Cover photo: Martin Zuidhof

2017 ANNUAL REPORT

Poultry Research Centre

APRIL 1, 2016 TO MARCH 31, 2017

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

The past year has been a busy year at the PRC. It is my privilege to highlight some of the accomplishments from the past year. The advisory board was very focused on finalizing and implementing the new strategic plan. I think full implementation of this plan is the key for the PRC to achieve its potential in the coming years. One of the key parts of that plan was realizing that each stakeholder and platform partner is a contributing part of the PRC and that success is maximized when we all work together. I am pleased to highlight some of the many achievements:

The PRC led by Val Carney and Brenda Reimer received a grant for extension work from ALMA. This grant is administered by ACP, and most of the implementation work will be led by AF. It is an excellent example of partnership to increase the impact of each stakeholder's investment in the PRC.

One thing that was clearly apparent this year is that the students, technicians, and post-docs of the PRC are our life-blood. The PRC's scientists guide the students, administer the projects, and train these budding scientists. In 2016, the PRC's students won over 40 awards and scholarships, totaling in excess of $150,000, which not only rewards their success, but supports their training.

It was most fortunate for us to have Frank Robinson return from his University administrative role to work on projects for the PRC. This year he has developed curriculum for a Green Certificate Program for poultry. This is an industry driven agricultural training program that is delivered to over 200 high schools in Alberta and administered through Alberta Agriculture and Forestry. The goal of this program is to create a safe and competent entry-level worker through the apprenticeship style of delivery. Participants learn by actively performing the skills required on an agriculture operation. Many agriculture students now come from urban communities, and have limited farm experience. To enable them to understand the day-to-day operations of a farm, Dr. Robinson developed three day mini-internships that enable students to volunteer on farms. This has been highly rewarding for both farmers and students, and a crucial part of developing the next generation of agricultural leaders.

These are just three of the highlights for the year. Overarching all this work is that I think we've been really working toward and focusing on the value proposition for all stakeholders. To some extent the PRC is only as effective as the effort and cooperation that all members bring to the table in cooperation with each other. I would aver that this industry/government/university collaboration is what makes us strong and will be the key to our future!

I want to thank Martin for his work as the academic lead of the PRC, my fellow board members and industry partners and all those who have been active at the university for making this past year a success at the PRC and for taking initial steps to implement the strategic plan. The future looks bright to me and I look forward to seeing the PRC grow and thrive in the coming years!

David Hyink
PRC Advisory Board Chair

Academic Leader's Report

As I write this report, the final pieces of the PRC bridge funding plan for the next two years are being aligned. It has been a busy but productive year investigating opportunities for leveraging the base support of the PRC. Our aim in this process is to maximize the benefits of our partnership for research, technology transfer, and teaching and learning. As I look back over the last 5 years, I can say with certainty that we've made a lot of progress. The level of engagement of all of our partners is better than it has ever been since the PRC was established over 30 years ago! Each partner recognizes more clearly their unique role in PRC governance, and in creating, communicating, disseminating, and using the innovations that make the Canadian poultry enterprise more sustainable.

Each year, I look back with pride for what we've accomplished together. In the last year, 1 PhD and 2 MSc students graduated. Our 2 MSc grads have found meaningful roles in the Alberta poultry industry. Congratulations to Lyle Bouvier, our Poultry Unit manager, who celebrated 35 years of dedicated service to the University. Dr. Frank Robinson has achieved 30 years of teaching, research, and service excellence. Our group demonstrated continued excellence in teaching. Dr. Clover Bench reached the pinnacle of early achievement at the University of Alberta when she received the Provost's Award for Early Achievement of Excellence in Undergraduate Teaching. Our 38 graduate students continue to thrive, receiving over 40 awards collectively exceeding a value of $150,000. Together, we brought in 4,456,028 of research and technology transfer funding for projects that move forward the frontiers of poultry science. Most of these projects also contribute in notable ways to poultry industry sustainability.

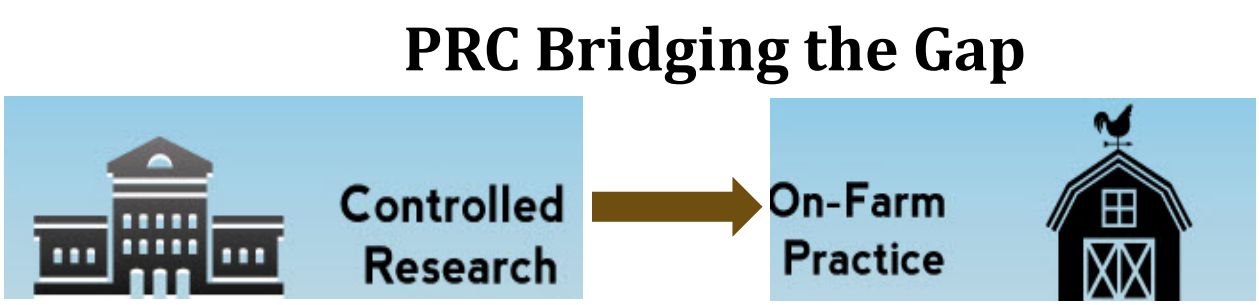
Our total research and teaching team consisted of 85 people, all working to create new knowledge and encourage implementation of new innovations in poultry science.

These are remarkable achievements, yet I know the PRC can work together to be even more effective. I look forward to working with Agnes Kulinski in a somewhat revised Business Director role. Agnes' new focus will be as point person for the PRC. She will be involved in all aspects of running the PRC, a much needed role for maintaining the PRC's momentum. Her most important focus will be implementation of our collaboratively developed Strategic Framework.

I want to thank David Hyink for excellent leadership as chair as we began the process of implementing the PRC's new Strategic Framework. All of us at the PRC wish you the best in your new role at Marketing Council. I look forward to Jenna Griffin's leadership. We remain in good hands.

Dr. Martin Zuidhof
Academic Leader

Technology Transfer



Delivering on many of the strategic outcomes of the PRC Strategic Framework (2016-21) is a step closer through the ALMA awarded project: Working together: a unified communication and research adoption strategy for the Poultry Research Centre. This project includes the development of a communication plan, funding for speakers for Western Poultry Conference 2017, Genetic Preservation Summit, a Hatchery workshop and numerous Flock Talks from 2016 to 2018. Alberta Agriculture and Forestry is leading the execution of the proposed activities and Alberta Chicken Producers are leading the grant administration.

To make a lasting resource of the informative presentations delivered at the 2016 Western Poultry Conference, short videos of key messages from each of the speakers were produced. These videos covering topics such as Avian influenza, ventilation, feeding Camelina, and navigating social media and consumer expectations are housed on the Alberta Agriculture and Forestry YouTube channel.

In cooperation with the Banff Egg Forum and the International Egg Nutrition Consortium, the University of Alberta helped to organize the International Egg Symposium. Attendees from industry, university and government learned about the newest developments in egg nutrition and human health and opportunities in egg-based functional foods. It was a great opportunity to exchange ideas with “egg-sperts” from around the globe.

The 3rd annual Western Poultry Conference hosted nearly 350 attendees who learned about understanding and preventing Salmonella, Biosecurity, the PRC Heritage hen program, student research projects and ventilation. Reviews were positive and plans for next year are underway.

Working together with EFA, the PRC brought together farmers and industry technical staff to share experiences and lessons learned in the process of moving to loose housing systems with those who had recently made a similar move or were considering it. The hands-on element of the workshop had farmers assessing live birds according to the outcomes of the Welfare Quality Assessment protocols.

Dr. Valerie Carney
Technology Transfer Liaison
April 2017

Leadership in Training Highly Qualified Personnel

The PRC has an important role to play in the training of 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 see the table showing our undergraduate and graduate teaching responsibilities elsewhere in the report.

PRC team members play an important role in graduate and undergraduate teaching at the University of Alberta. Our faculty teach courses at the graduate and undergraduate level. Although there are few poultry-specific courses (ANSC 471 – Applied Poultry Science and ANSC 463 – Poultry Nutrition) at the U of A, our faculty teach introductory and upper-year courses that often have poultry-relevant material included – poultry management, nutrition, metabolism, welfare, behaviour, products, food safety and food product development. In addition to teaching at the University of Alberta, members of the PRC also deliver lecture content and practical experience to students at the University of Calgary faculty of Veterinary Medicine. During my sabbatical leave, I had the opportunity to teach two lectures (graduate animal nutrition) and a seminar (undergraduate animal science) at Kasetsart University in Thailand.

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 November 2016, 15 students spent 3 days during Reading Week to gain work experience on 6 animal production units, including commercial layer, turkey and broiler breeder farms, as well as the U of A Poultry Unit. In February 2017, the program was expanded to 22 students who worked on 9 sites. The program is being evaluated currently, but plans are to expand it next year. Producers interested in participating are invited to contact frank.robinson@ualberta.ca.

In addition to undergraduate and graduate teaching, training of highly qualified personnel (HQP) remains an important focus for the PRC. In 2016/2017, PRC faculty supervised approximately 50 graduate students, 12 visiting scholars, 13 research technicians, 7 Research Associates, 14 post-doctoral fellows, and 5 undergraduate research assistants. Our students have won presentation awards at international scientific meetings, as well as numerous scholarships.

