

Cover photo: Martin Zuidhof

# 2018 ANNUAL REPORT



# APRIL 1, 2017 TO MARCH 31, 2018

The Poultry Research Centre is a partnership of the poultry industry, Government of Alberta and University of Alberta to foster a healthy Canadian poultry enterprise. Excellence in research and innovation, knowledge management, technology transfer and mentoring tomorrow's poultry professionals are the Centre's hallmark.

# Contents

Chair's Report	3
Academic Leader's Report	4
Technology Transfer	5
Leadership in Training Highly Qualified Personnel	6
Animal Science Mini-Internships	8
Heritage Chicken Program	9
Awards	11
Research Highlights	13
The PRC Advisory Board and Committees	17
Personnel - Poultry Unit	19
Senior Scientists	20
Graduate Students (N = 44)	21
Visiting Students and Scholars (N = 7)	22
Summer Students (N = 2)	23
Technical Support (N = 33)	23
Ongoing Research Projects (\$2,507,770 project funding received in 2017)	25
Facility Usage	30
Evidence of Productivity (2017)	31
Financial Report 2017-2018	39
Acronyms and Abbreviations	48
Contact Information	49

# Chair's Report

#### Jenna Griffin, Advisory Board Chair

The past year has been a year of change at the PRC.

As I write this, preparations are well underway for the Prairie Poultry Meeting. While the meeting is an annual tradition with the University of Alberta and University of Saskatchewan there has been a change in scope this year. The event has been expanded to include additional institutions and researchers and to engage industry partners and stakeholders. The Prairie Poultry Meeting beautifully pulls together core strengths of the PRC: Student opportunities, excellence in education and learning, a commitment to technology transfer and, not least of all, a "roll up the sleeves" attitude to working together. It also represents a first step toward a new opportunity: The PRC as a node for broad partnerships and collaboration. My sincerest thanks to the great number of people contributing to the success of this event.

The past year has also seen changes to personnel and leadership at the PRC. After 5 years spearheading business development, Agnes Kulinski stepped aside to pursue other opportunities. While the Heritage Hens surely miss her passion and enthusiasm, the Genetics Preservation Summit hosted last May provided momentum toward capitalizing on the unique genetics of the PRC lines. The event was another testament to the value of bringing diverse stakeholders together. After over 35 years in service to the PRC, Lyle Bouvier retired as the PRC Facility Manager. Kerry Nadeau seamlessly stepped into some very large shoes. While I can't say Martin Zuidhof ever truly took leave from the PRC, he did take sabbatical for the year. I'd like to thank Martin for his continued support and Doug Korver for carving out the time to act as Interim Academic Lead while Martin focused on his research.

Change is an essential part of continuous improvement. This past year a project with communications specialists was initiated to proactively engage with stakeholders and understand their needs and expectations. Two-way communication and collaboration is vital to the sustainability of the PRC and I would like to thank Val Carney for her leadership in spearheading the PRC Communications and Engagement strategy. I'm confident the outcomes will represent a positive change for the PRC.

As I reflect on the changes over the past year, I'm also aware of the changes yet to come. Government and industry alike have expressed the desire to see transformative change in the structure of the PRC partnership. This stems from an evolving research landscape in Alberta, a desire to see the PRC be the best that it can be, and a belief that we can leverage our collective resources more strategically toward grand pursuits. Socrates said, "The secret of change is to focus all of your energy, not on fighting the old, but on building the new." It's certainly true that we will need the energy and visionary thinking of all partners over the next few months to succeed in developing and delivering a new model for collaboration.

The more things change, the more they stay the same. Once again, the PRC has impressive numbers to show for a year of hard work:

- 7 students graduated
- Over \$2.5M in grant dollars awarded for poultry projects
- \$179,000 in student awards and scholarships
- Layer, broiler, broiler breeder and turkey farms, and Poultry Health Services engaged in internship and on-farm experience programs

Congratulations to the PRC on another year full of accomplishments, I look forward to the year to come.

# Academic Leader's Report

#### Dr. Martin Zuidhof, Academic Leader

I am excited about and proud of the accomplishments of the PRC contained in this document. The PRC is a unique model of effective collaboration between the poultry industry, Alberta Agriculture and Forestry (Alberta government), and the University of Alberta. Industry priorities include sustainable production of safe and high quality poultry products, growing markets, and building public trust. The Government of Alberta seeks to improve quality of life through a vibrant economy, and continuous improvement of public health, safety, and education. Toward public good, the University of Alberta aims for excellence in learning and teaching, discovery, and citizenship. As partners, we all value innovation and leadership development, and we seek continuous improvement. The PRC can be most effective when we recognize that although our specific objectives differ, there is a 'sweet spot' where the benefits of working together outweigh the costs.

The PRC, like any responsible organization, has struggled with how to maximize the benefits of engaging together. As partners, we all recognize the importance of leveraging our contributions to that end. Notably,

participation in the PRC leverages every partner's resources. Through the PRC, every industry dollar currently engages over 18 dollars of research, education and technology transfer and commercialization spending by the Alberta Government, the University of Alberta, and competitive project-specific funding. That's already pretty good, but there is still opportunity to increase beneficial outcomes from that investment. In the next months, we will together lay out a plan for the next several



years. We will need to refine mechanisms and perhaps implement new ones to further match base industry cash contributions to the PRC. Even more important, we will identify ways in which the sweet spot can be enhanced, bringing all stakeholders closer to their individual and shared goals. What will be needed to realize those goals, and how will the process be financed? The Strategic Framework lays out a tremendous path to success that will help ensure that we're not only matching the dollars, we're maximizing the return on investment.

In the last year, 111 different people at the PRC supported learning, discovery, and sharing efforts. We saw a lot of turnover, with 7 graduate students successfully completing their programs (5 PhD and 2 MSc), and notable departures of Agnes Kulinski (Business Director) and Lyle Bouvier (Poultry Unit Manager). We look forward to working with Kerry Nadeau as our new Poultry Unit manager. Your PRC team demonstrated continued excellence in teaching. Dr. Clover Bench and Frank Robinson each received teaching awards, and I was grateful to receive the Faculty Teaching Award. Our 38 graduate students reported 27 awards totaling \$178,900. We successfully competed for just over \$2.5M received for projects in 2017.

I want to thank Jenna Griffin for her excellent leadership as Advisory Board Chair in the past year. I also want to thank all stakeholders for their ongoing support. I look forward to continuing to work together.

# **Technology Transfer**

#### Dr. Valerie Carney, Technology Transfer Liaison

Alberta Agriculture and Forestry and EFA collaborated to deliver 2 learning and training events about vaccination best practices. The relaxed discussion format of these Flock Talk sessions provided a great forum for producers to learn from the experience of industry professionals and each other. Many attendees indicated that they intended to make changes in their operations based on what they learned at the events. These events were made possible through funding from EFA and an Alberta Agriculture and Forestry grant for PRC tech transfer and communication initiatives.

The PRC hosted a Genetic Preservation Summit that drew national and international attendees. The summit opened with an opportunity for members of the public and scientific community to learn and discuss the factors that influence progress in the poultry industry and the outcomes of this progress. In the afternoon, scientists shared how heritage and controlled lines have contributed to society and science. One notable finding was that the University of Alberta is home to a breed of brown leghorns that has unique genes related to immunology when compared to 78 other global poultry populations. The second day focused on developing next steps to promote conservation of these valuable genetic resources.

# Leadership in Training Highly Qualified Personnel

#### Dr. Doug Korver, Teaching and Learning Liaison

The PRC has an important role in training the next generation of poultry scientists, industry leaders, and a well-trained work force. The poultry industry is growing in Alberta, Canada and worldwide, and we are positioned to have a profound impact on the future of poultry. That is an exciting and awesome responsibility! I have pointed out some highlights, but please also refer to the table at the end of this report for details on our undergraduate and graduate teaching responsibilities.

The PRC team plays an important role in graduate and undergraduate teaching at the University of Alberta. A total of 35 students took the 2 poultry-specific courses, there were 2 poultry-focused Independent Study (AN SC 400) projects, and 1 AN SC 479 (Capstone; 4 students) project related to poultry. There were additional 8 courses, with 382 students enrolled with 5 to 60% poultry-related material (poultry management, nutrition, metabolism, welfare, behaviour, products, food safety and food product development). In addition to teaching at the University of Alberta, PRC members also deliver lecture content and practical experience to students at the University of Calgary Faculty of Veterinary Medicine. Unfortunately, 2018 marks the final offering of AN SC 463 Poultry Nutrition. In 2019, the current poultry and swine nutrition courses will be combined into a single Monogastric Nutrition course. This will result in a course that is ¼ swine nutrition, ¼ monogastric feedstuffs, and ¼ poultry nutrition. Thus, the new course will still have 66% of the course material specifically relevant to poultry.

In 2016, the Faculty of ALES, in cooperation with the U of A Career Centre launched an Animal Science Mini-Internship program for undergraduate students. In 2017-2018, the mini internship program continued to gain momentum. Please see Frank Robinson's detailed write-up next in the PRC Annual report for more details about this excellent opportunity for both industry and students.

The training of highly qualified personnel (HQP) remains an important focus for the PRC. In 2017/2018, PRC faculty supervised 44 graduate students, 15 research technicians, 6 Research Associates, 13 post-doctoral fellows, 2 undergraduate research assistants, and hosted 9 visiting scholars. Our students have won presentation awards at international scientific meetings, as well as numerous scholarships totalling over \$180,000 in 2017/2018. This clearly speaks not only to the quantity of students being trained in poultry science and production at the PRC, but also the quality.

As in previous years, members of the PRC (including technicians, researchers, extension specialists and students) were on hand for the 2018 Western Poultry Conference, held the day prior to the poultry industry Annual General Meetings in Red Deer. Research posters highlighting student and other projects were displayed, giving our students and staff opportunities to meet directly with producers and talk about the exciting work being done at the PRC, and the relevance of that work to the poultry industry in Alberta. The Western Poultry Conference has rapidly become a premier event for knowledge and technology transfer to the benefit of the Alberta poultry industry.

The Poultry Research Centre Student Club continues to be an excellent opportunity for students to gain experience in poultry handling, poultry science and the poultry industry. Currently comprised of approximately 20 active and enthusiastic members, the club meets formally approximately every two months. Club activities include educational tours of commercial poultry operations, as well as hands-on work by providing labour for layer and breeder vaccinations and pullet transfers. The Club is also a great

source of help on research projects at the PRC. The PRCSC has been an effective means of communicating job opportunities from industry to potential summer and permanent employees.

# POULTRY RELATED COURSES (2017/18)

Course	Instructor	Course name	Enrollment	% related to Poultry
AN SC 463	Doug Korver	Poultry Nutrition	11	100
AN SC 471	Frank Robinson	Applied Poultry Research	24	100
AN SC 400	Martin Zuidhof	Independent Study	1	100
AN SC 260	Doug Korver	Fundamentals of Animal Nutrition	84	60
AN SC 200	Frank Robinson	Principles of Animal Agriculture	112	50
AN SC 479/499	Leluo Guan & Paul Stothard	Animal Health Science (capstone)		25
AFNS 500	Clover Bench	Advanced Ethological Methods	1	10
AN SC 377	Clover Bench	Food Animal Behaviour	27	10
NUFS 200	Jianping Wu	Introduction to Functional Foods & Nutraceuticals	42	10
NUFS 450	Mirko Betti	Food Product development	30	10
NUFS 425	Jianping Wu	Nutritional Product development	19	5
NUFS 490	Jianping Wu	Advanced Food Protein Chemistry and Technology	5	5
NUFS 374	Mirko Betti	Food Fundamental and Quality	90	5

# Animal Science Mini-Internships

#### Dr. Frank Robinson

The University of Alberta recently implemented a November "reading week" break to match a long standing February reading week break. This additional week without scheduled classes and laboratories was approved by the university with the intent that academic programming would be scheduled during this week to assist students in their programs of study. In 2016 a program was developed to provide students in Animal Science and Animal Health programs with the opportunity to volunteer to work on private farms, the University of Alberta Research Station or large animal/poultry veterinary clinics. The objective of the program was to enable students to gain initial experience so that they could have the experience and confidence to seek longer term employment in animal science. The 3-day internship program has been offered four times in Fall 2016 (15 students), Winter 2016 (22 students), Fall 2017(50 students) and Winter 2018 (38 students). Students must apply to the program, pay a modest administration fee and are interviewed to assess maturity, background knowledge and to find out their specific commodity interests. Students are then placed in groups of 2-4 and are expected to work 24 hours. An orientation session is provided to help prepare students for what to expect. Students either commute daily or are billeted on work sites. A wind up session is held after the internship to debrief student experiences and to obtain suggestions for improving the program.

