidhof, University of Alberta

Also covers: Animal care science, research gaps identified by the Code of Practice.

Objective

This project aims to optimize nutritional management for free run pullets and hens. The researchers will strive to understand the metabolic and physiological interactions that govern sexual maturation and lifetime egg production using precision feeding.



Functional feedstuffs to bolster performance and immunocompetence of pullets reared at different rearing densities in enriched colony housing systems

Dr. Elijah Kiarie, University of Guelph

Also covers: Research gaps identified by the Code of Practice.

Objective

This study aims to understand the impact of functional feedstuffs (e.g. omega-3 fatty acids, yeast metabolites) on pullet growth, mortality, health and *E. coli* load in enriched colony housing systems at low and high stocking densities. Additionally, this project will examine the long-term effects of functional feedstuffs on laying hen performance and livability.

Use of full-body imaging scans on live hens to develop a model describing the impact of body composition on sexual maturation

Dr. Gregoy Bedecarrats, University of Guelph

Also covers: Research gaps identified by the Code of Practice.

Objective

This project seeks to develop a standard operating procedure for using full-body imaging scans on live hens and monitor body composition changes during growth of pullets with a specific focus on adipose tissue accumulation and bone characteristics. The researchers will also determine the precise relationship between changes in body composition and the onset of sexual maturation throughout the development of pullets and will generate a model describing the physiological processes governing the impact of body composition on reproductive capacity and fitness. This model will provide the tools to predict growth and maturation of pullets and adjust management practises to ensure nutrition and housing requirements are met during pullet growth.



Supplementation strategies to protect layers from vitamin D deficiency and immunological stress

Dr. Marie-Pierre Létourneau-Montminy, Université Laval

Also covers: Human nutrition and health.

Objective

This study will test the addition of vitamin D to hen diets in a more active form, to the maximum allowed, for up to 90 weeks of laying. Researchers will specifically explore the impact of this diet on production performance, mineral levels, immune system, and bone health. With this project, the researchers look to improve the robustness of laying hens so that they can better cope with nutritional, immune, and environmental stresses in a context of longer laying cycles.

Manipulation of maturity with light during incubation

Dr. Bruce Rathgeber, Dalhousie University

Objective

The researchers will determine the impact of photoperiod length during incubation of hatching eggs on several factors, including hatch success and timing of hatch, early post-placement feed and water intake, recovery from

long distance transportation, age at first egg, overall performance over a production period, egg number and egg size, and bone health in the long term. This project will provide data to further the knowledge of potential benefits of using light in incubators.

Building a usable surveillance and monitoring tool for avian influenza outbreaks in Canada

Dr. Rozita Dara, University of Guelph

This research project is currently underway and an update will be provided in a future research summary.

Functional nutrients to support calcium metabolism and egg production in a context of extending laying period in modern hens

Dr. Angel René Alfonso Avila, Centre de recherche en sciences animales de Deschambault (CRSAD)

Also covers: Animal care science, environment and sustainability.

Objectives

Over the decades, the assessment of nutrients such as vitamin K and magnesium requirements has not evolved with those of amino acids or calcium. The researchers in this project look to determine the impact of functional nutrients on calcium metabolism and egg production, particularly in extended lay cycles.

Evaluation of hemp seed products to ameliorate fatty liver disease and reduce cannibalism in laying hens in a modern group housing system and generation of efficacy and safety data

Dr. Stephanie Collins, Dalhousie University

Also covers: Animal care science, human nutrition and health, research gaps identified by the Code of Practice.

Objective

This project will be the continuation of a recently completed project on the use of hemp by-products fed to white and brown laying hens' strains housed in single tier and conventional systems. The researchers aim to expand on the findings of feeding hemp by-products to white and brown laying hens housed in enriched colony systems, and brown laying hens housed in free run systems.

The impact of synchronizing photoperiod with body weight and metabolic thresholds to optimize sexual maturation in free run layers

Dr. Gregoy Bedecarrats, University of Guelph

Also covers: Animal care science, research gaps identified by the Code of Practice.