As in previous years, members of the PRC (including technicians, researchers, extension specialists and students) were on hand for the 2017 poultry industry Annual General Meetings held 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.

One of the most rewarding things we as PRC educators can experience is seeing our former students and trainees working and using their training. A few recent examples include Kaustav Majumder (PhD with Jianping Wu; Assistant Professor of Food Science at the University of Nebraska-Lincoln) and Paulo Carneiro (MSc with Martin Zuidhof; breeder technical service, Maple Leaf Foods). Sometimes, we see this success in unexpected places. In October, 2016, I was speaking at a layer feed quality conference in Kuala Lumpur, Malaysia, and I met one of our undergraduate students, who is now working for a feed ingredient supplier in Malaysia. It's a big world, and our graduates are having an impact globally.

Now in its fourth year of operation, the Poultry Research Centre Student Club continues to be an excellent opportunity for University of Alberta students to gain experience in poultry handling, poultry science and the poultry industry. Club members have regularly provided labour to local poultry operations, gaining both experience and employment.

Dr. Doug Korver
Teaching and Learning Liaison

Photo: Frank Robinson

POULTRY RELATED COURSES (2016/17)

Instructor	*Course*	*Course Name*	*Enrolment*	*% poultry*
Douglas Korver	ANSC 463	Poultry Nutrition	23	100
Douglas Korver	AFNS 563	Poultry Nutrition	2	100
Martin Zuidhof	AN SC 471	Applied Poultry Research	11	100
Martin Zuidhof	AFNS 571	Applied Poultry Research	2	100
Frank Robinson	ANSC 260	Fundamentals of Animal Nutrition	53	60
Frank Robinson	AN SC 200	Principles of Animal Agriculture	116	50
Martin Zuidhof *Lynn McMullen*	NUFS 361/363	Food Microbiology	150	40
Leluo Guan *Paul Stothard*	AN SC 479/499	Animal Health Science (capstone)		25
Mirko Betti	ANSC 420	Carcass and Meat Quality	23	15
Clover Bench	ANSC 377	Food Animal Behaviour	24	10
Jianping Wu	NUFS 200	Functional Foods and Nutraceuticals	42	10
Mirko Betti	NUFS 374	Food Fundamental and Quality	82	5
Mirko Betti	NUFS 425	Nutritional Product development	25	5
Eduardo Beltranena	AN SC 476	Applied Swine Science	22	0
Aman Ullah	AFNS 510	Renewable biomaterials		
Ellen Goddard				

Commercialization

We continue to be successful at generating revenue and getting closer to a sustainable and self – sufficient PRC. The Heritage Chicken and Heritage Chick Programs are running smoothly and we are grateful for the program supporters' ongoing contribution for our flocks. The strong partnership with Peavey Industries is instrumental in the program's success. Together we delivered two workshops that provided small flock owners with management strategies. The workshops are an excellent way to connect with this group and deliver messages to support the health of the Alberta poultry industry.

Over the past year, I have been fortunate to bring two projects closer to market –commercialization of Egg Peptides and Precision Feeding System. To commercialize egg technologies as natural health products, it is imperative to perform clinical trials to provide evidence of safety and efficacy. With the help of Afinity Life Sciences we developed clinical trial protocols and submitted two grant applications to fund the study. Currently, we are exploring market potential of egg derived phosvitin for animal bone health.

As the validation and prototype demonstration in simulated environment continues, the Zuidhof team has been in discussions with potential industry partners. Furthermore, the Precision Feeding System patent protection has been filed. I was very happy to be part of the IP protection process.

Agnes Kulinski
Business Director

Awards

FACULTY/STAFF AWARDS

Name	Award
Clover Bench	Provost Award for Early Achievement of Excellence in Undergraduate Teaching
Lyle Bouvier	35 Years of Service
Doug Korver	ALES Teacher of the Year 2015/2016
Frank Robinson	30 Years of Service
Wendy Wismer	ALES Teacher of the Year 2015/2016
Jianping Wu	ALES Mentor Award

GRADUATE STUDENT AWARDS

Name	Supervisor	Award
Jesse Hunter	Bench	Poultry Science Association- Certificate of Excellence
Jesse Hunter	Bench	Western Poultry Conference – Alberta Poultry Industry Certificate of Excellence
Koonphol Pongmanee	Korver	Western Poultry Conference – Alberta Poultry Industry Certificate of Excellence
Abiodun Bello	Korver	Western Poultry Conference Certificate of Excellence (poster)
Abiodun Bell	Korver	Poultry Science Association Graduate Student Travel Award
Abiodun Bello	Korver	World's Poultry Science Association -- Canada Branch Travel Scholarship (unable to attend)
Abiodun Bello	Korver	World's Poultry Science Association Youth Program Travel Award (unable to attend)
Felipe Silva	Korver	Western Poultry Conference Certificate of Excellence (poster)
Reza Ahmadi	Ullah	AFNS Tuition award + Academic Travel award
Muhammad Ashrad	Ullah	2rd place poster prize
Liejiang Jin	Ullah	2nd place poster award ISBBB-2016 and GSA award
Liejiang Jin	Ullah	AFNS Tuition Award
Manpreet Kaur	Ullah	GSA academic travel award
Manpreet Kaur	Ullah	AFNS Tuition Award
Muhammad Safder	Ullah	3rd place poster award at ISBBB -2016 and GSA travel award
Muhammad Zubair	Ullah	AOCS travel support and student meeting registration Award
Muhammad Zubair	Ullah	GSA -Academic Travel Award
Muhammad Zubair	Ullah	Mary Louise Imrie GS award
Muhammad Zubair	Ullah	Guelph food technology award
Nandika Bandara	Wu	Karl C Iverson Agricultural Scholarship

Nandika Bandara	Wu	Dr. Bruce Jeffery Canola Travel Award
Nandika Bandara	Wu	Mitacs Accelerate Graduate Student Scholarship/Internship
Shreyak Chaplot	Wu	AFNS Tuition Award
Shreyak Chaplot	Wu	FGSR Travel Award
Shreyak Chaplot	Wu	GSA travel award
Hongbing fan	Wu	China Scholarship Council (CSC)
Selene Gonzalez Toledo	Wu	Conacyt (The Mexico National Council for Science and Technology)
Selene Gonzalez Toledo	Wu	First place Poster Presentation
Forough Jahandideh	Wu	GSA travel award
Forough Jahandideh	Wu	International Egg Symposium travel award
Nan Shang	Wu	Alberta Innovates Technology Futures (AITF)
Nan Shang	Wu	GFTC Award
Sheila Hadinia	Zuidhof	WPSA Canada Branch Student Travel Scholarship
Sheila Hadinia	Zuidhof	GSA Travel award
Sasha van der Klein	Zuidhof	Alberta Poultry Industry Student Certificate of Excellence for poster presented at Western Poultry Conference
Sasha van der Klein	Zuidhof	WPSA Canada Branch Student Travel Scholarship

GRADUATIONS (N = 3)

Student	Supervisor	Degree	Focus
Jesse Hunter	Bench	MSc	Broiler foot pad dermatitis
Paulo Carneiro	Zuidhof	MSc	Precision feeding & efficiency
Nandika Bandara	Wu	PhD	Value addition to agricultural byproducts and waste proteins through biomimetics and nanotechnology

Research Highlights

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 behaviour and welfare and focus on five main themes: 1) Stress and disease behaviour, 2) behaviour ontogeny, 3) behaviour genetics, 4) housing design and management, and 5) science-based welfare standards. Dr. Bench's research in 2016 in poultry ethology has included on-farm management practices and genomic factors impacting the prevalence of foot pad dermatitis in broilers, the impact of housing type on laying hen welfare assessment outcomes and bone strength, perching behaviour 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 post-docs dedicated to collaborating with Alberta's livestock industry to promote animal care.

DR. EDUARDO BELTRANENA

This fiscal year, we accomplished a major goal that we have been working on for several years. Camelina cake was approved 'as a source of protein in feed of layer hens in an amount not to exceed 10% of the total daily diet'. We were thrilled by the approval, but not the level. Safety and efficacy data submitted supported greater inclusions with no detrimental effects. The Canadian Food Inspection Agency likely erred on the side of caution selecting 10% to rhyme with the US approved level. Camelina cake was previously listed at 12% inclusion for broiler chickens in the *Feeds Regulations Schedule IV.*

We were busy this year with contract work for two new projects. For the first, funded by ALMA, Egg Farmers of Alberta, Egg Farmers of Canada, Canadian Bio-Systems and Shac Environmental Products, we initiated a new project evaluating practical dietary strategies to reduce the ammonia emission intensity of table egg production. We completed a layer digestibility trial last spring to obtain accurate estimates of digestible nutrient content in ingredients to be included in diets that should reduce barn ammonia by 25%. A second project, funded by GF2, aims to reduce the carbon footprint of broiler chicken and table egg production by dietary manipulation. Matt Oryschak got the first trial started last December and single-handedly took care of egg layers over the Christmas holiday. Emmanuel Opoku Yeboah and Daniella Batres, who joined our team in January, will be completing the trial this spring.