In the poultry area, we have had students work on layer, turkey, broiler breeder and broiler farms. The last two internships have also had a placement with Poultry Health Services in Airdrie. Students are not paid, and they provide boots and coveralls. For sites that are more than an hour drive from Edmonton, students may be provided with funding for accommodation provided by donors to the program. Any producers interested in hosting students for Fall or Winter internships, or to learn more about the dates for next year are invited to contact Frank Robinson (<u>frank.robinson@ualberta.ca</u>).

# Heritage Chicken Program

#### Dawn Hage, Heritage Chicken Program Coordinator

The 2018 Heritage Chicken Program (HCP) is rolling along at full speed with a supporter base of 510 members and 113 people currently on the waiting list. Registration in November was an intense time with hundreds of emails and anxious applicants worried that they might miss out on the opportunity to secure their spot for the upcoming season. Overall, the registration process went smoothly and the spots were filled within a five day period.

This experience demonstrated to me that the program is extremely important to both the supporters who get a spot and the community at large and this feeling is confirmed every two weeks when I hand out eggs. The HCP provides a rare opportunity for non-farming people to feel like they are involved and playing an important role in their own food production and husbandry. A large part of my job is sharing information, pictures, anecdotes and support to both the registered members and the public at large who email with questions and comments.

Supporters range from seniors who farmed in their youth, ardent environmentalists, parents who want to teach their kids about their food sources, students, teachers, academics, 4H members and a whole range of other individuals passionate about chickens. Emails from non-members include questions about how to get into the program, specific chicken information and problem solving (which I direct to experts as needed), information about our hatch and workshops and requests for links to materials that are specific to their needs. Sometimes the questions come from experienced poultry farmers and academics which indicates to me that our program is viewed as a resource to a community far beyond the supporter base.

The opportunities within the program for connecting and educating the public about poultry are vast. As coordinator, I feel that my most rapt and committed audience is the supporter base itself and I have dedicated a great deal of time and effort to build on that relationship through newsletters, emails, pictures and in-person connection. Topics include grading eggs, specifics about each strain of birds, roosters, the workshops and hatch, information about the program in general and sharing frequently asked questions.

I find the supporters cannot get enough information and pictures. The feedback at egg pickup time is always incredibly positive with constant requests to keep it coming. Some tell me that egg pickup time is their favourite part of the week. I am often asked how the birds are faring.

The Small Flock Poultry Workshop provided another excellent opportunity for education. I promoted it heavily within the supporter base as well as our other advertising venues in conjunction with Peavey Mart. The 27 member audience was comprised of small flock farmers, heritage project supporters and other interested community members, primarily from Edmonton and surrounding areas. Our speakers, Dr. Frank Robinson, Rachelle Davidson, Jesse Hunter and Dr. Madhu Ravi were wonderful and the evening was extremely successful. Below is a quote from a workshop participant:

I attended the workshop in Sherwood Park and it was excellent! You could have easily charged a couple hundred dollars for the 4 hours of quality content and even supplying food! We've ordered chicks through this program and we're so looking forward to expanding our little flock with heritage birds.

As the program moves along, there will be ongoing opportunities to share pictures and information about both the Peavey Mart hatch and when we replenish our own flock. From chick hatch to processing I think there is no other program where people can vicariously follow a food cycle from beginning to end and have such a feeling of participation and personal stake.

There have been many highlights so far in 2018 as described above. There is one consistent challenge with the program that comes up frequently and I would love to see addressed in the future. In a nutshell, the supporters want to see the birds. They ask constantly. They want to volunteer, to help, to hold. The parents have kids that beg to see the chickens. I think the program creates a very strong feeling of "our birds" and yet there is no real contact beyond pictures. I explain about bio-security and how a chicken brought out of the barn cannot return and they understand, but it still comes up constantly. I wonder if we might be able to find a way to somehow address this. I realize there is no way we can have hundreds of people walking through the barns and handling the birds. But, perhaps there could be an annual education event with live birds or some way to allow for minimal, safe observation. I would love to discuss this further for future seasons of the HCP project.

#### Heritage Chicken Program Revenue (2017)

Revenue source	Revenue in 2017
Adopt a hen	\$ 77,250
Peewee eggs	\$ 927
Heritage Chick	\$ 39,617
Heritage Meat	\$ 2,878
Small Flock Workshop	\$ 1,840
Donations	\$ 1,990
Total	\$ 124,502

# Awards

# GRADUATE STUDENT AWARDS (N = 27)

Name	Supervisor	Award	
Sasha van der Klein	Zuidhof	Vanier Scholarship	
Khushwant Bhullar	Wu	Alberta Innovates Health Services Doctoral scholarship	
Hongbing Fan	Wu	China Scholarship Council (CSC) Scholarship	
Xu Jiang	Wu	CSC scholarship	
Stepheny Zani	Wu	Thesis based Master's Recruitment scholarship	
Hongbing Fan	Wu	Alberta Innovates-Technology Future (AITF)	
Mohammad Afrouziyeh	Zuidhof	J Macgregor Smith Graduate Scholarship	
Sasha van der Klein	Zuidhof	ALES Centennial Dutch Endowment	
Sasha van der Klein	Zuidhof	Lallemand Forward PhD Scholarship	
Mohammad Afrouziyeh	Zuidhof	Harry J Hargrave Memorial Graduate Scholarship in Animal Science	
Mohammad Afrouziyeh	Zuidhof	Lloyd Johnston Graduate Scholarship on Poultry Science	
Khushwant Bhullar	Wu	Alberta Innovates Health Services Career Development award	
Jiandong Ren	Wu	Profiling Alberta's Graduate Students Award	
Hongbing Fan	Wu	Professor JB McQuitty Graduate Scholarship	
Sheila Hadinia	Zuidhof	Poultry Science Association Annual Meeting Travel Award	
Sheila Hadinia	Zuidhof	Don and Mary Copeland Graduate Travel Prize	
Katelyn Humphreys	Zuidhof	Copeland Graduate Travel Award in Poultry Research	
Selene Gonzalez	Wu	GSA Travel award	
Sheila Hadinia	Zuidhof	GSA Travel award	
Jiandong Ren	Wu	Academic Travel Award	
Nan Shang	Wu	Academic Travel Award	
Nan Shang	Wu	AFNS Travel Award	
Nandika Bandara	Wu	First place poster presentation – Protein and Co-products division	
Nandika Bandara	Wu	Protein and co-products division travel award	
Sheila Hadinia	Zuidhof	Evonik Doctoral Student Travel Award	
Nan Shnag	Wu	AOCS PCP Student Travel Grant	
Sasha van der Klein	Zuidhof	Student Certificate of Excellence for an oral presentation during the PSA Annual Meeting	

# FACULTY/STAFF AWARDS (N = 6)

Name	Award
<b>Clover Bench</b>	AFNS Teacher of the Year
<b>Clover Bench</b>	ALES Teaching Wall of Fame
<b>Clover Bench</b>	Tec Edmonton Patent Award
Frank Robinson	Ag Club Teacher of the Year
Frank Robinson	ALES Teaching Wall of Fame
Martin Zuidhof	ALES Faculty Teaching Award

# GRADUATIONS (N = 7)

Student	Supervisor	Degree	Focus
Ali Akbari	Wu	PhD	Canola proteins and potential applications for delivery of bioactive compounds
Misaki Cho	Korver	PhD	Broiler breeder nutrition
Felipe Silva	Korver	MSc	25-OH vitamin $D_3$ in layer diets
Nandika Bandara	Wu	PhD	Value addition to agricultural byproducts and waste proteins through biomimetics and nanotechnology
Yussef Esparza	Wu	PhD	Feather keratin biomaterials
Forough Jahandideh	Wu	MSc	Beneficial effects of egg white peptides on metabolic syndrome
Xiaohong Sun	Wu	PhD	Ovomucin as value added ingredient or antiadhesive agent

# **Research Highlights**

### DR. EDUARDO BELTRANENA

This year, Dr. Beltranena's group continued work on two projects started last year. For the first, funded by formerly ALMA, Egg Farmers of Alberta, Egg Farmers of Canada, Canadian Bio-Systems and Shac Environmental Products, they continued evaluating practical dietary strategies to reduce the ammonia emission intensity of table egg production. For a second project, funded by GF2, aimed at reducing the carbon footprint of broiler chicken and table egg production by dietary manipulation, they completed a 16-week egg production trial Dec 20. Preliminary results presented at 2018 Western Poultry Conference showed that carbon intensity of table egg production can be measurably reduced through modifying the composition of the diet, without jeopardizing productivity, egg quality or profitability. They also completed 4 broiler experiments to measure the effect of feeding diets formulated to reduce the life cycle analysis (LCA)-based carbon intensity. No results are available yet as this experiment finished March 15.

In addition to user fees for the projects above, Agriculture and Forestry contributed \$20,580 in barn and processing plant equipment and general supplies and \$23,000 in consumables including funds to fix the carcass blenders and replace desktop computers in the Alberta Turkey Producers Computer Lab housed at the poultry unit.

### DR. CLOVER BENCH

Dr. Clover Bench is an Assistant Professor of Applied Ethology in the Department of Agricultural, Food, and Nutritional Science in the Faculty of ALES. Her research interests include both poultry behaviour and poultry welfare and focus on five main themes:

- 1) Stress and disease behaviour
- 2) Behaviour ontogeny
- 3) Behaviour genetics
- 4) Housing design and management
- 5) Science-based welfare standards

Dr. Bench's research in 2017 in poultry ethology included investigating genomic biomarkers related to the prevalence of foot pad dermatitis in broilers and the use of 3D kinematics to study broiler gait phenomics. In addition to research, Dr. Bench teaches undergraduate courses in livestock behaviour, writes columns in industry newsletters and magazines related to livestock behaviour and welfare, and supervises a research team of graduate students, NSERC-funded undergraduate summer students, technicians, and postdocs dedicated to collaborating with Alberta's livestock industry to promote animal care.

#### DR. MIRKO BETTI

This year one PhD student successfully graduated advancing knowledge in the field of collagen-derived glycopeptides. Of interest was the stimulating effect of the novel glycopeptide on skin fibroblast growth in cell culture models. This glycopeptide has potential to induce skin regeneration. Novel flavour compounds with antimicrobial capacity were also discovered during the caramelization of amino sugars. These compounds could be used in the future in the formulation of meat products. Finally, new evidences about the role of sulfated glycans on iron bioavailability in dairy products were provided using in vitro cell culture model. Dr. Betti continues to serve as an editorial board member in Food Chemistry and LWT Food Science Technology journals and as an associated editor at Heliyon journal.

#### DR. DOUG KORVER

Doug Korver's poultry nutrition program often uses one specific type of poultry, but often has implications that apply to multiple types of poultry. In the current era of reduced antimicrobial use, a multi-pronged approach to bird health is becoming even more important. Dr. Korver currently has 5 projects underway, and 2 in the planning stages, which address bird health and welfare, and production efficiency. Three of these trials are ambitious field trials. Field trials are difficult and expensive to execute, which underscores Dr. Korver's commitment to providing value for PRC stakeholders. Dr. Korver is a member of the National Academies of Science (USA) Committee to revise the 1994 Nutrient Requirements of Poultry. This publication is one of the standard sources of information globally for the nutrient requirements of different types of poultry. It was last updated in 1994, and so this represents a major re-writing of this publication. An invitation to serve with this committee is solid evidence of international respect in the field of poultry nutrition.

#### DR. FRANK ROBINSON

This year, Dr. Robinson conducted an on farm research trial looking at egg shell color and shell quality on hatchability and chick quality. He taught the senior Applied Poultry Science class in 2017 and introduced 25 students to egg incubation, table egg quality determination and other aspects of the four poultry commodities. Dr. Robinson taught a 3-week course for Edmonton seniors on animal agriculture as part of the Edmonton Lifelong Learners Association (ELLA). This program will be offered again in 2018. He received the U of A Ag Club Teacher of the year award. He continues his passion for "Ag Evangelism", inspiring students to engage with issues in Agriculture and food production, from production to perception.

### DR. JIANPING WU

This year, Dr. Wu supervised 15 graduate students (4 PhD students and 1 MSc student successfully defended); students won 14 various awards/scholarships including 1 prestigious Alberta Innovates-Technology Futures and 1 Alberta Innovates-Health Services Doctoral Scholarships. Wu is very proud of his students for many achievements as a testimony of the excellence in academic, research and leadership of HQP trained at his laboratory. Along with his HQP, his lab published 20 peer-reviewed papers, and 13 conference presentations (8 invited).