Objectives

The researchers want to identify the relationship between metabolic and photoperiodic (light) cues in laying hens and determine the minimum thresholds to achieve optimal entry into lay. In addition, they will establish the influence of free run environments on activity levels and its impact on body composition and bone quality as it relates to the timing of sexual maturation in laying hens.



Nutraceuticals for hens and humans through polyphenol-enriched feeds and eggs

Dr. Deborah Adewole, University of Saskatchewan

Also covers: Human nutrition and health.

Objective

Polyphenols are a natural compound commonly found in many fruits, vegetables, and cereals, with antioxidant properties that have the potential to improve hen health and production. This project will determine if feeding hens a polyphenol-rich diet can result in polyphenol-enriched eggs, and the effects on egg shelf life, egg taste, hens' health, and environmental emissions.

Impact of body weight, age and strain on keel bone health and sexual maturity in layer pullets raised in commercial free run housing systems

Dr. Gregoy Bedecarrats, University of Guelph

Also covers: Animal care science, research gaps identified by the Code of Practice.

Objectives

This project is an extension of a previous project, which assessed the impact of synchronizing photoperiod with hen body weight and the metabolic threshold to optimize sexual maturation in free run layers. In this extension, the researchers will enhance the applicability of the results by expanding the scope to include brown hens and testing the results at a commercial farm.

Dietary strategies to improve calcium status in hens with extended laying cycles

Dr. Marie-Pierre Létourneau-Montminy, Université Laval

Also covers: Environment and sustainability.

Objectives

Calcium is an important mineral for bone health and eggshell formation in laying hens, and it can be paired with vitamin D3 to better promote its absorption. Phytogenics, plant-based natural bioactive compounds with antioxidant, anti-inflammatory and anti-bacterial properties, have also been found to improve bone metabolism. With extended lay cycles and the concurrent increase in bird age, additional calcium will be needed to support the hens' metabolism and maintain bone quality. This study aims to determine if supplementing hens' drinking water with calcium, either alone or with vitamin D3, or the use of phytogenics will improve performance, egg quality, mineral status, and bone mineralization.

Evaluation of a novel multi-component protease to bolster dietary protein utilization for sustainable poultry production

Dr. Elijah Kiarie, University of Guelph

Also covers: Environment and sustainability, food safety.

This research project is currently underway and an update will be provided in a future research summary.

The effect of dietary omega-3 polyunsaturated fatty acids on birds' response to immune challenge induced by vaccination against avian encephalomyelitis

Dr. Anna Rogiewicz, Dr. Chengbo Yang and Dr. Heather Blewett, University of Manitoba

Objectives

This project will examine the effects of omega-3 polyunsaturated fatty acids on the immune response to avian encephalomyelitis in both pullets and laying

hens. To do this, the researchers will evaluate three different types of omega-3 polyunsaturated fatty acids incorporated into laying hens' diets and measure their effects on antibody production, overall bird health and productivity.

End of flock management

Valorization of end-of-lay hens for a sustainable egg industry

Dr. Jianping Wu, University of Alberta

Also covers: Environment and sustainability.

Objective

This project seeks to develop an industry-viable approach of valorizing end-of-lay hens with demonstrated financial feasibility and environmental sustainability. While a single product is normally extracted from the valorization process, this project will focus on developing a methodology to extract fat, muscle protein and collagen from a single hen and evaluate the characteristics of the resulting products.



A novel approach to end-of-flock management and biomass valorization using ambient alkaline hydrolysis

Dr. Brandon Gilroyed, University of Guelph

Also covers: Environment and sustainability.

Alkaline hydrolysis involves using an alkaline solution (pH greater than 7) at ambient temperature and pressure to break down end-of-lay hens into nutrient-rich by products. This research project is currently underway and an update will be provided in a future research summary.

Environment and sustainability

Towards circular manufacturing strategies for the egg industry using eggshells as value-added mortar filler material for large-scale additive manufacturing

Dr. Lucas Hof, École de technologie supérieure

Also covers: Innovative uses of eggs.

This research project is currently underway and an update will be provided in a future research summary.



Global warming: Impact of cooling strategies on the air quality inside livestock buildings and environmental emissions of gas and bioaerosols

Dr. Stéphane Godbout, Institut de recherche et de développement en agroenvironnement (IRDA)

Also covers: Animal care science, bird nutrition and health, food safety, human nutrition and health.