In addition to projects, Agriculture and Forestry will be contributing 3 new capital items to the UofA poultry unit: First, 16 new elevated floor pens to compare raising chickens on direct contact or off their litter to evaluate reducing or eliminating feed antibiotic and(or) coccidiostat use. Second, 4 existing floor-level pens will be equipped with elevated scale flooring. This researcher' dream technology will allow weighing birds, feeders and water flow as often as minute by minute. That will result in growth curves derived from thousands of time points instead of weighing birds on trial sporadically. And third, a Zephyr EXL captive bolt device including hose and compressor will facilitate bird euthanasia.

DR. MIRKO BETTI

This year two PhD and one MSc students successfully graduated advancing knowledge in the field of the Maillard reaction chemistry, collagen peptides and protein functionalities. Of interest was the identification of amino acids sequences of the collagen molecule which possess the ability to protect the meat proteins against the freezing damage. 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 meat were provided using *in vitro* cell culture model.

In 2016 Dr. Betti became a member of the editorial boards of Food Chemistry and Heliyon peer reviewed journals.

DR. VAL CARNEY

Building on the successful uptake and media attention from our trial describing genetic change over 50 years, PRC researchers are now investigating these changes over the last 60 years. In addition to the 1957 and 1978 random bred lines in the PRC collection, the project has expanded to include 1997 and 2015 random bred lines from the University of Arkansas. Drs. Carney, Robinson, Zuidhof and Korver and their research teams have conducted two trials: one to investigate changes in broiler growth and the other to assess changes in broiler breeders over the years. Insights from these project may contribute to new management recommendations.

DR. DOUG KORVER

2016 represented an entirely new opportunity for me, as I took my first sabbatical leave in 19 years at the University of Alberta. After completing my teaching responsibilities in the spring of 2016, my family and I moved to Bucaramanga, Colombia, where I worked with Avidesa-MacPollo, the country's largest broiler integrator.

Many of the management aspects are different than the Canadian industry (imagine a broiler breeder complex with 125,000 hens – all feeding and egg collection by hand!). However, working with an integrated company allowed me to follow the flow of inputs and products from feed mill to breeder farm to hatchery to broiler farm to processing plant to rendering plant (and back to feed mill). I was also able to spend a substantial amount of time with the company's nutritionist and veterinarians. The experience gained last year gives me a different perspective on the poultry industry, and new ideas for research and teaching that I hope will benefit the Canadian poultry industry, and also new ideas for teaching.

While I was on leave, I also maintained my research program at the University of Alberta. One of my MSc students defend his thesis in 2016, and another MSc student and 2 PhD students made progress towards completing their programs in the first half of 2017. My research program continues to focus on nutritional supplements to optimize poultry performance (phytase, 25-OH vitamin D_3, canthaxanthin), management factors involved in poultry performance and health (broiler cold weather transportation, barn sanitation, hatching eggshell quality), as well as poultry physiology. I have active research collaborations with researchers at the University of Saskatchewan (T. Crowe) University of Guelph (T. Widowski and G.

Bedecarrats), University of Arkansas (S. Ricke) and Kasetsart University in Thailand. Additionally, my sabbatical in Colombia has led to the development of a large-scale field trial on practical replacements for antibiotic growth promotors. Although the research will be conducted in Colombia, the knowledge gained will be applicable to Canada as well.

DR. LYNN MCMULLEN

Food safety issues are front of mind for the meat industry and new regulations and guidelines will challenge the industry to keep controls in place to manage the incidence of pathogens on meat. Our research on novel technologies to control foodborne pathogens such as *Salmonella, Escherichia coli* and *Listeria monocytogenes* may lead to new technological advances that will help the industry control these pathogens in meat systems. Fundamental to this is our understanding of how microorganisms react to the interventions that are used in the meat harvest and processing industries. Our research on high pressure processing has clearly demonstrated that this technology is not a "magic bullet" that can guarantee products are free from *L. monocytogenes* but we need to build in other safeguards to ensure that levels are sufficiently low to manage the risks associated with this pathogen. We are collaborating with a food safety engineer to evaluate the potential of cold plasma to control pathogens on ready-to-eat meat products. This technology is in the early stages of development but has shown promise for use as an intervention for control of pathogens on meat. Through a collaboration with the Department of Oncology, we have developed and are expanding a new technology for detection of pathogens in meat. To date, we can rapidly detect Salmonella and E. coli in meats in less than 12 hours. We continue to work on how highly aerotolerant *Campylobacter* spp survive on poultry meat.

DR. JIANPING WU

This year, research at Wu's lab generated 12 peer-reviewed papers, and 21 conference presentations (7 invited). Wu wants to thank his fellow students and PDF for their hard-working and dedication. Wu is very proud of his students for various awards received as a testimony of the excellence in academic, research and leadership of HQP trained at his laboratory.

This year I like to highlight Xiaohong Sun's work on ovomucin: Ovomucin is a glycoprotein from egg white, which accounts for ~3.5% of egg albumen protein. The ultimate goal of this work is to understand the potential of egg white ovomucin as a value-added ingredient and as an anti-fouling surface, to provide evidence-based knowledge on eggs beyond the food uses and thus to support a sustainably growing egg industry in Alberta and in Canada.

Ovomucin hydrolysates as value-added ingredient in follow-up formula:

Generally, ovomucin is insoluble at neutral pH or in the absence of denaturing agents, which may limit its future application. Ovomucin was hydrolyzed by different proteases to improve its solubility.

Our research demonstrated that sialic acid rich hydrolysate can be prepared with improved solubility; sialic acid is an essential nutrient for infants. Additionally, the sialic acid in ovomucin is Neu5Ac, the identical one found in human glycans but different from the form of Neu5Gc present in glycans of other mammals. Herein, ovomucin

hydrolysates have the potential to serve as a value-added ingredient to increase sialic acid content in follow-up formula.

Ovomucin glycopeptides as anti-adhesive agents against Enterotoxigenic Escherichia coli (ETEC) infection:
About 10 million episodes of traveler' ETEC associated diarrhea happens each year and ETEC diarrhea cause fatal consequence for children under five, especially in developing countries, about 157, 000 deaths annually. ETEC also are the big concern for swine industry, 20% to 50% of weaned piglets affected by ETEC diarrhea, causing substantial economic loss. The common approach to treat ETEC diarrhea is to use antibiotics which can develop antibiotic resistant bacterial. Since bacterial adhesion to host cell surfaces is the initial step in the infection process, anti-adhesive therapy is a promising alternative approach to prevent bacterial infection. Our results showed that ovomucin hydrolysates at the concentration of 2.5 mg/mL could efficiently prevent porcine ETEC adhesion to epithelial cells, which indicates their anti-adhesive activity and holds great promise to use ovomucin hydrolysates in functional foods and nutraceuticals.

Ovomucin as anti-fouling surface to prevent biofouling:
Biofouling, an undesired accumulation of biomacromolecules (e.g. proteins) or organisms (e.g. bacteria) on wetted surfaces, is a serious issue affecting numerous applications, such as biosensors, biomedical implants, and food industry. Biofouling is considered to be one of the major causes for the failure of in vivo biosensors. In the food industry, biofouling formation, especially biofilm, in pipes, equipment and cooling systems causes enormous economic losses through increasing maintenance costs and reducing equipment operational efficiencies. One promising approach is to prepare anti-fouling surfaces to address the biofouling problem. Our work suggested the potential of ovomucin as an anti-fouling surface, which would open new windows for developing cheap, abundant and effective anti-fouling biomaterials.

In summary, Xiaohong's work demonstrated the potential applications of ovomucin as an ingredient for follow-up formula due to its high sialic acid content, an anti-adhesive agent against infection, and an anti-fouling surface.

DR. MARTIN ZUIDHOF

This year my research team has been able to clearly demonstrate that precision feeding technology can be used to improve flock uniformity. In four separate experiments, we achieved pullet flocks with approximately 1% coefficient of variation in body weight. That means that the distribution of body weights of 2.3 kg pullets was very tight. In practical terms, 99.7% of the flock fell within 2.231 to 2.369 kg, or a range of 138 g. Under conventional feeding, body weight distributions would typically have a much wider range, such as 1.6 to 3.0 kg for a 10% coefficient of variation. We noted improved fertility in precision-fed vs. conventionally fed breeders, most likely due to tight control of male body weight. What surprised us was that the expected increase in egg production did not result from high uniformity alone. We achieved acceptable egg production in very few treatments over all of our studies. The successful treatments involved a substantial increase in feeding level. It appears that the precision feeding may change the birds' metabolism. Although it may be gentler on the birds in that they may eat several meals throughout the day, they do not deposit as much fat and may need a stronger nutritional signal to begin forming and laying eggs.

Investigating body weight management strategies will be a major research focus in the short term. Through collaboration with Dr. Bedecarrats at the University of Guelph, we are discovering lighting programs which can stimulate a more rapid onset of lay. We are expanding precision feeding investigations to laying hens and broilers. As a data acquisition tool, the precision feeding system has yielded phenomenal insights into broiler, broiler breeder, and layer efficiency and behaviour. We developed a new methodology for determining net energy of feeds by estimating total heat production. In layer pullets, we used precision feeding to raise pullets to 18 weeks of age with 13% less feed compared with ad libitum fed pullets. A precision feeding patent was filed, representing a major step toward commercialization.