#### Highlight: Forough Jahandideh's work on the potential of using egg white peptides against metabolic syndrome

Metabolic syndrome (MetS), a cluster of several abnormalities of hypertension, inflammation, glucose intolerance and dyslipidemia, enhances a person's risk for cardiovascular disease and type 2 diabetes. The number of people with MetS is increasing largely worldwide. The multi-faceted nature of MetS makes patients take several medications to target different aspects of this disease. In addition to significant side effects associated with synthetic drugs and possible dugs interactions, adherence to life-long therapies is usually poor. Therefore, there is increasing interest in developing functional foods or natural health products as an alternative for the prevention and management of the complications of this disease. Bioactive peptides may potentially alleviate several complications of MetS namely hypertension and insulin resistance, the key features of the disease. Several peptides with antioxidant and antihypertensive activity were previously identified from egg white protein hydrolysate (EWH). The main purpose of the current research was to investigate the potential of egg white hydrolysate (a mixture of peptides) on hypertension, inflammation, glucose intolerance, and insulin resistance.

Using spontaneously hypertensive rats (SHRs), oral administration of EWH at a dose of 1000 mg/kg body weight over a period of 12 days showed a significant blood pressure reduction compared to the untreated controls. BP reduction was associated with enhanced ex vivo vasodilation, reduced oxidative/nitrosative stress, reduced angiotensin converting enzyme and angiotensin II type 1 receptor expression, while enhanced angiotensin II type 2 receptor expression.

Egg white ovotransferrin derived bioactive peptides have shown beneficial effects against hypertension, oxidative stress and inflammation in vitro and in vivo. Given the interplay among hypertension, inflammation, oxidative stress and metabolic syndrome, the effects of EWH on differentiation, insulin signaling and inflammatory responses in 3T3-F442A pre-adipocytes were studied. Our study suggested that EWH could promote adipocyte differentiation as shown by increased lipid accumulation, increased release of adiponectin and upregulation of peroxisome proliferator associated receptor gamma (PPAR $\gamma$ ) and CCAAT/ enhancer binding protein alpha (C/EBP- $\alpha$ ). In addition to enhanced insulin effects on the upregulation of protein kinase B/Akt phosphorylation, EWH treatment increased extracellular signal regulated kinase 1/2 (ERK1/2) phosphorylation to a level similar to that of insulin, indicating insulin sensitizing and mimetic properties.

Given the critical role of adipose in the pathogenesis of insulin resistance and MetS, EWH may have potential applications in the prevention and management of MetS and its complications. Next, we evaluated the effectiveness of EWH on glucose and insulin tolerance in diet-induced insulin resistant rats. Supplementing a high-fat diet (HFD) with 4% EWH (equivalent to 1.2 g/Kg BW) improved glucose tolerance, muscle and adipose tissue insulin sensitivity, and inflammatory profile in insulin resistant rats.

The study confirmed the effectiveness of EWH on several complications of MetS, including hypertension, inflammation, oxidative stress, glucose tolerance and insulin resistance in vitro and in vivo. Findings illustrate the potential of egg protein-derived peptides to prevent and manage MetS complications.

### DR. MARTIN ZUIDHOF

Dr. Zuidhof was on sabbatical from July 1, 2017 to June 30, 2018, providing an opportunity to explore new collaborations, and to develop and acquire new skills. He visited researchers at their institutions and scientific and industry meetings in Canada, the EU, Australia, and New Zealand. Recent precision feeding projects have highlighted emerging issues related to very lean broiler breeders, and many of his discussions with producers and breeding companies centered on developing a systematic way to evaluate the impact of diet formulation and feeding programs to optimize broiler breeder pullet and hen management.

Once per year, the Faculty of ALES chooses one outstanding faculty member to receive the Faculty teaching award, recognizing commitment to excellence and leadership in undergraduate teaching. Dr. Zuidhof was honored to be selected for this award in 2017. He is looking to returning to teaching, inspired by comments like these:

#### Thank you for going out of your way to ensure that we get a fantastic education at U of A!

Dr. Zuidhof believes that training the next generation of leaders is all about respecting their contributions, yet pushing them to achieve a high level of technical excellence and practical relevance, while as much possible, also encouraging their work-life balance. He is proud of, inspired by, and challenged by his graduate students. This year they received 11 awards, including Sasha van der Klein's prestigious Vanier Scholarship: a testament to her excellence, and recognition of the innovation and value of her research at the PRC.

# The PRC Advisory Board and Committees

# ADVISORY BOARD

Board Member	Organization	Position (end of term)		
Jenna Griffin	Egg Farmers of Alberta*	Chair (2019)		
Cora Scheele	Alberta Hatching Egg Producers*	Vice Chair (2019)		
Martin Zuidhof	University of Alberta	Academic Leader (sabbatical)		
Doug Korver	University of Alberta	Acting Academic Leader Education Liaison (2018)		
Valerie Carney	Alberta Agriculture and Forestry	Tech Transfer Liaison (2018)		
Alysson Blaine for Susan Novak	Alberta Agriculture and Forestry			
Cara Prout	Alberta Turkey Producers*			
Marcy O'Neill	Peavey Industries*			
Helen Anne Hudson	Burnbrae Farms			
Karen Summerfield	Egg Farmers of Canada*			
Kathleen Long	Maple Leaf Foods*			
Martin van Diemen	Alberta Chicken Producers*			
Ruurd Zijlstra	University of Alberta*			
Sunny Mak	Sofina Foods*			
Wes Johnson	Alberta Agriculture and Forestry*			
Rob Renema	Alberta Chicken Producers Ex officio committee member (2019)			
Frank Robinson	University of Alberta Ex officio committee membe (2019)			
Matt Oryschak	Alberta Agriculture and Forestry Ex officio committee member (2019)			
Agnes Kulinski		Ex officio committee member (2020)		

\*Representative of platform partner (contributing  $\geq$  \$15,000 to the PRC in the reporting year)

# COMMITTEES

Committee	Members	Purpose
Governance Committee	Martin Zuidhof Wes Johnson Karen Summerfield Alysson Blaine	Develop and recommend to the PRC Advisory Board for approval, governance-related policies
Education and Mentoring Committee	Doug Korver Kathleen Long Sunny Mak Frank Robinson	Facilitate learning opportunities and speak to student groups about poultry careers
Communication Committee	Valerie Carney Karen Summerfield Rob Renema	Promote the PRC, share news, build awareness and connections
Heritage Chicken Program Steering Committee	Jenna Griffin Valerie Carney Helen Anne Hudson Agnes Kulinski	Ensure that poultry genetic preservation continues at the PRC in a manner consistent with the needs of PRC stakeholders Guide and support a sustainable business plan for the heritage chickens at the PRC
Facilities Committee	Doug Korver Matt Oryschak	<u> </u>
Funding and Business Strategy Committee	Martin Zuidhof Ruurd Zijlstra Wes Johnson	

# Personnel - Poultry Unit (N = 14)

Staff member	Affiliation	Role
Lyle Bouvier*	AFNS	Poultry Unit Manager
Kerry Nadeau	AFNS	Poultry Unit Manager
Agnes Kulinski*	AFNS	Business Development
Giles Hinse	AFNS	Animal Technician
Shawn Rankin	AFNS	Animal Technician
Rachelle Davidson*	AFNS	Animal Technician
William Carney	AFNS	Animal Technician
Chris Ouellette	AFNS	Instrumentation Technician
Jesse Hunter*	AFNS	Heritage Chicken Program Coordinator
Dawn Hage	AFNS	Heritage Chicken Program Coordinator
Amber Dobson	Student	Summer/weekend Animal Technician
Kevin Andrusky*	Student	Intern
Aliya Lakha*	Student	Intern
Maureen Neitsch*	Student	Intern

\*retired, resigned, or position ended in the current reporting year

# Senior Scientists (N = 11)

Name	Position (% FTE, if less than 100%)	Specialty	Number hosted <sup>1</sup> or supervised		Technician	Research Associate	PDF <sup>2</sup>	
			Grad	U/G <sup>3</sup>	Visiting			
Eduardo Beltranena	Research Scientist Adjunct Professor (33%)	Monogastric feeds & feeding	-	-	-	1	2	1
Clover Bench	Assistant Professor	Behaviour & welfare	-	1	-	1	-	-
Mirko Betti	Associate Professor	Chemistry/ Muscle food biochemistry	5	-	1	1	1	3
Valerie Carney	Research & extension specialist Adjunct Professor	Applied poultry research	-	-	-	-	1	-
Ellen Goddard	Professor	Marketing & business	*	*	*	*	*	*
Doug Korver	Professor	Poultry nutrition	5.5	-	1	3	-	-
Lynn McMullen	Professor (10%)	Food microbiology	2	-	-	1	-	1
Frank Robinson	Professor	Poultry reproductive physiology	-	-	-	-	-	-
Aman Ullah	Assistant Professor	Poultry by-products	10	-	3	3	1	1
Jianping Wu	Associate Professor	High value egg utilization	14.5	-	-	2	1	7
Martin Zuidhof	Associate Professor	Systems modeling & Precision feeding	4	1	2	2	-	-
			41	2	7	14	6	13

<sup>1</sup>Co-supervision indicated as 0.5. Some co-supervisors are not PRC researchers, thus the total varies from the total number of students listed below.

<sup>2</sup>Post-doctoral fellow

<sup>3</sup>Undergraduate

\*not reported

# Graduate Students (N = 44)

\*Successful program completion in current reporting year

Student	Team	Degree	Focus
Ali Akbari*	Wu	PhD	Canola proteins and potential applications for delivery of bioactive compounds
Misaki Cho*	Korver	PhD	breeder nutrition
Felipe Silva*	Korver	MSc	25-OH vitamin D3 in layer diets
Nandika Bandara*	Wu	PhD	Value addition to agricultural byproducts and waste proteins through biomimetics and nanotechnology
Yussef Esparza*	Wu	PhD	Feather keratin biomaterials
Forough Jahandideh*	Wu	MSc	Beneficial effects of egg white peptides on metabolic syndrome
Xiaohong Sun*	Wu	PhD	Ovomucin as value added ingredient or antiadhesive agent
Mengmeng Feng	Betti	PhD	Chemical glyation of collagen peptides
Minhui Lu	Betti	MSc	Food grade isolation of the glycopmacropeptide from cheese-whey
Dhungel Prinjiya	Betti	MSc	Nonenzymatic browning reaction of aminosugars
Yang Tianzhi	Betti	MSc	Allergen free meat products
Henan Wang	Betti	PhD	Glycosaminoglycans and "the Meat Factor"
Abiodun Bello	Korver	PhD	phytase in layer and broiler diets
Koonphol Pongmanee	Korver	PhD	phytase in layer diets
Oscar (Mauricio) Sanabria	Korver	MSc	replacements for antibiotic growth promotors
Yi (Edward) Fan	Korver/Willing	PhD	barn sanitation and gut microflora
Danielle Robocon	McMullen	PhD	
Devon Willis	McMullen	MSc	Response of Listeria to stress
R Ahmadi	Ullah	MSc	
L Jin	Ullah	MSc	
Manpreet Kaur	Ullah	MSc	
R Kaur	Ullah	MSc	
Rehan Pradhan	Ullah	PhD	Biomaterials
Yanet Rodriguez Herrero	Ullah	MSC	
M Safder	Ullah	PhD	
Wujun Zhao	Ullah	PhD	
M Zubair	Ullah	MSc	

# THE POULTRY RESEARCH CENTRE

# 2018 ANNUAL REPORT

Student	Team	Degree	Focus
Jorge Grock Pereira	Ullah/Siddique	MSc	
Irum Zahra	Ullah/Siddique	PhD	Biomaterials
Harshita Arora	Wu	MSc	Bioactivity of egg components
Hongbing Fan	Wu	PhD	Antihypertensive peptides from spent hen muscle protein
Xu Jiang	Wu	PhD	Taste and activity of bioactive peptides
Qiyi Li	Wu	MSc	Production optimization and sensory evaluation of egg white protein hydrolysate with ACE inhibitory activity
Jiandong Ren	Wu	PhD	The beneficial effects of egg yolk phosvitin on bone health and dental health
Nan Shang	Wu	PhD	Egg protein and bone health
Selene Gonzalez Toledo	Wu	PhD	Value added egg yolk products
Liao Wang	Wu	PhD	Mechanisms of food protein derived antihypertensive peptides
Stepheny Zani	Wu/Chan	MSc	Egg peptides on metabolism syndrome
Khushwant Singh Bhullar	Wu/Hubbard	PhD	Mechansism of bioactive peptides
Sule Keskin Ulug	Wu/Temelli	MSc	Extraction of egg yolk components
Mohammad Afrouziyeh	Zuidhof	PhD	Precision feeding of layers
Sheila Hadinia	Zuidhof	PhD	Precision feeding & energy partitioning
Katelyn Humphreys	Zuidhof	MSc	Transgenerational effects of nutrition on broiler metabolism
Sasha van der Klein	Zuidhof	PhD	Precision feeding & epigenetics