Objectives

Global warming and the increasing frequency of heat waves might promote the use of water-based cooling systems. However, little is known about the potential health risks associated with their use. This study will investigate the effects on air quality of an experimental evaporative cooling pad system, with a focus on gas and bioaerosols emissions, and on water condition and biofilms presence in the cooling pad.

Modelling of alternative ventilation designs in layer houses

Dr. Syeda Tasnim, University of Guelph

Also covers: Animal care science.

Objective

This project aims to develop and implement simulation mathematical models to evaluate the performance of conventional and alternative ventilation designs for egg farms in Ontario.

Sustainable and resilient management of egg supply chains using Internet of Things

Dr. Armin Jabbarzadeh, École de technologie supérieure

Also covers: End of flock management, food safety, human nutrition and health, public policy and economics.

This research project is currently underway and an update will be provided in a future research summary.



Cleaner egg production: Conversion of manure to energy as a pathway for reduction of GHG emission and production costs

Dr. Khaled Benis, Dalhousie University

Also covers: Research gaps identified by the Code of Practice.

Objective

This research project is currently underway and an update will be provided in a future research summary.

Food safety

Canadian phytobiotics as natural alternatives to antibiotics to control APEC

Dr. Sophie Kernéis-Golsteyn, Lethbridge College

Also covers: Bird nutrition and health.

This research project is currently underway and an update will be provided in a future research summary.

Developing a vaccine against APEC

Dr. Aaron White, VIDO, University of Saskatchewan

Also covers: Human nutrition and health.

This research project is currently underway and an update will be provided in a future research summary.

MARS: Validation of a rapid diagnostic workflow to support *Salmonella* control and surveillance program in egg farming

Dr. Musangu Ngeleka, Prairie Diagnostic Services, University of Saskatchewan

Also covers: Environment and sustainability.

Objective

This project seeks to develop and validate a rapid metagenomics-based workflow, based on gene sequencing technologies, to support *Salmonella* detection, characterization, risk profiling, and surveillance in egg production systems.

Optimizing relative humidity for superior shell cuticle to maintain egg quality and safety

Dr. Bruce Rathgeber, Dalhousie University

Objective

The eggshell cuticle prevents loss of moisture and protects a freshly laid egg from bacterial infection. Barn environment and hens' metabolic conditions could affect eggshell cuticle quality and reduce the success of suction cups used by egg transfer equipment. This study will look at the impact of relative humidity and bird stress levels on cuticle structure and deposition, both in the bird environment and during storage. In addition, the researchers will assess the effects of barn and egg storage conditions on cuticle structure and how this impacts its interactions with transfer equipment.

Human nutrition and health

A preliminary human study on bioavailability and efficacy of bioactive peptide IRW in egg white hydrolysate

Dr. Jianping Wu, University of Alberta

Also covers: Innovative uses of eggs.

Objectives

IRW is a bioactive peptide comprised of the amino acid's isoleucine, arginine and tryptophan. Naturally present in eggs, IRW has demonstrated potential health benefits, including protective effects against hypertension, type 2 diabetes, insulin resistance, oxidation, and inflammation. However, its bioavailability and efficacy in humans has yet to be studied. In this study, the researchers seek to perform a preliminary human study to test the bioavailability and efficacy of IRW in egg white hydrolysate in lowering blood pressure and blood glucose.

Additional daily intake of eggs for improving metabolic outcomes and choline levels in overweight and obese individuals: Phase I study

Dr. Clara Cho, University of Guelph

Objectives

This study aspires to determine the effect of additional daily intake of eggs on a variety of metabolic indices (e.g. liver, fat, glucose levels, body mass, etc.) and choline and related metabolites, including markers of disease, in overweight and obese individuals.

Egg-sploring the long-term impact of a low-carbohydrate egg-based breakfast for type 2 diabetes

Dr. Jonathan Little, University of British Columbia

Objective

This project is a follow-up study which will determine if a low-carbohydrate egg-based breakfast will improve glycemic controls and lower blood sugar, body weight, hunger, and daily caloric consumption in patients with type 2 diabetes when consumed over a 12-month period.