The PRC Advisory Board and Committees

ADVISORY BOARD

Board Member	Representing	Position (end)	Committees
David Hyink	Alberta Chicken Producers	Chair (2017) Platform Partner	
Jenna Griffin	Egg Farmers of Alberta	Vice Chair (2017) Platform Partner	HCP Steering*
Martin Zuidhof	University of Alberta	Academic Leader	Engagement Governance
Clover Bench	University of Alberta	Research (2018) Ex Officio	
Valerie Carney	Livestock Research Branch Alberta Agriculture and Forestry	Technology Transfer (2018) Ex Officio	Engagement HCP Steering Communication
Doug Korver	University of Alberta	Education (2018) Ex Officio	
Ruurd Zijlstra	University of Alberta	Platform Partner	
Susan Novak	Alberta Livestock and Meat Agency	Platform Partner	Governance (chair)
Wes Johnson	Alberta Agriculture and Forestry	Platform Partner	Engagement Governance
Cora Scheele	Alberta Hatching Egg Producers	Platform Partner	Engagement
Sunny Mak	Sofina Foods	Platform Partner	
Kathleen Long	Maple Leaf Foods	Platform Partner	
Helen Anne Hudson	Burnbrae Farms	Individual (2016)	Engagement HCP Steering
Karen Summerfield	Egg Farmers of Canada	Platform Partner	Governance Communication
Cara Prout	Alberta Turkey Producers	Platform Partner	
Harold Dyck	Peavey Industries	Platform Partner	

COMMITTEES

Committee Member	Affiliation	Position	Committees
Agnes Kulinski	University of Alberta	Business director	HCP Steering
Mirko Betti	University of Alberta		Engagement
Rob Renema	Alberta Chicken Producers		Communication

* Heritage Chicken Program Steering Committee

Personnel - Poultry Unit Operations

Staff member	Affiliation	Role
Lyle Bouvier	University of Alberta	Poultry Unit Manager
Agnes Kulinski	University of Alberta	Business Development
Giles Hinse	University of Alberta	Poultry Unit Technician
Shawn Rankin	University of Alberta	Poultry Unit Technician
Rachelle Davidson	University of Alberta	Poultry Unit Technician
Chris Ouellette	University of Alberta	Instrumentation Technician
Jesse Hunter	University of Alberta	HCP Coordinator
Dr. Martin Zuidhof	University of Alberta	Academic Leader

Researchers

Name	Position (% FTE, if less than 100%)	Specialty	Student[1]			Technician	PDF[2]	Research Associate
			Grad	U/G[3]	Visiting			
Eduardo Beltranena	Research Scientist Adjunct Professor (33%)	Monogastric feeds & feeding				4		2
Clover Bench	Assistant Professor	Behaviour & welfare	1			1		
Mirko Betti	Associate Professor	Chemistry/ Muscle food biochemistry	5		1		6	1
Valerie Carney	Research & extension specialist Adjunct Professor	Applied poultry research				1		1
Ellen Goddard	Professor	Agricultural marketing & business						
Douglas Korver	Professor	Poultry nutrition	5.5			2		
Lynn McMullen	Professor (10%)	Food microbiology	2			1	2	
Aman Ullah	Assistant Professor	Poultry by-products	8.5	4	3	3	2	1
Jianping Wu	Associate Professor	High value egg utilization	12			2	6	1
Martin Zuidhof	Associate Professor	Poultry systems modeling	4		1	1		
			38	4	6	15	16	6

[1]Co-supervised students shown as increments of half student

[2]Post –Doctoral Fellow

[3]Undergraduate

Graduate Students (N = 38)

Student	Team	Degree	Focus
Jesse Hunter	Bench	MSc	Broiler foot pad dermatitis
Mengmeng Feng	Betti	PhD	Chemical glycation of collagen peptides
Henan Wang	Betti	PhD	Glycosaminoglycans and "the Meat Factor"
Dhungel Prinjiya	Betti	MSc	Nonenzymatic browning reaction of aminosugars
Yang Tianzhi	Betti	MSc	Allergen free meat products
Abiodun Bello	Korver	PhD	phytase in layer and broiler diets
Misaki Cho	Korver	PhD	breeder nutrition
Koonphol Pongmanee	Korver	PhD	phytase in layer diets
Oscar (Mauricio) Sanabria	Korver	MSc	replacements for antibiotic growth promotors
Felipe Silva	Korver	MSc	25-OH vitamin D3 in layer diets
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	
Yanet Rodriguez Herrero	Ullah	MSC	
M Safder	Ullah	PhD	
Wujun Zhao	Ullah	PhD	
M Zubair	Ullah	MSc	
Jorge Grock Pereira	Ullah/Siddique	MSc	
Ali Akbari	Wu	PhD	Canola proteins and potential applications
Nandika Bandara	Wu	PhD	Value addition to agricultural byproducts and waste proteins
Shreyak Chaplot	Wu	MSc	Effect of spent hen collagen peptide on skin health
Yussef Esparza	Wu	PhD	Feather keratin biomaterials
Hongbing Fan	Wu	PhD	Antihypertensive peptides from spent hen
Forough Jahandideh	Wu	MSc	Beneficial effects of egg peptides on metabolic syndrome
Qiyi Li	Wu	MSc	Production optimization and sensory evaluation of egg white protein hydrolysate
Jiandong Ren	Wu	PhD	The beneficial effects of phosvitin on bone health

Student	Team	Degree	Focus
Nan Shang	Wu	PhD	Egg protein and bone health
Xiaohong	Wu	PhD	Ovomucin as value added ingredient or antiadhesive agent
Selene Gonzalez Toledo	Wu	PhD	Value added egg yolk products
Liao Wang	Wu	PhD	Mechanisms of food protein derived antihypertensive peptides
Paulo Carneiro	Zuidhof	MSc	Precision feeding & efficiency
Sheila Hadinia	Zuidhof	PhD	Precision feeding & energy partitioning
Sasha van der Klein	Zuidhof	PhD	Precision feeding & epigenetics
Katelyn Humphreys	Zuidhof	MSc	Transgenerational effects of nutrition on broiler metabolism

Visiting Students and Scholars (N = 5)

Visitor	Team	Program
Xue Zhao	Betti	Visiting MSc
Niteesha Divulapally	Ullah	Visiting Research Student
Irshad Humna	Ullah	Visiting
Shahi Noureen	Ullah	Visiting PhD
Xavier Toublanc	Zuidhof	Visiting Student (MSc)

Summer Students (N = 4)

Visitor	Team	Program
Allemand Lynnette	Ullah	Summer Research Student
Saitz Rayeann	Ullah	Summer Research Student
Hall Rebekah	Ullah	Summer Research Student
Rizvi Syed Noor	Ullah	Summer Research Student

Technical Support (N = 37)

ASSITANTS AND TECHNICIANS

Name	Role	Team
Zahra Dehghani	Research Assistant	Beltranena
Cristina Neva	Research Technician	Beltranena
Dharma Shrestha	Research Assistant	Beltranena
Daniela Batres	Research Technician	Beltranena
Emmanuel Opoku Yeboah	Research Technician	Bench
Jessica Josephson	Research Technician	Carney
Kerry Nadeau	Research Technician	Korver
Daniella Batres	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

RESEARCH ASSOCIATES

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

POST DOCTORAL FELLOWS

Name	Team	Focus
Satyanarayana Bejiani	Betti	Valorization of Poultry processing by-products
Zied Khiari	Betti	Valorization of Poultry processing by-products
Abhihek Bhattacharjee	Betti	Cell culture and glycation
Zied Zhiari	Betti	Valorization of Poultry processing by-products
Abhihek Bhattacharjee	Betti	Cell culture and Maillard reaction
Yuliya Hrynets	Betti	Maillard Reaction
Petr Miller	McMullen	Food microbiology
Januana Teixeira	McMullen	Food microbiology
Muhammad Arshad	Ullah	Biomaterials
Mark Khosa	Ullah	Biomaterials
Muhammad Khosa	Wu	Value added egg science
Myoungjin Son	Wu	Benificial effects of egg white protein peptides on insulin resistance and type 2 diabetes
Hui Hong	Wu	Protein assembly
Chalamaiah Meram	Wu	novel applications for egg yolk in food and non food uses
Qingbiao Xu	Wu	Bioactive peptide absorption and screen bitter acceptors antagonist
Yu Wenlin	Wu	Structure and activity of bioactive peptides

Research Projects ($4,456,028 received in 2016)

FEED AND NUTRITION $602,659

Granting Body	Title	Received in 2016	Applicant	Planned Duration	Total grant
ALMA, EFA, EFC, SHAC, Cdn Bio-Systems	Carbon footprint	$306,500	Beltranena	2016-2019	$394,900
GF2	HyD Field Trial -- Colombia	$214,119	Beltranena	2016-2017	$171,120
DSM Nutritional Products	Net energy	$ -	Korver	2014-2016	$ 50,162
Dupont	Phytase use in laying hen diets	$ 50,000	Korver	2016-2016	$ 50,000
Danisco UK	Phytase use in laying hen diets	$ 25,785	Korver	2016-2017	$ 50,785
Danisco UK	Pullet rearing environment effects on bone	$ 6,255	Korver	2016-2017	$ 12,255
NSERC	Carbon footprint	$ -	Korver	2014-2016	$128,642