# Visiting Students and Scholars (N = 7)

Visitor	Туре	Team	Program
Niteesha Divulapally	Student	Ullah	Visiting Research Student
Irshad Humna	Student	Ullah	Visiting
Shahi Noureen	Student	Ullah	Visiting PhD
Mehdi Heidari	Student	Zuidhof	Visiting PhD
Rene Kwakkel	Scholar	AFNS	Adjunct Professor
Yangying Sun	Scholar	Betti	Visiting PDF
Ananya Aiaowanit	Student	Korver	Visiting graduate student

# Summer Students (N = 2)

Visitor	Team	Program
Jo Ann Chew	Zuidhof	Summer Research Student
Sarah Nowicki	Bench	NSERC-USRA

# Technical Support (N = 33)

### ASSITANTS AND TECHNICIANS

Name	Role	Team
Daniela Batres	Research Technician	Beltranena
Emmanuel Opoku Yeboah	Research Technician	Bench
Takuo Nakano	Research Technician	Betti
Kerry Nadeau	Research Technician	Korver
Ana Ruiz Sanchez	Research Technician	Korver
Kim Thorsteinson	Research Technician	Korver
Patrick Ward	Research Technician	McMullen
Lynnette Allemand	Research Assistant	Ullah
Shokoofeh Marasi	Research Assistant	Ullah
Faria Shakoor	Research Technician	Ullah
Marina Offengenden	Research Technician	Wu
Sareh Panahi	Research Technician	Wu
Kathleen Lovely	Research Technician	Zuidhof
Thania Moraes	Research Technician	Zuidhof

# **RESEARCH ASSOCIATES**

Name	Team
Emmanuel Opoku Yeboah	Beltranena
Matt Oryschak	Beltranena
Maurice Ndagijimana	Betti
Brenda Reimer	Carney
Mark Khosa	Ullah
Jiapei Wang	Wu

# POST DOCTORAL FELLOWS

Name	Team	Focus
Misaki Cho	Beltranena	Carbon foot print of broiler production
Abhihek Bhattacharjee	Betti	Cell culture and Maillard reaction
Yuliya Hrynets	Betti	Maillard Reaction
Yangying Sun	Betti	Antifreeze properties of collagen peptides in meat products
Januana Teixeira	McMullen	Food microbiology
Punita Upadyay	Ullah	Biomaterials
Ali Akbari	Wu	Canola protein encapsulation
Nandika Bandara	Wu	Egg yolk emulsification
Hui Hong	Wu	Protein assembly
Chalamaiah Meram	Wu	Novel applications for egg yolk in food and non-food uses
Myoungjin Son	Wu	Beneficial effects of egg white protein peptides on insulin resistance and type 2 diabetes
Yu Wenlin	Wu	Structure and activity of bioactive peptides
Qingbiao Xu	Wu	Bioactive peptide absorption and screen bitter acceptors antagonist

# Ongoing Research Projects (\$2,507,770 project funding received in 2017)

BACTERIOLOGY & FOOD SAFETY					
Granting Body	Title	Received in 2017	Applicant	Planned Duration	Total grant
AAF	Hatching Egg Shell Quality	\$0	D. Korver; J. Hamidu; T. Inglis	2016-2018	\$206,340
ACP	Hatching Egg Shell Quality	\$0	D. Korver; J. Hamidu; T. Inglis	2016-2018	\$18,500
AAF	Poultry Microbiome	\$0	D. Korver; D. Guttman; J. Brummel; J. Parkinson; S. Sharif	2016-2018	\$240,000

BEHAVIOUR & WELFARE					
Granting Body	Title	Received in 2017	Applicant	Planned Duration	Total grant
SRDP	Kinematic gait analysis	\$124,677	C. Bench; G. Plastow	03/2017 - 08/2019	\$138,530

FEED & NUTRITION					\$379,531
Granting Body	Title	Received in 2017	Applicant	Planned Duration	Total grant
ALMA, EFA, EFC, Shac, Cdn Bio-Systems	Ammonia Emissions	\$172,743	E. Beltranena	2016-2019	\$394,900
GF2	Carbon footprint	\$201,288	M. Oryschak	2016-2017	\$399,341
Danisco UK	Phytase use in laying hen diets	\$5,500	D. Korver	2016-2017	\$63,040

# THE POULTRY RESEARCH CENTRE

# 2018 ANNUAL REPORT

# BYPRODUCT UTILIZATION

# \$1,085,344

Granting Body	Title	Received in 2017	Applicant	Planned Duration	Total grant
AAF	A Novel Integrated Approach for Water Treatment	\$36,800	Ullah, Symladevi, Jeon	2017-2020	\$130,400
EFC; NSERC	Bioactive peptides from spent hens	\$128,761	Wu, J.	09/01/2015- 08/31/2019	\$502,959
AAFC	biomaterials	\$139,000	Ullah, Symladevi	05/01/2017- 04/30/2021	\$139,000
FES	Biomaterials for waste water treatment	\$80,000	Ullah, Siddique	06/01/2017- 05/01/2018	\$180,000
IC-IMPACTS	Biopolymer water treatment	\$25,000	Ullah, Song	2017-2018	\$25,000
NSERC - CRD	Biopolymer-based Nanocomposites	\$10,000	Ullah, Wu, Temelli, Siddique	2014-2017	\$72,015
ACPC	Biopolymer-based Nanocomposites	\$130,000	Ullah	08/01/2017- 07/30/2021	\$130,000
Alberta Funding Consortium	Cruciferin/chitosan complex: a novel colon-targeted delivery system for probiotics	\$85,533	Wu, J., (PI), Ganzle, M.,; Temelli, F.	04/01/2016- 03/31/2018	\$171,066
ALMA	Identification and functional characterization of novel bitter taste blockers	\$27,000	Chelikani, P. (PI, UofM), Aluko, R. (UofM); Wu, J.	01/13/2015- 07/12/2017	\$164,000
AI-Bio	Monomers and biopolymers	\$30,150	Ullah, Elias, Zeng	2014-2017	\$194,400
NSERC; Innotech	Nano-catalysis	\$50,000	Ullah	2017-2018	\$50,000
NSERC DG	Nanomodifications	\$21,000	Ullah	2014-2019	\$105,000
ACPC	New biomaterials	\$39,300	Ullah, Qureshi	2017-2020	\$130,900
AI-Bio	Rapid Conversion Technology	\$213,850	Ullah	2016-2018	\$293,580
Future Energy Systems	Resilient Land and Water Systems	\$68,950	Naeth (PI) + 8 others	2017-2023	\$7,000,000

GENOMICS					\$2,550
Granting Body	Title	Received in 2017	Applicant	Planned Duration	Total grant
ALMA	FPD Genomics	\$2,550	C. Bench; G. Plastow	10/2016 - 9/2017	\$25,550

LEARNING & TEACHING					
Granting Body	Title	Received in 2017	Applicant	Planned Duration	Total grant
AAF	PRC Technology Transfer	\$50,000	V. Carney; R. Renema	2016-2018	\$128,581

# MANAGEMENT & PHYSIOLOGY

# \$31,000

Granting Body	Title	Received in 2017	Applicant	Planned Duration	Total grant
AAF	Barn sanitation	\$0	D. Korver; L. McMullen; M. Zuidhof; T. Inglis; B. Willing	2016-2019	\$267,670
CPRC	Barn sanitation	\$0	D. Korver; L. McMullen; M. Zuidhof; T. Inglis; B. Willing	2016-2019	\$40,000
АСР	Barn sanitation	\$6,000	D. Korver; L. McMullen; M. Zuidhof; T. Inglis; B. Willing	2016-2019	\$36,000
NSERC	Bone metabolism & Inflammation in Fowl	\$25,000	D. Korver	2013-2018	\$125,000

# MEAT AND EGG PRODUCTS & PROCESSES

# \$1,256,768

Granting Body	Title	Received in 2017	Applicant	Planned Duration	Total grant
AAF; Pulse growers	Allergen free meats	\$72,375	Petrasik; Betti	04/01/2016- 31/12/2018	\$144,750
AAF; AB Innovates	Aminosugars in meat application	\$83,666	Betti, Pietrasik, Gaenzle	05/01/2015- 30/11/2018	\$251,000
EFC	Antihypertensive activity of cooked egg yolk digest	\$64,888	Wu, J.	02/01/2017- 01/31/2018	\$129,776
NSERC DG	Antioxidant peptides in inflammatory and endothelial function	\$40,000	Wu, J.	04/01/2013- 03/31/2018	\$200,000
Alberta Economic Development and Trade Grant	Egg yolk for improved yolk stability in food applications	\$269,000	Wu, J.,	03/01/2016- 01/31/2018	\$269,000
NSERC CRD	Fractionation of valuable egg yolk components for niche market application	\$74,725	Wu, J., Chan, C., Temelli, F.	08/01/2016- 07/31/2019	\$384,560
ALMA; EFC	Fractionation of valuable egg yolk components for niche market application	\$152,514	Wu, J., Temelli, F	06/01/2015- 05/31/2017	\$246,514
AAF; AB Innovates	Functional modification of gelatin	\$77,500	Betti; Pietrasik	05/01/2014 - 05/01/2018	\$310,000
ALMA	Ovotransferrin peptides against metabolic syndrome	\$-	Wu, J., Davidge, S., Proctor, S.; Chan, C.	09/01/2015- 08/31/2018	\$128,000
EFC; EFA	Ovotransferrin peptides against metabolic syndrome	\$163,785	Wu, J., Davidge, S., Proctor, S.; Chan, C.	01/01/2016- 12/31/2018	\$256,000
NSERC CRD; Michael Foods Ltd.	Phosvitin phosphopeptides and residual egg yolk applications	\$172,315	Wu, J.; Temell, F.	01/01/2015- 12/31/2018	\$659,884

# THE POULTRY RESEARCH CENTRE

# 2018 ANNUAL REPORT

CPRC; Mitacs	Scale-up processing adhesive from spent hens	\$60,000	Wu, J., Zeng, H.,; Chen, S	09/01/2015- 08/31/2017	\$120,000
NSERC	Understanding the meat factor	\$26,000	Betti	04/01/2014- 04/01/2019	\$130,000

# POULTRY SYSTEMS

# \$

Granting Body	Title	Received in 2017	Applicant	Planned Duration	Total grant
CHEP	Lifetime productivity breeders	\$2,500	M. Zuidhof	03/01/2016-02/28/2018	\$5,000
CPRC	Lifetime productivity breeders	\$4,000	M. Zuidhof	03/01/2016-02/28/2018	\$20,000
Cargill	PF Epigenetics	\$20,000	M. Zuidhof	04/01/2016-03/31/2021	\$10,000
EFC & EFA	PF Layers	\$6,150	M. Zuidhof	12/01/2015-11/30/2018	\$75,000
AAF	PF Training phase	\$127,200	M. Zuidhof	03/01/2017-02/28/2019	\$127,200

# Facility Usage

# **RESEARCH FACILITIES**

Facility	Overall	Broiler &	Breeder	Laver	Unit
		Turkey	Trials	Trials	Operations
		Trials			
		U	tilization Rate	(%)	
Brooder house	77.1	18.6	0	6.4	52.1
48 floor pens					
Breeder hen cages	30		30		
288 individual cages					
Breeder male cages	40			40	
60 individual cages					
Nutrition house	65	55	10		
32 pens					
Specht pullet cages	37.8	12.6		25.2	
64 group cages					
Environmental chambers	80		15.3	64.7	
Test House Heritage breeds	100				100
Floor pens					
Test House	100				100
Conventional cages					
Test House	100				100
Colony cages					
Broiler Processing Plant	5				
(3 days per use)					
Hatchery					
Setter use AVN	17				
Hatcher use AVN	17				
Setter use BIG J	10	5			5
Hatcher use BIG J	10	5			5