Innovative uses of eggs

Modified eggshell membrane formulations as a novel supplement to maintain gut health

Dr. Maxwell Hincke, University of Ottawa

Also covers: Environment and sustainability, human nutrition and health.

This research project is currently underway and an update will be provided in a future research summary.

Animal implant studies with nano-textured eggshell-based constructs for bone regeneration

Dr. Maxwell Hincke, University of Ottawa

Also covers: Human nutrition and health.

This research project is currently underway and an update will be provided in a future research summary.

From eggshell wastes to key components in green energy storage and conversion

Dr. Zhi Li, University of Alberta

This research project is currently underway and an update will be provided in a future research summary.



An integrated process for recovering calcium carbonate and collagen/collagen amino acids from waste shells

Dr. Duncan Cree, University of Saskatchewan

Also covers: Environment and sustainability, human nutrition and health.

This research project is currently underway and an update will be provided in a future research summary.

Bioprinting of eggshell membrane-based biomaterials for promotion of wound healing

Dr. Maxwell Hincke, University of Ottawa

Also covers: Environment and sustainability, human nutrition and health.

This research project is currently underway and an update will be provided in a future research summary.

Development of 3D printable self-powered biosensors for glucose monitoring from natural egg white

Dr. Wen Zhong, University of Manitoba

This research project is currently underway and an update will be provided in a future research summary.

Use of adeno-associated virus for production of monoclonal antibodies in eggs

Dr. Leonardo Susta, University of Guelph

Objective

Adeno-associated virus is a virus with no pathogenic potential, currently used for gene therapy in patients. This study will look at the efficacy of injecting pullets at the start of lay with adeno-associated virus to produce Palivizumab (PVZ), an antibody used for treating respiratory infections in humans, in eggs. The characteristics of PVZ produced from eggs will be compared to commercially available PVZ. The results of the project will provide an alternative, cost-effective method to obtaining PVZ antibodies through eggs, compared to the traditional methods of obtaining them from mammals.

Public policy and economics

Environmentally and economically optimal lay cycle in aviaries and enriched colony housing systems in Canada

Dr. Maurice Doyon, Université Laval

Also covers: Environment and sustainability.

This research project is currently underway and an update will be provided in a future research summary.

Research gaps identified by the Code of Practice

Effects of microclimate on the airborne dust concentration in layer houses in Ontario

Dr. Syeda Tasnim, University of Guelph

Objective

This project will characterize the microclimate of layer barns in Ontario, with an emphasis on understanding its effect on the concentration of airborne dust.

Upcoming research projects

Bird nutrition and health

Phage therapy to decrease *E. coli* mortality in laying hens

Dr. Martine Boulianne, Université de Montréal

Also covers: Environment and sustainability.

This research project is currently underway and an update will be provided in a future research summary.

Exploring the potential role of surface coating and ultraviolet (UV) irradiation against aerosol based highly pathogenic avian influenza (HPAI) virus transmission

Dr. Faizal Careem, University of Calgary

Also covers: Research gaps identified by the Code of Practice.

Objectives

This experiment will determine if the avian influenza virus, including HPAI, will become inactive when applying UV irradiation alone or in combination with surface coatings containing titanium dioxide, in a simulated barn environment. The results of this project aim to benefit the Canadian poultry industry by tackling challenges around reducing the incidence of HPAI.

Food safety

Lay facility disinfection using gaseous aqueous ozone applications

Mr. Trevor Carlson, Geosyntec Consultants

Also covers: Animal care science, end of flock management, environment and sustainability.



Objective

This project will determine the effectiveness of ozone application as a disinfectant in poultry barns for reducing infectious pathogens such as avian influenza, *Salmonella*, coccidia oocysts, and intestinal roundworms. The experiment will be completed in both a laboratory setting and on-farm to establish the dosage level and duration of application.

Innovative uses of eggs

Green approaches to enhance anticancer bioactivities of particalized eggshell membranes

Dr. Maxwell Hincke, University of Ottawa

Also covers: Environment and sustainability, human nutrition and health.

This research project is currently underway and an update will be provided in a future research summary.



Visit eggfarmers.ca or contact us at research@eggs.ca for more information about Egg Farmers of Canada or our research program.