POULTRY HEALTH $41,670

Granting Body	Title	Received in 2016	Applicant	Planned Duration	Total grant
ALMA, ACP	Broiler foot pad dermatitis	$ -	C. Bench D. Korver T. Crowe	2014-2016	$ 145,832
AAFC Poultry Cluster	Broiler foot pad dermatitis	$ 18,720	C. Bench D. Korver T. Crowe	2014-2016	$ 113,046
ALMA	Genomic markers of broiler FPD	$ 22,950	C. Bench G. Plastow	2016-2017	$ 25,500

BACTERIOLOGY / FOOD SAFETY $787,380

Granting Body	Title	Received in 2016	Applicant	Planned Duration	Total grant
ALMA	Aerotolerance of Campylobacter	$83,000	B. Jeon L. McMullen	2016-2019	$221,000
NSERC	Bacteriocins for food safety	$31,000	L. McMullen	2012-2017	$155,000
ALMA, ACP, CPRC	Broiler barn sanitation	$46,000	D. Korver K. Liljebjelke L. McMullen M. Zuidhof T. Inglis B. Willing	2016-2019	$343,670
ALMA	Chicken GI tract microbiome	$67,500	D. Korver D. Guttman J. Brummel J. Parkinson S. Sharif	2016-2018	$240,000
AI-BIO, ALMA	Expanded pathogen detection	$289,880	L. McMullen L. Pilarski P. Pilarski	2015-2017	$579,760
ALMA	Heat resistance in E. coli and Salmonella	$108,000	M. Gänzle L. McMullen X. Yang A. Gill	2016-2019	$234,000
AI-BIO/ALMA	In-package non-thermal cold plasma treatment	$68,000	R. Symaladevi L. McMullen	2016-2019	$208,000
AI-BIO, ALMA	Process innovation to ensure lethality of Listeria	$94,000	L. McMullen M. Gänzle	2016-2019	$317,250

MEAT AND EGG PRODUCTS AND PROCESSES $2,084,595

Granting Body	Title	Received in 2016	Applicant	Planned Duration	Total grant
ALMA AI-Bio	Aminosugars as curing agents	$84,333	Betti Pietrasik Gaenzle	2015-2018	$253,000
NSERC DG	Antioxidant peptides in inflammatory and endothelial function	$40,000	Wu, J.	2013-2018	$200,000
Egg Farmers of Canada/NSERC	Bioactive peptides from spent hens	$128,761	Wu, J. (PI)	2014-2018	$502,959
ALMA	Biopolymer-based nanocomposites from poultry byproducts for packaging applications	$70,000	A. Ullah. J. Wu F. Temelli T. Siddique	2013-2016	$150,000
CPRC	Biopolymer-based nanocomposites from poultry byproducts for packaging applications	$70,000	A. Ullah. J. Wu F. Temelli T. Siddique	2013-2016	$60,000
NSERC CRD	Biopolymer-based nanocomposites from poultry byproducts for packaging applications	$70,000	A. Ullah. J. Wu F. Temelli T. Siddique	2013-2016	$73,456
Alberta Funding Consortium	Cruciferin/chitosan complex: a novel colon-targeted delivery system for probiotics	$85,533	Wu, J. (PI) Ganzle, M. Temelli, F.	2016-2018	$171,066
Alberta Economic Development and Trade Grant	Egg yolk for improved yolk stability in food applications	$269,000	Wu, J., (PI)	2016-2018	$269,000
ALMA	Enzymatic modification of egg lecithin and canola lecithin for functional food development	$71,500	Curtis, J. (PI) Field, C. Jacob, R. Wu, J	2014-2016	$143,000

Alberta Livestock & Meat Agency	Fractionation of valuable egg yolk components for niche market application	$152,514	Wu, J. Temelli, F.	2015-2017	$152,514
Egg Farmers of Canada	Fractionation of valuable egg yolk components for niche market application	$152,514	Wu, J. Temelli, F.	2015-2017	$94,000
ALMA	Free allergen meat products	$72,375	Pietrasik Betti	2016-2018	$144,750
ALMA	Funtional modification of gelatin	$77,500	Betti Peitrasik Gaudette	2014-2018	$310,000
Alberta Livestock & Meat Agency	Identification and functional characterization of novel bitter taste blockers	$27,000	Chelikani, P. (PI, UofM) Aluko, R. (UofM) Wu, J.	2015-2017	$164,000 (my portion, $54,000)
Al-Bio	Omega-3 nutritional egg yolk	$69,750	Wu, J., (PI) Wismer, W. Kulinski, A. Montpetit, P.	2014-2016	$138,500
EFC	Ovotransferrin peptides against metabolic syndrome	$128,000	Wu, J. Davidge, S. Proctor, S. Chan, C.	2015-2018	$256,000
ALMA	Ovotransferrin peptides against metabolic syndrome	$128,000	Wu, J. Davidge, S. Proctor, S. Chan, C.	2015-2018	$120,500
EFA	Ovotransferrin peptides against metabolic syndrome	$128,000	Wu, J. Davidge, S. Proctor, S. Chan, C.	2015-2018	$8,206
NSERC CRD/Michael Foods Ltd.	Phosvitin phosphopeptides and residual egg yolk applications	$172,315	Wu, J. (PI) Temelli, F.	2015-2019	$659,884

CPRC (Canadian Poultry Research Council)/Mitacs	Scale-up processing adhesive from spent hens	$60,000	Wu, J. (PI) Zeng, H. Chen, S.	2015-2017	$120,000
NSERC	Understanding the meat factor	$27,500	Betti	2014-2019	$137,500

BYPRODUCT UTILIZATION $347,514

Granting Body	Title	Received in 2016	Applicant	Planned Duration	Total grant
CPRC	Biopolymer nanocomposites from Poultry byproduct	$11,500	Ullah Wu Temelli Siddique	2013-2017	$60,000
ALMA	Biopolymer nanocomposites from Poultry byproduct	$54,875	Ullah Wu Temelli Siddique	2013-2016	$150,000
NSERC - CRD	Biopolymer-based Nanocomposites	$10,000	Ullah Wu Temelli Siddique	2014-2017	$72,015
NSERC (DG)	Fundamental understanding on nanomodification	$21,000	Ullah	2014-2019	$105,000
AI-Bio (funding consortium)	Monomers and biopolymers from plant oils	$60,300	Ullah Elias Zeng	2014-2017	$194,400
AI-Bio (ABF Res and Innovation Prg)	Scale Up Trials for Highly Efficient and Rapid Plant Oil Conversion Technology	$189,839	Ullah	2016-2018	$293,580

METABOLISM AND REPRODUCTION $220,152

Granting Body	Title	Received in 2016	Applicant	Planned Duration	Total grant
ALMA, Alberta Chicken Producers	Hatching egg shell quality	$ 90,000	D. Korver J. Hamidu T. Inglis	2016-2018	$247,760
ALMA	Offspring of precision fed breeders	$ 130,152	M. Zuidhof	2016-2018	$130,152

MANAGEMENT AND PHYSIOLOGY $25,000

Granting Body	Title	Received in 2016	Applicant	Planned Duration	Total grant
NSERC	Bone metabolism & Inflammation in Fowl	$25,000	D. Korver	2013-2018	$125,000
ALMA, EFA	Layer housing type and bone strength	$ -	C. Bench D. Korver	2014-2016	$108,000

POULTRY SYSTEMS $180,650

Granting Body	Title	Received in 2016	Applicant	Planned Duration	Total grant
NSERC	Broiler transportation	$25,000	D. Korver	2016	$25,000
CHEP	Lifetime productivity	$2,500	M. Zuidhof	2016-2018	$ 5,000
Cobb-Vantress	Lifetime productivity	$40,000	M. Zuidhof	2016-2018	$40,000
ALMA	Lifetime productivity	$40,000	M. Zuidhof	2016-2018	$88,114
CPRC	Lifetime productivity	$16,000	M. Zuidhof	2016-2018	$20,000
CPRC	Precision feeding and lighting	$16,000	M. Zuidhof G. Bedecarrats (Guelph)	2014-2017	$50,000
ALMA, ACP	Precision feeding and lighting	$35,000	M. Zuidhof G. Bedecarrats (Guelph)	2014-2017	$355,000
EFC, EFA	Precision feeding for layers	$6,150	M. Zuidhof	2015-2018	$75,000

LEARNING/TEACHING PROJECTS $166,408

Granting Body	Title	Received in 2016	Applicant	Planned Duration	Total grant
Alberta Livestock & Meat Agency	International Egg Symposium	$10,050	Wu, J.	2016-2016	$10,050
NSERC	International Egg Symposium	$10,000	Wu, J.	2016- 2017	$10,000
Multi Conference Sponsors	International Egg Symposium	$96,358	Wu, J.	2016-2017	$96,358
Alberta Livestock & Meat Agency	Working together: a unified communication and research adoption strategy for the PRC	$50,000	Carney, ACP, EFA, ATP, AHEP	2016-2018	$128,581

Facility Usage

RESEARCH FACILITIES

Facility	Overall	Broiler & Turkey Trials	Breeder Trials	Layer Trials	Unit Operations
	---------- Utilization Rate (%) ----------				
Brooder house 48 floor pens	61.1	13.8	6.3	3.1	37.9
Breeder hen cages 288 individual cages	68.2		18.3	49.9	
Breeder male cages 60 individual cages	0				
Nutrition house 32 pens	99.7		99.7		
Specht pullet cages 64 group cages	30.7	30.7			
Environmental chambers	100		100		
Test House Heritage breeds Floor pens	100				100
Test House Conventional cages	100			36.2	63.8
Test House Colony cages	100				100
Broiler Processing Plant (3 days per use)	-				
Hatchery					
Setter use AVN					
Hatcher use AVN					
Setter use BIG J	34.7	3.2	22.1		9.5
Hatcher use BIG J	4.1	0.8	0.8		2.5

NON-RESEARCH FACILITIES

Facility	Description	Utilization
Lilydale Room	Combined producer meetings	1
	Processors	1
	PRC alumni, exec group & educational institutions	23 days
	U of A, safety, animal care, animal handling, HACCP	9 days
	Industry related workshops (swine, dairy, AAF, etc.)	12 days
	Student presentations & community learning	8 days
	Community rental	35 days
Alberta Turkey Producers Computer Lab	Used by graduate students, undergraduate students, technicians and researchers	10 person h/d

Evidence of Productivity

ARTICLES PUBLISHED IN REFEREED JOURNALS (N = 37)

1. Akbari, A. and Wu, J. (2016). Cruciferin coating improves the stability of chitosan nanoparticles at low pHs. Journal of Materials Chemistry B. 4: 4988 – 5001 (Journal cover page).