# NON-RESEARCH FACILITIES

Facility	Description	Utilization
Lilydale Room	Combined producer meetings	0
	Processors	1 day
	PRC alumni, exec group & educational institutions	18 days
	U of A, safety, animal care, animal handling, HACCP	20 days
	Industry related workshops (swine, dairy, AAF, etc.)	2 days
	Student presentations & community learning	7 days
	Community rental (weight watchers)	50 days
Alberta Turkey Producers	Used by graduate students, undergraduate students,	10 person∙h/d
Computer Lab	technicians and researchers	

### THE POULTRY RESEARCH CENTRE

# Evidence of Productivity (2017)

### ARTICLES PUBLISHED IN REFEREED JOURNALS (N = 51)

- 1. Ahmadi, R.; Ullah, A., RSC Adv., 2017, 7, 27946–27959. (IF = 3.108)
- 2. Akabari A, and Wu J. 2017. Ovomucin nanoparticles: promising carriers for mucosal delivery of drugs and bioactive compounds. Drug Delivery and Translational Research 7(4):598-607.
- 3. Akbari A, Lavasanifar A, and Wu J. 2017. Interaction of cruciferin-based nanoparticles with Caco-2 cells and Caco-2 /HT29-MTX co-cultures. Acta Biomaterialia 64: 249-258
- 4. Arshad, M.; Pradhan, RA.; Ullah, A, Mater. Sci. Eng. C., 2017, 76: 217-223. (IF = 4.164)
- Asomaning, J., Zhao, Y., Lewis, E. D., Wu, J., Jacobs, R. J., Field, C. J. and Curtis, J. M. 2017. The development of a choline rich cereal based functional food: Effect of processing and storage. LWT – Food Science and Technology, 447-452.
- 6. Bandara N, Esparza Y, and Wu J. 2017. Exfoliating nanomaterials in canola protein derived adhesive improves strength and water resistance. RSC Advances. 7: 6743-6752.
- 7. Bandara N, Esparza Y, and Wu J. 2017. Graphite oxide improves adhesion and water resistance of canola protein–graphite oxide hybrid adhesive. Scientific Reports 7(1):11538. doi: 10.1038/s41598-017-11966-8.
- 8. Bench, C. J., M.A. Oryschak D.R. Korver, and E. Beltranena. 2017. Behaviour, growth performance, foot pad quality, bone density and carcass traits of broiler chickens reared with barrier perches and fed different dietary crude protein levels. Can. J. Anim. Sci. 97:268–280.
- 9. Bench, C.J., Oryschak, M.A., Korver, D.R., and Beltranena, E. 2017. The effect of perch design and dietary crude protein on performance, carcass attributes, broiler behavior, litter moisture, foot pad quality, and femur strength. Canadian Journal of Animal Science. 97: 268-280. Doi: 10.1139/CJAS-2015-0202.
- 10. Bhattacherjee A., Y. Hrynets and M. Betti. 2017. Transport of the glucosamine-derived browning product fructosazine (polyhydroxyalkylpyrazine) across the human intestinal Caco-2 cell monolayer: role of the hexose transporters. Journal of Agricultural and Food Chemistry 65(23):4642-4650.
- 11. Casey-Trott, T., D. Korver, M. Guerin, V. Sandilands, S. Torrey and T. Widowski. 2017. Opportunities for exercise during pullet rearing Part II: Long-term effects on bone characteristics of adult laying hens at the end-of-lay. Poult. Sci. 96: 2518–2527.
- 12. Casey-Trott, T., D. Korver, M. Guerin, V. Sandilands, S. Torrey, and T. Widowski. 2017. Opportunities for exercise during pullet rearing Part I: Effect on the musculoskeletal characteristics of pullets. Poult. Sci. 96: 2509–2517.
- Chakrabarti, S., Wang, L., Davidge, S. T. & Wu, J. 2017. Milk-derived Tripeptides IPP (Ile-Pro-Pro) and VPP (Val-Pro-Pro) differentially modulate angiotensin II effects on vascular smooth muscle cells. Journal of Functional Foods. 30: 151-158.
- 14. Esparza Y, Ullah A, and Wu J. 2017. Molecular mechanism and characterization of self-assembly of feather keratin gelation. International Journal Biological Macromolecules doi: 10.1016/j.ijbiomac.2017.08.168.
- Esparza Y, Ullah A, and Wu J. 2017. Preparation and characterization of graphite oxide nano-reinforced biocomposites from chicken feather keratin. Journal of Chemical Technology & Biotechnology. 92(8): 2023-2031.
- 16. Esparza Y, Ullah A, Boluk Y, and Wu J. 2017. Preparation and characterization of thermally crosslinked poly(vinyl alcohol)/feather keratin nanofiber scaffolds. Materials and Design 133: 1-9
- 17. Esparza, Y.; Ullah, A.; Bolak, Y.,Wu, J., Materials & Design, 2017, 133: 1-9 (IF = 4.364)
- 18. Esparza, Y.; Ullah, A.; Wu, J., J. Chem. Technol. Biotechnol. 2017, 92: 2023-2031. (IF = 3.135)
- 19. Feng M., and M. Betti. 2017. Both PepT1 and GLUT intestinal transporters are utilized by a novel glycopeptide Pro-Hyp-CONH-GlcN. Journal of Agricultural and Food Chemistry 65 (16):3295-3304.

- 20. Feng M., and M. Betti. 2017. Transepithelial transport efficiency of bovine collagen hydrolysates in a human Caco-2 cell line model. Food Chemistry 224:242-250.
- Girard, T.E., Zuidhof, M.J., and Bench, C.J. 2017. Aggression and social rank fluctuations in precision-fed and skip-a-day broiler breeder pullets. Applied Animal Behaviour Science. 187: 38-44. Doi: 10.1016/j.applanim.2016.12.005.
- Girard, T.E., Zuidhof, M.J., and Bench, C.J. 2017. Feeding, foraging, and feather pecking behaviours in precisionfed and skip-a-day broiler breeder pullets. Applied Animal Behaviour Science. 188: 42-49. Doi: 20.1016/j.applanim.2016.12.011.
- 23. Guesgen, M.J. and Bench, C.J. 2017. Application of kinematic techniques for welfare assessment in livestock: A Review. Animal Welfare. 26: 383-397. Doi: 10.7120/09627286.26.4.383
- 24. Hrynets Y., D. J. H. Martinez, M. Ndagijimana and M. Betti. 2017. Inhibitory activity of a Concanavalin-isolated fraction from a glucosamine-peptides reaction system against heat resistant E. coli. Heliyon 3: e00348.
- 25. Hui H, Akabari A, and Wu J. 2017. Small amphipathic peptides are responsible for the assembly of cruciferin nanoparticles. Scientific Report. 10.1038/s41598-017-07908-z
- 26. Hui H, Shreyak C, Meram C, Bimol R, Heather B, and Wu J. 2017. Removing cross-linked Telopeptides enhances the production of low-molecular-weight collagen peptides from spent hens. Journal of Agricultural and Food Chemistry. 65(34): 7491-7499.
- 27. Hunter, J.M., Korver, D.R., Anders, S. Crowe, T., and Bench, C.J. 2017. Practical assessment and management of foot pad dermatitis in broiler chickens. J. Appl. Poult. Res. 26(4): 593-604. Doi: 10.3382/japr/pfx019.
- 28. Jahandideh F, Chakrabarti S, Davidge S, and Wu J. 2017. Egg white hydrolysate shows insulin-mimetic and sensitizing effects in 3T3-F442A pre-adipocytes. Plos One https://doi.org/10.1371/journal.pone.0185653
- 29. Jin, L.; Geng, K.; Arshad, M.; Ahmadi, R.; Ullah, A. ACS Sustainable Chemistry & Engineering, 2017, 5, 9793– 9801. (Impact Factor = 5.951)
- 30. Jin, L.; Zeng, H.; Ullah, Polymer Chemistry, 2017, 8, 6431-6442. (IF = 5.375)
- Johnson-Dahl, M., M. J. Zuidhof, and D. R. Korver. 2017. The effect of maternal canthaxanthin supplementation and hen age on indices of chick early innate immune function. Poultry Science 96:634-646. doi 10.3382/ps/pew293
- 32. Kaur, M.; Arshad, M.; Ullah, A., ACS Sustainable Chemistry & Engineering, 2018, 5, 6 (2), 1977–19 (IF = 5.951)
- 33. Lin Q, Xu Q, Bai, J., Wu, W. and Wu, J. 2017. Transport of soybean protein antihypertensive peptide LSW across Caco-2 monolayers. Journal of Functional Foods 39: 96-102.
- 34. Lu X., Y. Hrynets, and M. Betti. 2017. Transglutaminase-catalyzed amination of pea protein peptides using the biogenic amines histamine and tyramine. Journal of the Science of Food and Agriculture 97:2436–2442.
- 35. Lu X., Y. Hrynets, Z. Pietrasik and M. Betti. 2017. Incorporating tyramine with transglutaminase weakens gelatin gels A rheological investigation. LWT Food Science and Technology 82:96-103.
- Meram C, and Wu J. 2017. Anti-inflammatory effects of egg yolk water soluble protein (livetins) and its enzymatic hydrolysates in lipopolysaccharide-induced RAW 264.7 macropages. Food Research International 100(1): 449-459.
- 37. Meram C, Esparza Y, Temelli F, and Wu J. 2017. Physicochemical and functional properties of livetin (IgY) fraction from hen egg yolk. Food Bioscience. 18: 38-45.
- 38. Nakano, T., Ozimek, L., and M. Betti. 2018. Separation of bovine k-casein glycomacropeptide from sweet whey products with undetectable level of phenylalanine by protein precipitation and by anion exchange chromatography. Journal of Dairy Research.
- 39. Roy B.C., D.A. Omana, M. Betti and H.L. Bruce. 2017. Extraction and characterization of gelatin from bovine lung. Food Science and Technology Research. 23 (2): 255-266.

- 40. Roy, B.C., C. Das, H. Hong, M. Betti and H.L. Bruce. 2017. Extraction and characterization of gelatin from bovine heart. Food Bioscience 20:116-124.
- 41. Shahi, MN.; Arshad, M.; Ullah, A., Materials, 2017, 10: 315. (IF = 2.654)
- 42. Shoaib, M.; Saeed, A.; Akhtar, J.; Rahman, M.; Ullah, A.; Jurkschat, K.; Naseer, M., Mater. Sci. Eng. C., 2017, 75: 836-844 [IF = 4.164]
- 43. Sun X. and Wu J. 2017. Food derived anti-adhesive components against bacterial adhesion: current progresses and future perspectives. Trends in Food Science & Technology 69(A): 148-156.
- 44. Sun, X., Gänzle, M., Wu, J. 2017. Identification and characterization of glycopeptides from egg protein ovomucin with anti-agglutinating activity against porcine K88 Enterotoxigenic Escherichia coli strains. Journal of Agricultural and Food Chemistry 2017, 65 (4), 777–783.
- 45. Ullah, A.; Arshad, M., ChemSusChem, 2017, 10, 2167-2174. (IF = 7.226)
- 46. van der Klein, S.A.S., F. Silva, R. P. Kwakkel, and M. J. Zuidhof. 2017. The effect of quantitative feed restriction on allometric growth in broilers. Poult. Sci. 96:118-126 doi: 10.3382/ps/pew187
- 47. Wang H., and M. Betti. 2017. Sulfated glycosaminoglycan-derived oligosaccharides produced from chicken connective tissue promote iron uptake in a human intestinal Caco-2 cell line. Food Chemistry. 220, 460-469.
- 48. Wu J, Liao W, and Udenigwe C. 2017. Revisiting the mechanisms of ACE inhibitory peptides from food proteins. Trends in Food Science and Technology 69(B): 214-219.
- 49. Xu Q, Fan H, Yu W, and Wu J. 2017. Transport study of egg derived antihypertensive peptides (LKP and IQW) using Caco-2 and HT29 cocultured monolayers. Journal of Agricultural and Food Chemistry. 2017, 65(34): 7406-7414.
- 50. Yi J, Zhao J, and Wu, J. 2017. Egg ovotransferrin derived IRW exerts protective effect against H<sub>2</sub>O<sub>2</sub>-induced oxidative stress in Caco-2 cells. Journal of Functional Foods 39: 160-167.
- 51. Zuidhof, M. J., M. V. Fedorak, C. A. Ouellette, and I. I. Wenger. 2017. Precision feeding: Innovative management of broiler breeder feed intake and flock uniformity. Poult. Sci. 96:1-10. doi https://doi.org/10.3382/ps/pex013

### SCIENTIFIC AND INDUSTRY PRESENTATIONS WITH PROCEEDINGS (N = 2)

- 1. Betti M. 2017. Isolation, bioactivity and applications of sulfated polysaccharides from poultry by-products. Midwest Poultry Federation Convention. March 14-16, Minneapolis, MN, USA. (Invited)
- 2. Poultry Research Centre Afternoon of Learning and Sharing Proceedings. Edmonton. May 2017. Carney, V. L., editor.

### SCIENTIFIC AND INDUSTRY PRESENTATIONS WITHOUT PROCEEDINGS (N = 37)

- 1. Betti M. 2017. Isolation, bioactivity and applications of sulfated polysaccharides from poultry by-products. Midwest Poultry Federation Convention. March 14-16, Minneapolis, MN, USA. (Invited)
- 2. Betti M., and Y. Hrynets. 2017. Functionalization of food proteins and peptides via transglutaminase (TGase) catalysis: effects on bioactivity, functionality and safety. 253rd American Chemical Society National Meeting and Exposition. April 2-6, San Francisco, USA. (Invited)
- 3. Gonzalez, S.Y., Wu, J. Omega-3 polyunsaturated fatty acids encapsulation using phospholipase A1 treated egg yolk. 2017 PRC Annual Meeting, May 1, 2017, Edmonton, Alberta.
- 4. Hong, H., Wu, J. Removing cross-linked telopeptides enhances the production of low-molecular-weight collagen peptides from spent hen. 2017 PRC Annual Meeting, May 1, 2017, Edmonton, Alberta.
- 5. Humphreys, K., van der Klein, S.A.S., and M. J. Zuidhof. 2017. Effects of broiler breeder management on offspring performance. Presentation to Cargill, Velddriel, NL. August 28, 2017.

- 6. Jahendideh, F., Wu, J. (2017). Egg white peptides alleviate metabolic syndrome complications. 2017 PRC Annual Meeting, May 1, 2017, Edmonton, Alberta.
- 7. Korver, D. 2017. 25-OH Vitamin D3 and Canthaxanthin in Broiler Breeder and Broiler Diets. Oral presentation given to a major broiler integrator (Avicola los Cambulos), Bogota, Colombia. 16-Nov-2017
- 8. Korver, D. R. 2017. Development of digestive tract: physiology and function, including immune development. Poultry Beyond 2023: 6th International Broiler. 18-Oct-2017
- 9. Korver, D. R. 2017. Feeding the hen for longer laying cycles Development of digestive tract: physiology and function, Layer Feed Quality Conference Bangkok, Thailand. 12-Sep-2017
- 10. Korver, D. R. 2017. Keynote presentation: Pullet nutrition setting the stage for success. Layer Feed Quality Conference Bangkok, Thailand. 11-Sep-2017
- 11. Korver, D. R. 2017. Pullet management and long cycle egg production. Science-Based Poultry Production. Edmonton, AB. 28-Aug-2017
- 12. Korver, D. R. 2017. The cost of immunity: opportunities for nutritionists and producers. Zinpro Pan-European Poultry Seminar, Warsaw, Poland. 22-Mar-2017
- 13. Korver, D. R. 2017. The cost of immunity: opportunities for nutritionists and producers. Zinpro Pan-European Poultry Seminar, Amsterdam, the Netherlands. 23-Mar-2017
- 14. Korver, D. R. 2017. The cost of immunity: opportunities for nutritionists and producers. Zinpro Pan-European Poultry Seminar, Barcelona, Spain. 24-Mar-2017
- 15. Meram, C., Wu, J. (2017). Pilot scale separation of egg yolk into plasma and granule. MFI on site visit. March 3, 2017
- 16. Oryschak, M. A., and E. Beltranena. 2018. Dietary approaches to reducing the carbon intensity of table egg production: A conservative approach. Western Poultry Conference, Red Deer, Alberta, Feb 26.
- 17. Oryschak, M. A., and E. Beltranena. 2018. Dietary approaches to reducing the carbon intensity of table egg production: A more aggressive approach. Western Poultry Conference, Red Deer, Alberta, Feb 26.
- 18. Ren, J., Wu, J. (2017). Phosphivtin extraction and cell study. MFI on site visit. March 3, 2017
- 19. Robinson, F. E. 2017. A Case for Agricultural Education in Alberta Schools. Ag-Education Workshop. Cochrane AB.
- 20. Robinson, F. E. 2017. An Introduction to Animal Agriculture. 15 Lectures to Edmonton Lifeline Learners Association (ELLA). University of Alberta. Edmonton AB.
- 21. Robinson, F. E. 2017. Chicken Anatomy and Where Eggs Come From. Oral Presentation. University of Alberta Heritage Poultry Workshop. Red Deer, AB.
- 22. Robinson, F. E. 2017. Chickens: Feeds and Feeding. Oral Presentation. University of Alberta Heritage Poultry Workshop. Red Deer, AB.
- 23. Robinson, F. E. 2017. Choosing a Breed. Oral Presentation. University of Alberta Heritage Poultry Workshop. Red Deer, AB.
- 24. Robinson, F. E. 2017. Housing Poultry for Small Flocks. Oral Presentation. University of Alberta Heritage Poultry Workshop. Red Deer, AB.
- 25. Robinson, F. E. 2017. Recruiting and Training People to Consider Careers with Poultry. Red Deer Poultry Conference. Red Deer AB.
- 26. Wang, J., Wu, J. (2017). Preparation of phosvitin-depleted egg yolk mayonnaise. MFI on site visit. March 3, 2017
- 27. Wu, J. Introduction of Canadian egg market and recent achievements of egg research. March 21, 2017, Kewpie, Tokyo, Japan.
- 28. Wu, J. Introduction of Canadian egg market and recent achievements of egg research. March 22, 2017, Pharma Foods International, Kyoto, Japan.

- 29. Zuidhof, M. J. 2017. New insights from Precision Feeding. PRC Symposium: Science Based Poultry Production. Edmonton, AB. August 28, 2017.
- Zuidhof, M. J. 2017. Precision broiler breeder nutrition: Implications for hens, chicks and managers. DSM Satellite Symposium, European Symposium on Poultry Nutrition (ESPN), Salou-Tarragona, Spain, May 8, 2017. 1 pp.
- 31. Zuidhof, M. J. 2017. Precision feeding of Poultry. Presentation to Alberta Agriculture and Forestry. Edmonton, AB. March 23, 2017.
- Zuidhof, M. J. and M. V. Fedorak. 2017. Precision broiler breeder feeding system: Taking the stress out of managing breeders. Presentation to Jansen Poultry Equipment technical team. Barneveld, NL. May 13-14, 2017.
- 33. Zuidhof, M. J. and M. V. Fedorak. 2017. Precision broiler breeder feeding system: Taking the stress out of managing breeders. Presentation at Wageningen University, Wageningen, NL. May 15, 2017.
- 34. Zuidhof, M. J. and M. V. Fedorak. 2017. Precision Feeding of Poultry. Presentation to VDL and EEDC. Leduc, AB. February 24, 2017.
- 35. Zuidhof, M. J. and M. V. Fedorak. 2017. Precision Feeding of Poultry. Presentation to Joe Jurgielewicz and Son Ltd. technical team. Video conference. March 30, 2017.
- 36. Zuidhof, M. J. Precision Feeding of Poultry. Presentation to Innovate UK. Edmonton, AB, March 23, 2017.
- 37. Zuidhof, M. J., V. L. Carney, B. L. Reimer, D. R. Korver, and F. E. Robinson. 2017. Fifty years of genetic change: A global perspective. Presentation to Genetic Preservation Summit, Edmonton, AB, May 24-25, 2017.
- 38. Zuidhof, M. J., V. L. Carney, B. L. Reimer, F. E. Robinson, and N. B. Anthony. 2017. Sixty years of genetic change: A preliminary perspective. Presentation to Genetic Preservation Summit, Edmonton, AB, May 24-25, 2017.

### CONFERENCE PRESENTATIONS (ORAL ABSTRACTS; N = 17)

- 1. Bello, A, Y. Dersjant-Li, and D. Korver. 2017. Phytase supplementation in Ca- and available P-deficient diets maintains laying hen productivity. Poult. Sci. 96(E-Suppl. 1):74.
- 2. Carney, V. L., B. L. Reimer, M. J. Zuidhof, D. R. Korver, F. E. Robinson, and N. B. Anthony. 2017. BW restriction in female broiler breeders from 1957 to 2015 to 19 weeks of age. Poultry Sci. 96(Suppl. 1):215.
- Hadinia, S. H., G. Y. Bédécarrats, P.R.O. Carneiro, and M. J. Zuidhof. 2017. The effect of post-photostimulation energy intake on GnRH and GnIH gene expression at the onset of lay in broiler breeder pullets. Poultry Sci. 96(Suppl. 1):186.
- Jahandideh, F., Chakrabarti, S., Davidge, S., <u>Wu, J. (2017).</u> Egg white hydrolysate shows insulin-mimetic and sensitizing effects in 3T3-F442A pre-adipocytes. The 10th International Conference and Exhibition on Functional Foods, Nutraceuticals and Dietary Supplements. October 22-25, 2017, Jeinbuk (Gunsan), Korea. (Invited)
- 5. Jahandideh, F., Wu, J. (2017). Egg White Hydrolysate improves metabolic syndrome beneficially affects hypertension, glucose homeostasis and insulin resistance. March 29, 2017, Cardiovascular Research Centre (CVRC), Faculty of Medicine & Dentistry, University of Alberta, Edmonton, Alberta.
- 6. Li, Jia, K. Pongmanee, K. Nadeau and D. Korver. 2017. Effect of laying hen strain on egg quality. August 23, 2017. University of Alberta, Edmonton, AB.
- 7. Reimer, B. L., V. L. Carney, M. J. Zuidhof, D. R. Korver, F. E. Robinson, and N. B. Anthony. 2017. Sexual maturation status at 21 weeks in 1957, 1978, 1997, and 2015 broiler breeder pullets. Poultry Sci. 96(Suppl. 1):214.
- 8. Robinson, F. E., M. J. Zuidhof and C. Varnhagen. 2017. What's Behind the Barn Doors? An Inquiry Project for Animal Science. NACTA Journal. 61: 10.

- Takeshima, K., M. J. Zuidhof, C. Hanlon, A. Rodriguez, and G. Y. Bédécarrats. 2017. Growth and reproductive performances of broiler breeder hens under different daytime and supplemental light spectrum. Poultry Sci. 96(Suppl. 1):32.
- 10. van der Klein, S.A.S., K. L. Lovely, C. A. Ouellette, G. Y. Bédécarrats, and M. J. Zuidhof. 2017. Broiler breeder laying signals: Body weight and rearing daylength. Poultry Sci. 96(Suppl. 1):30.
- 11. Wang, L., Wu, J. (2017). Modulatory effects of egg white ovotransferrin-derived tripeptide IRW (Ile-Arg-Trp) on vascular smooth muscle cells against angiotensin II stimulation. The 3<sup>rd</sup> International Symposium of Food Science and Human Wellness. Changchun, China, August 15-17, 2017. (Invited)
- 12. Wu, J. (2017). Bioactive peptides for human health: opportunities and challenges. 2017 International Symposium on Bioactive Peptides. May 26-27, 2017, Hangzhou, China (Invited keynote).
- Wu, J. (2017). Egg white protein derived peptides show insulin-mimic and sensitizing activities in 3T3 F442A pre-adipocytes. BIT's 10<sup>th</sup> Anniversary of Protein & Peptide Conference. 2017 March 22-24, Fukuoka, Japan. (Invited)
- 14. Wu, J. (2017). Food proteins as a source of bioactive peptides against CVD. International Conference of Food Quality and Safety & the 4<sup>th</sup> Fruit Quality Biology. April 19-21, Hangzhou, Zhejiang. (Invited)
- 15. Wu, J. (2017). The potential of dairy derived bioactive peptides against metabolic syndrome. The 3<sup>rd</sup> International Symposium on Minerals & Dairy Products. Sept 20-22, 2017, Wuxi, China. (Invited)
- 16. Wu, J., Qi, L. (2017) Scale-up production and product development of egg white protein hydrolysate with angiotensin I converting enzyme inhibitory activity. The 108th American Oil Chemists' Society (AOCS) annual meeting & Expo, May 3-6, 2017, Orlando, Florida, USA. (Invited)
- 17. Zuidhof, M. J., and F. E. Robinson. Knowledge generation builds confidence in an advanced production class. Presentation to NACTA annual Meeting. Perdue, IN. June 28-July 1, 2017.