2. Anam, F.; Abbas, A.; Lob, KM.; Hameed, S.; Ramasami, P.; Umar, Y.; Ullah, A.; Naseer, M. Synthesis, crystal structure, experimental and theoretical investigations of 3-(4-ethoxy-3-methoxyphenyl)-1-phenylprop-2-en-1-one, Journal of Molecular Structure, 2017,1127, 742–750.

3. Arshad, M.; Haung, L.; Ullah. A. Lipid-derived monomer and corresponding bio-based nanocomposites, Polymer International, 2016, 65 (6), pp 653–660

4. Arshad, M.; Kaur, M.; Ullah. A. Green Biocomposites from Nanoengineered Hybrid Natural Fiber and Biopolymer, ACS Sustainable Chem. Eng., 2016, 4 (3), pp 1785–1793

5. Arshad, M.; Khosa, MA.; Siddique, T.; Ullah, A*. Modified biopolymers as sorbents for the removal of naphthenic acids from oil sands process affected water (OSPW), Chemosphere, 2016, 163, 334–341.

6. Bench, C.J., Oryschak, M.A., and Korver, D.R. 2016. Short Communication: Oxidized sub-bituminous coal water additive has no adverse effect on growth performance or water consumption of growing broilers. Canadian Journal of Animal Science. 96: 466-470. Doi: 10.1139/cjas-2015-0172.

7. 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. March 2017 Issue. Doi: 10.1139/CJAS-2015-0202.

8. Bhattacherjee A., Y Hrynets and M Betti. 2016. Fructosazine, a Polyhydroxyalkylpyrazine with Antimicrobial Activity: Mechanism of Inhibition against Extremely Heat Resistant *Escherichia coli*. *Journal of Agricultural and Food Chemistry* 64 (45):8530–8539.

9. Chakrabarti, S. & Wu, J.* (2016). Bioactive peptides on endothelial function. Food Science and Human Wellness doi:10.1016/j.fshw.2015.11.004 (Invited).

10. Du L. and M. Betti. 2016. Chicken collagen hydrolysate cryoprotection of natural actomyosin: Mechanism studies during freeze-thaw cycles and simulated digestion. *Food Chemistry* 211:791–802

11. Du L. and M. Betti. 2016. Identification and Evaluation of Cryoprotective Peptides from Chicken Collagen: Ice-Growth Inhibition Activity Compared to That of Type I Antifreeze Proteins in Sucrose Model Systems. *Journal of Agricultural and Food Chemistry* 64 (25): 5232–5240.

12. 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.*

13. 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. Doi: 10.1016/j.applanim.2016.12.005.

14. Girard, T.E., Zuidhof, M.J., and Bench, C.J. 2017. Feeding, foraging, and feather pecking behaviours in precision-fed and skip-a-day broiler breeder pullets. Applied Animal Behaviour Science. Doi: 20.1016/j.applanim.2016.12.011.

15. Gu, Y. & Wu, J.* (2016). The potential of antioxidative and anti-inflammatory peptides in reducing the risk of cardiovascular diseases. Current Opinion in Food Science 8, 25-32 (Invited)

16. Gu, Y., and Wu, J. (2016). Bovine lactoferrin-derived ACE inhibitory tripeptide LRP also shows antioxidative and anti-inflammatory activities in endothelial cells. Journal of Functional Food 25: 375-284.

17. Hong P.K. and M. Betti. 2016. Non-enzymatic browning reaction of glucosamine at mild conditions: Relationship between colour formation, radical scavenging activity and α-dicarbonyl compounds production. *Food Chemistry* 212:234–243.

18. Hong P.K., M. Ndagijimana and M. Betti. 2016. Glucosamine-induced glycation of hydrolysed meat proteins in the presence or absence of transglutaminase: Chemical modifications and taste-enhancing activity. *Food Chemistry 197:1143–1152*.

19. Hrynets Y., A. Bhattacherjee, M. Ndagijimana, D. J. Hincapie Martinez, and M. Betti. 2016. Iron (Fe2+)-Catalyzed Glucosamine Browning at 50 °C: Identification and Quantification of Major Flavor Compounds for Antibacterial Activity. *Journal of Agricultural and Food Chemistry 64 (16): 3266–3275.*

20. Jahandideh, F., Chakrabarti, S., Davidge, S. & Wu, J.* (2016). Antioxidant peptides identified from ovotransferrin by the ORAC method did not show anti-inflammatory and antioxidant activities in endothelial cells. Journal of Agricultural and Food Chemistry 64 (1), 113–119.

21. Jahandideh, F., Chakrabarti, S., Majumder, K., Li, Q., Panahi, S., Morton, J. S., Davidge, S. T. and Wu, J. (2016). Egg white protein hydrolysate reduces blood pressure, improves vascular relaxation and modifies aortic angiotensin II receptors expression in spontaneously hypertensive rats. Journal of Functional Foods http://dx.doi.org/10.1016/j.jff.2016.10.019

22. Kaur, K., O. Tarassova, R.V. Dangeti, S. Azmi, D. Wishart, L. McMullen, M. Stiles. 2016. Characterization of a highly potent antimicrobial peptide microcin N from uropathogenic Escherichia coli. FEMS Microbiol. Lett. 363: doi: 10.1093/femsle/fnw095

23. Liao,W., Chakrabarti, S., Davidge, S. T., Wu, J. (2016). Modulatory Effects of Egg White Ovotransferrin-Derived Tripeptide IRW (Ile-Arg-Trp) on Vascular Smooth Muscle Cells against Angiotensin II Stimulation. Journal of Agricultural and Food Chemistry 64(39): 7342-7347.

24. Liu, Q. Q., H. Y. Peng, X. F. Lu, M. J. Zuidhof, X. F. Li, and X. C. Le. 2016. Arsenic species in chicken breast: Temporal variations of metabolites, elimination kinetics, and residual concentrations. Environ. Health Perspect. 124:1174-1181. doi 10.1289/ehp.1510530

25. Liu, X., P. Miller, U. Basu, L.M. McMullen. 2017. Differential gene expression and filamentation of Listeria monocytogenes 08-5923 exposed to sodium lactate and sodium diacetate. Food Microbiol. 63:153-158.

26. Lu, X., Hrynets, Y., and M. Betti. 2016. Transglutaminase-catalyzed amination of pea protein peptides using the biogenic amines histamine and tyramine. *Journal of the Science of Food and Agriculture 10.1002/jsfa.8057*.

27. Majumder, K., Mine, Y. & Wu, J.* (2016). The potential of food-protein derived anti-iflammatory peptides against various chronic inflammatory diseases. Journal of the Science of Food and Agriculture 96(7):2303-11 doi: 10.1002/jsfa.7600 (Commissioned)

28. Nimalaratne, C., Lopes-Lutz, D., Schieber, A. & Wu, J.* (2016). An isocratic fast liquid chromatographic method for quantifying xanthophylls and their stereoisomers. Journal of Separation Science. doi: 10.1002/jssc.201500656

29. Nimalaratne, C., Schieber, A. & Wu, J.* (2016). Effects of Storage and Cooking on the Antioxidant Capacity of Laying Hen Eggs. Food Chemistry 194, 111-116.

30. Roy B., N. A. Dileep, M. Betti and H. Bruce. 2016. Extraction and Characterization of Gelatin from Bovine Lung. 2016. *Food Science and Technology Research 10.3136/fstr.23*.

31. Sun, X., Chakrabarti, S., Fang, J., Yin, Y. & Wu, J.* Egg Protein Ovomucin Hydrolysates Differentially Regulate Inflammation in Human Dermal Fibroblasts. Nutrition Research 36(7): 648-57.

32. Sun, X., Gänzle, M., Field, C., Wu, J. Effect of proteolysis on the sialic acid content and bifidogenic activity of ovomucin hydrolysates. Food Chemistry 212: 78–86

33. Teixeira, J.S., M.B. Maier, P. Miller, M.G. Gänzle, L.M. McMullen. 2016. The effect of growth temperature, process temperature, and sodium chloride on the high-pressure inactivation of Listeria monocytogenes on ham. European Food Research and Technology 242:2021-2029.