### POSTER PRESENTATIONS (N = 11)

- 1. Afrouziyeh, M., M. J. Zuidhof and M. Shivazad. 2017. Comparison of maximum profit approach versus least cost ration formulation on profit in laying hens. Alberta Poultry Industry Annual General Meeting, Red Deer, AB. February 27-28, 2017.
- 2. Bandara, N., Wu, J. (2017). Chemically modified canola protein-nanomaterial hybrid wood adhesive shows improved adhesion. The 108th AOCS annual meeting & Expo, May 3-6, 2015, Orlando, Florida, USA.
- 3. Feng M., and Betti, M. 2017. Novel collagen-derived glycopeptide Pro-Hyp-CONH-GlcN: synthesis and transpithelial transport in Caco-2 cell model. 253rd American Chemical Society National Meeting and Exposition. April 2-6, San Francisco, CA, USA. (Poster)
- Gonzalez, S., Wu, J. (2017). n-3 Polyunsaturated fatty acids encapsulation using phospholipase A1-treated egg yolk. 17<sup>th</sup> AOCS Latin American Congress and Exhibition on Fats, Oils and Lipids, Sept 11-14, 2017, Cancun, Mexico.
- Hadinia, S. H., P.R.O. Carneiro, G. Y. Bédécarrats, and M. J. Zuidhof. 2017. If broiler breeders were a car, could you press the gas pedal to get them to start laying? Alberta Poultry Industry Annual General Meeting, Red Deer, AB. February 27-28, 2017.
- 6. Humphreys, K., and M. Zuidhof. 2017. The effect of broiler breeder maternal environment on offspring performance and efficiency. The Poultry Research Centre Annual General Meeting. Edmonton, AB. May 1, 2017.
- 7. Jahandideh, F., Wu, J. (2017). 1st international conference "<u>Nutrition: from laboratory to clinical studies</u>", Sept 608, 2017, Mashhad, Iran
- Ren, J., Wu, J. (2017) Using aqueous extraction of phosvitin or Ethylenediaminetetraacetic acid (EDTA) treatment to remove iron from egg yolk. 254th American Chemical Society (ACS) National Meeting & Exposition, Washington, DC. August 20-24, 2017.

- 9. Shang, N., Wu, J. (2017). Egg-derived tri-peptide IRW promotes differentiation of mouse osteoblastic cell MC3T3-E1. The 108th AOCS annual meeting & Expo, May 3-6, 2017, Orlando, Florida, USA.
- 10. van der Klein, S.A.S, C. A. Ouellette, K. Lovely, and M. Zuidhof. 2017. Day length, photostimulation, and body weight. The Poultry Research Centre Annual General Meeting. Edmonton, AB. May 1, 2017.
- 11. van der Klein, S.A.S, C. A. Ouellette, K. Lovely, and M. J. Zuidhof. 2017. Broiler breeder struggles: Day length, photostimulation, and body weight. Alberta Poultry Industry Annual General Meeting, Red Deer. AB. February 27-28, 2017.

### BOOKS AND BOOK CHAPTERS (N = 1)

1. Hrynets Y., Bhattacherjee A., and M. Betti. 2018. Non-enzymatic browning reactions: overview. Monograph in Encyclopedia of Food Chemistry. Elsevier. DOI: 10.1016/B978-0-08-100596-5.21629-6

#### RESEARCH REPORTS (N = 19)

- Bench, C.J., Korver, D.R., and Crowe, T. 2017. Improving foot pad quality in commercial broilers; Assessment of on-farm moisture management and foot pad scoring methods. Agriculture and Agri-Food Canada Agri-Innovation Program Stream B Final Report. April 30, 2017. 17 pp. plus attestations.
- Bench, C.J., Korver, D.R., and Crowe, T. 2017. Improving foot pad quality in commercial broilers; Assessment of on-farm moisture management and foot pad scoring methods. Agriculture and Agri-Food Canada Agri-Innovation Program Stream B Final Report. October 23, 2017. 4 pp.
- 3. Wu, J. 2017. Final report. Fractionation of valuable egg yolk components for niche market applications. Submitted to Alberta Government, 57 pp.
- 4. Wu, J. 2017. Interim report. Application of egg ovotransferrin peptides against metabolic syndrome. Submitted to the sponsor, 13 pp.
- 5. Wu, J. 2017. Interim report. Cruciferin/chitosan complex: a novel colon-targeted delivery system for probiotics. Submitted to Agriculture Funding Consortium, 4 pp.
- 6. Wu, J. 2017. Interim report. Developing an integrated method of preparing bioactive peptides from spent hens for functional food/nutraceutical and cosmetic applications, 15 pp.
- 7. Wu, J. 2017. Interim report. Developing functional phosivitin phosphopeptides from residues after preparing phosvitin-depleted egg yolk for improved yolk stability in food applications. Submitted to Alberta Economic Development and Trade, 4 pp.
- 8. Wu, J. 2017. Interim report. Developing functional phosvitin phosphopeptides from residues after preparing phosvitin-depleted egg yolk for improved yolk stability in food applications. Submitted to sponsors (NSERC and Michael Foods Ltd), 19 pp.
- 9. Wu, J. 2017. Interim report. Developing valuable egg components for niche market applications. Submitted to Egg Farmers of Canada, 7 pp.
- 10. Wu, J. 2017. Preshen Chelikani, Rotimi Aluko, Jianping Wu. Final report. Identification and functional characterization of advanced glycation end products and meat protein-derived peptides as novel bitter taste blockers. Submitted to Alberta Agriculture and Forestry, 27 pp.
- 11. Zuidhof, M. J. 2017. Lifetime Productivity of Conventionally and Precision-fed Broiler Breeders. Interim report to Canadian Hatching Egg Producers. Project 2015E. June 25, 2017. 6 pp.
- 12. Zuidhof, M. J. 2017. Lifetime Productivity of Conventionally and Precision-fed Broiler Breeders. Interim report to Canadian Hatching Egg Producers. Project 2015E. February 24, 2017. 34 pp.
- 13. Zuidhof, M. J. 2017. Lifetime productivity of precision- and conventionally-fed broiler breeders. Interim report to Alberta Agriculture and Forestry. Project RES0029966. March 31, 2017. 37 pp.

- 14. Zuidhof, M. J. 2017. Optimizing Lighting for Precision broiler Breeder Feeding. Final report to Alberta Agriculture and Forestry. Project 2014F182R. October 3, 2017. 53 pp.
- 15. Zuidhof, M. J. 2017. Optimizing Lighting for Precision broiler Breeder Feeding. Interim report to Alberta Agriculture and Forestry. Project 2014F182R. January 4, 2017. 18 pp.
- 16. Zuidhof, M. J. 2017. Poultry Research Centre Support for Business Director. Final report to Alberta Innovates Bio Solutions. Project Bio-2012-002. September 30, 2017. 36 pp.
- 17. Zuidhof, M. J. 2017. Precision feeding layers for improved uniformity, production, and sustainability. Interim report to Alberta Agriculture and Forestry. Project 2015E016R. November 29, 2017. 16 pp.
- 18. Zuidhof, M. J. 2017. Precision feeding layers for improved uniformity, production, and sustainability. Interim report to Alberta Agriculture and Forestry. Project 2015E016R, January 30, 2017. 17 pp.
- 19. Zuidhof, M. J. 2017. The Poultry Research Centre Annual Report (2016-2017). The Poultry Research Centre, The University of Alberta, Edmonton, AB, T6G 2P5. March 31, 2017. 56 pp.

### MAGAZINE ARTICLES (N = 6)

- 1. Kouritzin, V. (2017). Evaluating broiler gait using a 3D model. Alberta Farm Animal Care Insights Magazine. November.
- 2. Bench, C.J. and Korver, D.R. 2017. Welfare and bone density of laying hens in different housing types. December EggNotes Newsletter. 2 pp.
- 3. Canadian Poultry Magazine Improving foot pad quality in commercial broilers (2017)
- 4. Korver, D.. 2017. Feeding the hen for longer laying cycles. Asian Poultry Magazine. April, 2017. p. 16-19.
- Korver, D. 2017. Pullet nutrition setting the stage for success. Asian Poultry Magazine. March, 2017. p. 34, 36, 37.
- 6. Schaer, L. 2017. Incubator temperature can affect embryo metabolism and chick quality. Livestock Research and Investment Corporation. May, 2017. 1 page.

# Financial Report 2017-2018

#### PRC – OVERALL REPORT<sup>1</sup>

#### Income 2017-2018

PRC	Cash	In-Kind*	Total
Industry	255,549.00	35,000.00	290,549.00
AAF	43,000.00	337,600.00	380,600.00
UofA		1,843,885.00	1,843,885.00
Sub-total	298,549.00	2,216,485.00	2,515,034.00
Opening balance - Industry	(6,573.90)		(6,573.90)
Opening balance - AAF	0.00		0.00
TOTAL PRC	291,975.10	2,216,485.00	2,508,460.10
Expenses 2017-2018			

	Cash	In-Kind*	Total
Salaries and benefits (2 academic staffs)		2,181,485.00	2,181,485.00
Salaries and benefits (2 support staffs + Bus. Dev)	146,863.11	35,000.00	181,863.11
Supplies and Services	2,419.70		2,419.70
Repairs and Maintenance			0.00
Equipment			0.00
Others (incl. travel, overhead)	5,000.00		5,000.00
Total Expenses	154,282.81	2,216,485.00	2,370,767.81

#### Revenue/Expense Summary 2017-2018

	Cash	In-Kind*	Total
Total Income (incl. carryover)	291,975.10	2,216,485.00	2,508,460.10
Total Expenses	154,282.81	2,216,485.00	2,370,767.81
Total carryover to 2018/19			137,692.29

<sup>1</sup> The overall 2017-18 PRC financial report is the combination of the individual 2017-18 financial report for Industry and AAF grants, presented next.

\* In-Kind support from AAF includes 1.56 FTE for the research team, 1 FTE for Technology Transfer and support for Research, Technology and Knowledge adoption and commercialization. In-Kind support from the UofA includes approximately 4.8 FTE equivalents of academic staffs involved in the PRC activities. The UofA in-kind support of \$385,000 (or portion) is the average cost per faculty member to conduct research in the Faculty of ALES, University of Alberta, for a year. This amount includes faculty salary and benefits and facility costs (utilities, maintenance, security, insurance) that are not covered by overhead or direct research charges.

# THE POULTRY RESEARCH CENTRE

#### PRC - INDUSTRY GRANT FINANCIAL REPORT 2017 - 2018

Income 2017-2018	Actuals as of March 31, 2018			
Industry	Cash	In-Kind*	Total	
Alberta Turkey Producers	30,642.00		30,642.00	
Alberta Hatching Egg Producers	34,861.00		34,861.00	
Alberta Chicken Producers	97,650.00		97,650.00	
Egg Farmers of Alberta	38,896.00		38,896.00	
Egg Farmers of Canada	15,000.00		15,000.00	
Burnbrae Farms	8,500.00		8,500.00	
Maple Leaf	15,000.00		15,000.00	
Lilydale	15,000.00		15,000.00	
Poultry Health Services		35,000.00	35,000.00	
UofA		1,843,885.00	1,843,885.00	
Sub-total	255,549.00	1,878,885.00	2,134,434.00	
Opening balance	(6,573.90)		(6,573.90)	
TOTAL INDUSTRY	248,975.10	1,878,885.00	2,127,860.10	
Expenses 2017–2018	Actuals as	of March 31, 2018	3	
	Cash	In-Kind*	Total	
Salaries and benefits (academic staff)		1,843,885.00	1,843,885.00	
Salaries and benefits (support staff)	103,863.11	35,000.00	138,863.11	
Supplies and Services	2,419.70		2,419.70	
Repairs and Maintenance			0.00	
Equipment			0.00	
Other (incl. travel and overhead)	5,000.00		5,000.00	
Total Expenses*	111,282.81	1,878,885.00	1,990,167.81	
Income/Expense Summary 2017-2018	Actuals as of March 31, 2018			
	Cash	In-Kind	Total	
Total Income (incl. carryover)	248,975.10	1,878,885.00	2,127,860.10	
Total Expenses	111,282.81	1,878,885.00	1,990,167.81	
Carryover/Surplus to 2018/19			137.692.29	

\*In-Kind support from the UofA includes approximately 4.8 FTE equivalents of academic staffs involved in the PRC activities. The UofA in-kind support of \$385,000 (or portion) is the average cost per faculty member to conduct research in the Faculty of ALES, University of Alberta, for a year. This amount includes faculty salary and benefits and facility costs (utilities, maintenance, security, insurance) that are not covered by overhead or direct research charges.