34. 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.

35. 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*.

36. Woyengo, T. A., R. Patterson, B. A. Slominski, E. Beltranena, and R. T. Zijlstra. 2016. Nutritive value of cold-pressed camelina cake with or without supplementation of multi-enzyme in broiler chickens. Poultry Sci. 95:2314 Fraess, G., Bench, C.J., and Tierney, K. 2016. Automated behavioural response assessment to a feeding disturbance in two heritage chicken breeds. Applied Animal Behaviour Science. 179: 74-81. Doi: 10.1016/j.applanim.2016.03.002.

37. Zonglin, Y., H. Peng, X. Lu, R. Huang, B. Hu, G. Kachanoski, M. J. Zuidhof, X. C. Le. 2016. Arsenic metabolites, including n‑acetyl-4-hydroxy-m-arsanilic acid, in chicken litter from a Roxarsone-feeding study involving 1600 chickens. Environ. Sci. Tech. 50, 6737−6743. DOI: 10.1021/acs.est.5b05619 • Publication Date (Web): 13 Feb 2016

PRESENTATIONS AND ABSTRACTS (N = 108)

1. Abiodun Bello, Yueming Dersjant-Li, Doug Korver* Long-term effects of a Buttiauxella sp. phytase on performance, egg-shell quality, apparent ileal Ca and P digestibility, and bone properties of white egg layers. September 7, 2016. The Proceedings of the XXV World's Poultry Congress 2016. Beijing, China. P. 71.

2. Ahmadi, R.; Arshad, M.; Jin, L.; Ullah, A*. Microwave-Assisted Rapid Synthesis of Biopolyether from Plant Oil Derived Monomer, International Conference & Exhibition on Advanced & Nano Materials, August 1-3, 2016, Montreal, Quebec, Canada.

3. Arshad M.; George G.; Kuznetsova, A.; Ullah A*.; Siddique T*. Development of biopolymers for de-watering and consolidation of oil sands tailings. 14th International Symposium on Bioplastics, Biocomposites & Biorefining: Sustainable Bioeconomy to Marketplace May 31 to June 03, 2016, Guelph, Ontario, Canada.

4. Arshad M.; Kuznetsova, A.; Ullah A*.; Siddique T. Development of biopolymers for de-watering and consolidation of oil sands tailings. PRC Annual General Meeting, April 20-21, 2016, Edmonton, AB, Canada.

5. Arshad M.; Kuznetsova, A.; Ullah A*.; Siddique T. Development of biopolymers for de-watering and consolidation of oil sands tailings. The Future of Land Reclamation, March 09, 2016, Faculty Club, University of Alberta, Alberta Canada.

6. Arshad, M.; Ullah, A*. Conversion of Lipids into Various Chemicals/Monomers, 107th AOCS Annual Meeting & Expo, May 1–4, 2016, Salt Palace Convention Center Salt Lake City, Utah, USA

7. Bandara, N., and Wu, J. Value Added Utilization of Whole Spent Hen Protein in Plywood Manufacturing. 2016 PRC Annual Meeting, April 21, 2016, Edmonton, Alberta.

8. Bandara, N., Wu, J. (2016). Chemical modification of poultry feather keratin for biobased wood adhesive applications. 251st American Chemical Society National Meeting & Exposition. March 13-17th 2016, San Diego, California, USA. (Oral)

9. Bandara, N., Wu, J. (2016). Value addition to canola meal – progresses on developing canola protein based wood adhesives. 107th Annual Meeting of American Oil Chemist Society. May 1-4th 2016, Salt Lake City, Utah, USA. (Oral).

10. Bello, Abiodun*, Yueming Dersjant-Li, and Douglas R. Korver. 2016. The efficacy of two phytases on inositol phosphate degradation in different segments of the gastrointestinal tract and bone quality of broilers. Poultry Science Association Annual Meeting. New Orleans, LA. July 11, 2016. Poult. Sci. 95(E-Suppl. 1):10.

11. Beltranena, E. and M. A. Oryschak. 2016. Camelina sativa co-products as feedstuffs for poultry. Western Poultry Conference, Red Deer, Alberta, Feb 29.

12. Bench, C.J. Welfare Quality Assessments. 2016. Egg Farmers of Alberta Regional Meetings. Jan 19-21.

13. Bench, C.J., Opoku*, E.Y., Erickson, C., and Korver, D.R. 2016. Effect of commercial housing type on laying hen welfare and bone characteristics in Alberta. Poultry Science Association. New Orleans, LA, USA. July 11-14. Abstract #322P.

14. Bench, Clover J., Emmanuel Y. Opoku*, Caitlyn Erickson, and Douglas R. Korver. 2016. Effect of commercial housing type on laying hen welfare and bone characteristics in Alberta. Poultry Science Association Annual Meeting. July 14, 2016. New Orleans, LA. Poult. Sci. 95(E-Suppl. 1):111.

15. Betti M. and A. Bhattacherjee 2016. Trans-epithelial transport of Maillard reaction products (MRPs) through the GLUT receptor in a caco-2 cell line. 3 rd World Congress on Maillard Reaction & Glycation. May 26-27, Budapest, Hungary.

16. Chalamaiah, M., and Wu, J. (2016). Anti-inflammatory capacity of egg yolk water soluble proteins (livetins) and its derived peptides in LPS stimulated RAW 264.7 macrophages. 2016 International Egg Symposium, October 4-6, Banff, Alberta, Canada.

17. Chaplot, S., Chakrabarti, S., Offengenden, M. and Wu, J. Spent Hen Collagen Hydrolysates Differentially Mediate Protective Effects on Human Dermal Fibroblasts. 2016 PRC Annual Meeting, April 21, 2016, Edmonton, Alberta.

18. Chaplot, S., Wu, J. (2016). Spent hen collagen peptides as modulator of skin health. Oral presentation at the 2016 annual conference and exhibition Functional Foods, Nutraceuticals, Natural Health Products and Dietary Supplements (ISNFF), October 9-13, Orlando, FL, USA.

19. Esparza, Y., Ullah, A., Wu, J. Hydrogels from chicken feather keratins for tissue regeneration. 2016 PRC Annual Meeting, April 21, 2016, Edmonton, Alberta.

20. F. A. Silva*, R. Delgado, O. Ortiz, C.A. Lozano, D. Aldana, M. J. Zuidhof, D. R. Korver. Efectos del 25-OH- D_3 (HyD ®) sobre el desempeño, calidad de cáscara e integridad ósea de ponedoras comerciales: estudio de campo. DSM Dia Technico. Bogota, Colombia. November 22, 2016.

21. Fang, H., Wu, J. (2016). Spent hen muscle protein hydrolysate showed ability in inhibiting ACE activity and AT1 expression. 2016 annual conference and exhibition Functional Foods, Nutraceuticals, Natural Health Products and Dietary Supplements (ISNFF), October 9-13, Orlando, FL, USA.

22. Fatemi, Seyed, Douglas R. Korver*, and Kerry Nadeau. 2016. Effects of dietary 25-hydroxycholecalciferol on bone characteristics of broilers grown on reused litter. Poultry Science Association Annual Meeting. New Orleans, LA. July 12, 2016. Poult. Sci. 95(E-Suppl. 1):54.

23. Geng, K.; Ullah, A.* Synthesis and Characterization of Biopolymer from Plant Oil, U of A International's Symposium for the visiting interns, August 17, 2016 - Edmonton, AB, Canada.

24. Gonzalez SY, Wang J, Wu J (2016). Omega-3 egg yolk fortification using a processing approach. American Oil Chemist's Society (AOCS), May 1-4th, 2016, Salt Lake City, Utah, USA.

25. Gonzalez SY, Wang J, Wu J (2016). Omega-3 egg yolk fortification using a processing approach. International Egg Symposium, October 4-6th, 2016, Banff, AB, Canada.

26. Gonzalez, S.Y., Wu, J. Omega-3 enriched egg yolk. 2016 PRC Annual Meeting, April 21, 2016, Edmonton, Alberta.

27. Hadinia, S. H., P.R.O. Carneiro, C. A. Ouellette, and M. J. Zuidhof. 2016. How conventionally- and precision-fed broiler breeder hens use energy. Proceedings of the XXV World's Poultry Congress. Beijing, China. September 5-9, 2016.

28. Hall, R.; Saitz, R.; Arshad, M.; Ullah, A.* Renewable Polymers for the Delivery of Hydrophobic Drugs, WISEST research poster showcase August 16, 2016, U of A, Edmonton, AB, Canada.

29. Hrynets Y., A. Bhattacherjee and M. Betti. 2016. Antimicrobial activity of glucosamine-derived flavour compounds. 3rd World Congress on Maillard Reaction & Glycation. May 26-27, Budapest, Hungary.

30. Hunter*, J., Korver, D., Anders, S., Crowe, T., and Bench, C.J. 2016b. Practical assessment and management of foot pad dermatitis in broiler chickens. Poultry Science Association. New Orleans, LA, USA. July 11-14, 2016. Abstract # 68044.

31. Hunter*, J., Korver, D., Crowe, T., and Bench, C.J. 2016a. Impact of raised platforms and litter material on broiler chicken foot pad quality. Poultry Science Association. New Orleans, LA, USA. July 11-14, 2016. Abstract # 68058.