#### PRC - AAF GRANT FINANCIAL REPORT 2017 - 2018

Income 2017-2018	Actuals as of March 31, 2018			
Alberta Government	Cash	In-Kind*	Total	
AARD	43,000.00	337,600.00	380,600.00	
Opening balance			0.00	
TOTAL AAF	43,000.00	337,600.00	380,600.00	

Expenses 2017-2018	Actuals as of March 31, 2018		
	Cash	In-Kind	Total
Salaries and benefits (2 support staffs)	43,000.00	337,600.00	380,600.00
Supplies and Services			0.00
Repairs and Maintenance			0.00
Equipment			0.00
Other			0.00
Total Expenses*	43,000.00	337,600.00	380,600.00

Income/Expense Summary 2017-2018	Actuals as of March 31, 2018		
	Cash	In-Kind	Total
Total Income	43,000.00	337,600.00	380,600.00
Total Expenses	43,000.00	337,600.00	380,600.00
Carryover/Surplus to 2018/19			0.00

\* In-Kind support from AAF includes 1.56 FTE for the research team, 1 FTE for Technology Transfer and support for Research, Technology and Knowledge adoption and commercialization

#### POULTRY UNIT FINANCIAL REPORT 2017 - 2018

Income 2017-2018	Actuals as of March 31, 2018		
	Unit	Heritage*	Total
U of A/AFNS	196,473.56		196,473.56
Poultry Unit (Internal revenue) <sup>†</sup>	72,007.21		72,007.21
Poultry Unit (External revenue)‡	156,268.21	124,503.25	280,771.46
Sub-total	424,748.98	124,503.25	549,252.23
Opening balance	226,863.00		226,863.00
Total UofA	651,611.98	124,503.25	776,115.23

Expenses 2017-2018	Actuals as of March 31, 2018		
	Unit	Heritage*	Total
Salaries and benefits (3 support staffs)	317,223.66	52,712.93	369,936.59
Supplies and services (incl. feed cost)	104,691.41	36,377.83	141,069.24
Repairs and Maintenance	3,398.10	2,098.83	5,496.93
Equipment			0.00
Others (incl. communication, travel, finance fees,	13,472.71	6,087.14	19,559.85
Rentals)			
Total Expenses	438,785.88	97,276.73	536,062.61

Income/Expense Summary 2017-2018	Actuals as of March 31, 2018		
	Unit	Heritage*	Total
Total Income (incl. carryover)	651,611.98	124,503.25	776,115.23
Total Expenses	438,785.88	97,276.73	536,062.61
Subtotal from Poultry Unit	212,826.10	27,226.52	240,052.62
DM Shaver contribution			0.00
Carryover/surplus to 2017/18			240,052.62

<sup>+</sup> Poultry Unit Internal revenue includes user fees (animal and facilities) related to research project, bird and egg sale for research.

<sup>‡</sup>Poultry Unit External Revenue includes primarily birds and egg sales, Heritage Chicken program revenues and donations and non-U of A user fees (animal and facilities) related to research projects.

\*The Heritage expenses do not include the cost of the technical staff currently paid from the Industry grant, the \$28,500 cost for the reimbursement of the Sustainability grant used to develop the Heritage Chick Program and the anticipated 2017/18 contribution of approx. \$5,000 to the DM Shaver endowment related to the Heritage Chick Program with Peavey Industries.

#### PRC – OVERALL BUDGET 2018-2019

#### Income 2018–2019 (Budget)

PRC	Cash	In-Kind*	Total
Industry	255,549.00	35,000.00	290,549.00
AAF	0.00	337,600.00	337,600.00
UofA		1,843,885.00	1,843,885.00
Sub-total	255,549.00	2,216,485.00	2,472,034.00
Opening balance - Industry	137,692.00		137,692.00
TOTAL PRC	393,241.00	2,216,485.00	2,609,726.00

#### Expenses 2018-2019 (Budget)

	Cash	In-Kind*	Total
Salaries and benefits (academic staffs)		2,181,485.00	2,181,485.00
Salaries and benefits (2 support staffs + Bus. Dev)	250,000.00	35,000.00	285,000.00
Supplies and Services	138,241.00		138,241.00
Repairs and Maintenance			0.00
Equipment			0.00
Others (incl. travel, overhead)	5,000.00		5,000.00
Total Expenses	393,241.00	2,216,485.00	2,609,726.00

#### Revenue/Expense Summary 2018-2019 (Budget)

	Cash	In-Kind*	Total
Total Income (incl. carryover)	393,241.00	2,216,485.00	2,609,726.00
Total Expenses	393,241.00	2,216,485.00	2,609,726.00
Total carryover to 2019/20			0.00

<sup>1</sup> The overall PRC budget is the combination of the individual budget for Industry and AAF grant, presented next. \* In-Kind support from AAF includes 1.56 FTE for the research team, 1 FTE for Technology Transfer and support for Research, Technology and Knowledge adoption and commercialization. In-Kind support from the UofA includes approximately 4.8 FTE equivalents of academic staffs involved in the PRC activities. The UofA in-kind support of \$385,000 (or portion) is the average cost per faculty member to conduct research in the Faculty of ALES, University of Alberta, for a year. This amount includes faculty salary and benefits and facility costs (utilities, maintenance, security, insurance) that are not covered by overhead or direct research charges.

#### PRC – INDUSTRY GRANT BUDGET 2018-2019

Income 2018-2019	(Budget)
------------------	----------

Industry	Cash	In-Kind*	Total
Alberta Turkey Producers	30,642.00		30,642.00
Alberta Hatching Egg Producers	34,861.00		34,861.00
Alberta Chicken Producers	97,650.00		97,650.00
Egg Farmers of Alberta	38,896.00		38,896.00
Egg Farmers of Canada	15,000.00		15,000.00
Burnbrae Farms	8,500.00		8,500.00
Lilydale	15,000.00		15,000.00
Maple Leaf	15,000.00		15,000.00
Poultry Health Services		35,000.00	35,000.00
UofA		1,843,885.00	1,843,885.00
Sub-total	255,549.00	1,878,885.00	2,134,434.00
Opening balance	137,692.00		137,692.00
TOTAL INDUSTRY	393,241.00	1,878,885.00	2,272,126.00

#### Expenses 2018-2019 (Budget)

	Cash	In-Kind*	Total
Salaries and benefits (2 staffs)	250,000.00	1,878,885.00	2,128,885.00
Supplies and Services	138,241.00		138,241.00
Repairs and Maintenance			0.00
Equipment			0.00
Others (incl. overhead)	5,000.00		5,000.00
Total Expenses	393,241.00	1,878,885.00	2,272,126.00

#### Revenue/Expense Summary 2018-2019 (Budget)

	Cash	In-Kind*	Total
Total Income (incl. carryover)	393,241.00	1,878,885.00	2,272,126.00
Total Expenses	393,241.00	1,878,885.00	2,272,126.00
Total carryover to 2019/20		0.00	0.00

\*In-Kind support from the UofA includes approximately 4.8 FTE equivalents of academic staffs involved in the PRC activities. The UofA in-kind support of \$385,000 (or portion) is the average cost per faculty member to conduct research in the Faculty of ALES, University of Alberta, for a year. This amount includes faculty salary and benefits and facility costs (utilities, maintenance, security, insurance) that are not covered by overhead or direct research charges.

### PRC – Alberta Government Budget

### Income 2018-2019 (Budget)

Alberta Government	Cash	In-Kind*	Total
AAF		337,600.00	337,600.00
Opening Balance			0.00
TOTAL AAF	0.00	337,600.00	337,600.00

### Expenses 2018-2019 (Budget)

	Cash	In-Kind*	Total
Salaries and benefits		337,600.00	337,600.00
Supplies and Services			0.00
Repairs and Maintenance			0.00
Equipment			0.00
Others (incl. overhead)			0.00
Total Expenses	0.00	337,600.00	337,600.00

#### Revenue/Expense Summary 2018-2019 (Budget)

	Cash	In-Kind*	Total
Total Income (incl. carryover)		337,600.00	337,600.00
Total Expenses		337,600.00	337,600.00
Total carryover to 2019/20		0.00	0.00

\* In-Kind support from AAF includes 1.56 FTE for the research team, 1 FTE for Technology Transfer and support for Research, Technology and Knowledge adoption and commercialization.

#### POULTRY UNIT BUDGET 2018-2019

#### Income 2018-2019 (budget)

	Unit	In-Kind	Total
U of A/AFNS	200,000.00		200,000.00
Poultry Unit (Internal revenue) <sup>†</sup>	75,000.00		75,000.00
Poultry Unit (External revenue)‡	40,000.00	125,000.00	165,000.00
Sub-total	315,000.00	125,000.00	440,000.00
Opening balance	240,053.00		240,053.00
Total UofA	555,053.00	125,000.00	680,053.00

#### Expenses 2018-2019 (budget)

	Unit	In-Kind	Total
Salaries and benefits (3 support staffs)	247,712.00	60,500.00	308,212.00
Supplies and services (incl. feed cost)	80,000.00	45,000.00	125,000.00
Repairs and Maintenance	7,500.00	2,500.00	10,000.00
Equipment	7,000.00	3,000.00	10,000.00
Others (incl. communication, travel, finance fees,	18,500.00		18,500.00
Rentals)			
Total Expenses	360,712.00	111,000.00	471,712.00

#### Income/Expense Summary 2018-2019 (budget)

	Unit	In-Kind	Total
Total Income (incl. carryover)	555,053.00	125,000.00	680,053.00
Total Expenses	360,712.00	111,000.00	471,712.00
Subtotal from Poultry Unit	194,341.00	14,000.00	208,341.00
DM Shaver contribution		5,000.00	5,000.00
Carryover (surplus) to 2019/20	194,341.00	9,000.00	203,341.00

<sup>+</sup> Poultry Unit Internal revenue includes user fees (animal and facilities) related to research project, bird and egg sale for research.

<sup>‡</sup>Poultry Unit External Revenue includes primarily birds and egg sales, Heritage Chicken program revenues and donations.

\* The Heritage budget does not include the cost of the technical staff currently paid from the Industry grant and does not include the \$28,500 cost for the reimbursement of the Sustainability grant used to develop the Heritage Chick Program. The DM Shaver contribution is an estimate of the anticipated donation from Peavey Industries related to the Heritage Chick program.

# THE POULTRY RESEARCH CENTRE

### PRC FUNDING: ALL SOURCES RECEIVED IN 2017-2018 (\$2,127,860)



### PRC FUNDING: INDUSTRY CASH SOURCES RECEIVED IN 2017-2018 (\$255,549)



# THE POULTRY RESEARCH CENTRE

# Acronyms and Abbreviations

Abbreviation	Definition
ACP	Alberta Chicken Producers
AAF	Alberta Agriculture and Forestry
AAFC	Agriculture and Agri-Food Canada
AFNS	(Department of) Agricultural, Food and Nutritional Science
AI-Bio	Alberta Innovates Bio Solutions
AITF	Alberta Innovates Technology Futures
ALES	(Faculty of) Agricultural, Life and Environmental Sciences
ALMA	Alberta Livestock and Meat Agency
AN SC	Animal Science
CHEP	Canadian Hatching Egg Producers
CPRC	Canadian Poultry Research Council
CSC	China Scholarship Council
EFA	Egg Farmers of Alberta
EFC	Egg Farmers of Canada
ELLA	Edmonton Lifelong Learners Association
EWH	Egg white protein hydrolysate
FTE	Full-time equivalent
GSA	Graduate Students Association
GF2	Growing Forward 2
НСР	Heritage Chicken Program
HQP	Highly Qualified Personnel
LCA	Life cycle analysis
MetS	Metabolic syndrome
MSc	Master of Science
NSERC	National Science and Engineering Research Council
NSERC CRD	NSERC Collaborative Research and Development Grant
NSERC DG	NSERC Discovery Grant
NUFS	Nutrition and Food Science
PDF	Post-doctoral fellow
PhD	Doctor of Philosophy
PRC	Poultry Research Centre
SRDP	Strategic Research and Development Program
U of A or UA	University of Alberta
II/G	Undergraduate

# **Contact Information**

# THE POULTRY RESEARCH CENTRE

Dr. Valerie Carney, Technology Transfer Liaison Alberta Agriculture and Forestry 3rd fl JG O'Donoghue Building 7000 - 113 Street Edmonton, AB T6H 5T6 Tel (780) 415-2269 **valerie.carney@gov.ab.ca** 

> **Email** prc@ualberta.ca www.poultryresearchcentre.ca

Dr. Martin Zuidhof, Academic Leader University of Alberta Department of Agricultural, Food and Nutritional Science 410 Agriculture/Forestry Centre Edmonton, AB T6G 2P5 Tel (780) 248-1655 **mzuidhof@ualberta.ca** 