32. Hunter*, J.M., Korver, D.R., Anders, S., Crowe, T., and Bench, C.J. 2016. Foot pad dermatitis in Alberta broilers. Western Poultry Conference. Red Deer, AB, Feb 29, 2016

33. Hunter*, J.M., Korver, D.R., Anders, S., Crowe, T., and Bench, C.J. 2016. Foot pad dermatitis in Alberta broilers. Alberta Farm Animal Care Livestock Care Conference. Olds, Alberta, Canada. March 22-23, 2016.

34. Hunter*, J.M., Yeboah*, E.O., Anders, S., Crowe, T., Korver, D., and Bench, C.J. Improving foot pad quality in commercial broilers: benchmarking and practical strategies. ALMA Future Fare, October 13, 2016, Edmonton, AB.

35. Hunter, Jesse M.*, Douglas R. Korver, and Clover J. Bench. 2016. Effect of raised platforms and litter material on broiler chicken footpad quality. Poultry Science Association Annual Meeting. New Orleans, LA. July 12, 2016. Poult. Sci. 95(E-Suppl. 1):41.

36. Hunter, Jesse M.*, Douglas R. Korver, Sven M. Anders, Trever G. Crowe, and Clover J. Bench. 2016. Practical assessment and management of footpad dermatitis in broiler chickens. Poultry Science Association Annual Meeting. New Orleans, LA. July 11, 2016. Poult. Sci. 95(E-Suppl. 1):31.

37. Jahandideh, F., Chakrabarti, S., Davidge, S. T., Wu, J. (2016). Egg white hydrolysate positively affects insulin signaling in adipocytes. Accepted poster in International Union of Food Science and Technology. August 21-25, 2016, Dublin, Ireland.

38. Jahandideh, F., Davidge, S. T., Wu, J. (2016). Beneficial effects of egg white peptides on metabolic syndrome complications. Foodovation Conference, Nov 30-Dec 2, 2016, Leduc, AB, Canada

39. Jahandideh, F., Majumder, K., Chakrabarti, S., Panahi, S., Morton, J. S., Davidge, S. T., Wu, J. (2016). Simulated Gastro-Intestinal Digests of Fried Egg and its Fractions Lowers Blood Pressure, Plasma

Lipids and Oxidative Stress in Spontaneously Hypertensive Rats. International Egg Symposium. October 4-6, 2016, Banff, AB, Canada

40. Jahandideh, F., Wu, J.* (2016). Egg white protein hydrolysate reduces blood pressure, improves vascular relaxation and reduces aortic angiotensin II type 1 receptor expression in spontaneously hypertensive rats. 2016 annual conference and exhibition Functional Foods, Nutraceuticals, Natural Health Products and Dietary Supplements (ISNFF), October 9-13, Orlando, FL, USA. (Invited)

41. Jin, L.; Ullah, A*. Polyesters from renewable canola oil-based monomers, 14th International Symposium on Bioplastics, Biocomposites & Biorefining: Sustainable Bioeconomy to Marketplace May 31 to June 03, 2016, Guelph, Ontario, Canada

42. Kaur, M.; Ullah, A*. Nano-reinforced thermoplastic films from poultry feather keratin, 14th International Symposium on Bioplastics, Biocomposites & Biorefining: Sustainable Bioeconomy to Marketplace May 31 to June 03, 2016, Guelph, Ontario, Canada.

43. Kaur, M.; Ullah, A*. Poultry feather keratin based bio-nanocomposites, 3rd Annual Alberta Nano Research Symposium, May 26-27, 2016, Lister Centre, U of A.

44. Korver, D. R. 25-OH Vitamin D_3 and canthaxanthin in broiler breeder and broiler diets. Avicola San Ysidro, Guyaquil, Ecuador (Customer visit with DSM Nutritional Products). June 22, 2016.

45. Korver, D. R. 25-OH Vitamin D_3 and canthaxanthin in broiler, broiler breeder and turkey diets. Pronaca-Duran, Guyaquil, Ecuador (Customer visit with DSM Nutritional Products). June 23, 2016.

46. Korver, D. R. 25-OH Vitamin D_3 and canthaxanthin in poultry diets. Technical Training session for DSM marketing staff. Guayaquil, Ecuador. June 21, 2016.

47. Korver, D. R. Bone development in broilers and layers. De Heus Animal Nutrition. Ede, the Netherlands. May 25, 2106.

48. Korver, D. R. Bone development in broilers and layers. European Feed Team Meeting. Wageningen, the Netherlands. May 25, 2106

49. Korver, D. R. Bone metabolism in poultry. Poultry Outlook Forum – Middle East. Dubai, United Arab Emirates. March 13, 2016.

50. Korver, D. R. Breeder nutrition and its impact on progeny development. V Seminario Internacional de Nutrición. Asociación Colombiana de Médicos Veterinarios y Zootecnistas Especialistas en Avicultura. Bogota, Colombia. November 23, 2016.

51. Korver, D. R. Effects of 25-OH Vitamin D_3 on immune response, bone quality and meat yield of broiler chickens. Agripac, Guyaquil, Ecuador (Customer visit with DSM Nutritional Products). June 22, 2016.

52. Korver, D. R. Feeding laying hens for longer cycles – calcium metabolism, eggshells and bones. DSM Dia Technico. Bogota, Colombia. November 22, 2016.

53. Korver, D. R. Feeding laying hens for longer cycles – managing body weight and egg size. V Seminario Internacional de Nutrición. Asociación Colombiana de Médicos Veterinarios y Zootecnistas Especialistas en Avicultura. Bogota, Colombia. November 24, 2016.

54. Korver, D. R. Feeding the changing genotypes of layer and broiler chickens. Kasetsart University – Industry Seminar. Kamphaeng Saen, Thailand. October 6, 2016.

55. Korver, D. R. Feeding the hen for longer laying cycles. Layer Feed Quality Conference. Jakarta, Indonesia. October 17, 2016.

56. Korver, D. R. Feeding the hen for longer laying cycles. Layer Feed Quality Conference. Kuala Lumpur, Malaysia. October 20, 2016.

57. Korver, D. R. Keynote presentation: Pullet nutrition – setting the stage for success. Layer Feed Quality Conference. Jakarta, Indonesia. October 17, 2016.

58. Korver, D. R. Keynote presentation: Pullet nutrition – setting the stage for success. Layer Feed Quality Conference – Kuala Lumpur, Malaysia. October 20, 2016.

59. Korver, D. R. Management of egg size and shell quality in Layers. Danisco Animal Nutrition Seminar. Jakarta, Indonesia. September 21, 2016.

60. Korver, D. R. Management of egg size and shell quality in Layers. Wonokoyo Group, Surabaya, Indonesia. September 19, 2016.

61. Korver, D. R. Recent advances in breeder nutrition and its impact on progeny development. Jiuxing Group (Broiler Chicken company, Hebei, China; Customer visit with Novus International). September 5, 2016.

62. Korver, D. R. Recent advances in breeder nutrition and its impact on progeny development. Novus Industry Forum – Zhengzhou, China. September 10, 2016.

63. Korver, D. R. Recent advances in breeder nutrition and its impact on progeny development. Novus Industry Forum – Hachinohe, Japan. September 12, 2016.

64. Korver, D. R. Recent advances in breeder nutrition and its impact on progeny development. Novus Industry Forum – Fukuoka, Japan. September 13, 2016.

65. Korver, D. R. The requirement and functional role of dietary calcium and available phosphorus in bone development. Danisco Animal Nutrition Seminar. Jakarta, Indonesia. September 21, 2016.

66. Korver, Doug. 2016. Recent advances in breeder nutrition and its impact on progeny development. World's Poultry Congress. Beijing, China. September 7, 2016.

67. Li, Q., and Wu, J. Scale-up Production and Sensory Evaluation of Egg Protein Hydrolysate. 2016 PRC Annual Meeting, April 21, 2016, Edmonton, Alberta.

68. Liao, W., Guan, L., Davidge, S., Wu, J. Transcriptome analysis of rat mesenteric arteries treated with egg white derived tripeptide IQW. 2016 PRC Annual Meeting, April 21, 2016, Edmonton, Alberta.

69. Manage, D.*, J. Lauzon, P. Ward, P.M. Pilarski, L.M. Pilarski, L.M. McMullen. 2016. Cassette PCR for rapid detection of pathogenic Escherichia coli on meat. 3rd Annual Rapid Detection for Food Safety, Advances in Microbial Detection, Characterization and Process Validation, June 27-28, Baltimore, Maryland

70. Nimalaratne, C., Lopes-Lutz, D., Savard, P., Gauthier, S.F., Schieber, A., Wu, J. Antioxidants in egg yolk. 2016 PRC annual meeting, April 21, 2016, Edmonton, Alberta.

71. Opoku Yeboah*, E. and Bench, C.J. 2016. Nutrition and foot pad dermatitis. Western Poultry Conference. Red Deer, AB, Feb 29, 2016.

72. Opoku Yeboah*, E. and Bench, C.J. 2016. Nutrition and foot pad dermatitis. Alberta Farm Animal Care Livestock Care Conference. Olds, Alberta, Canada. March 22-23, 2016.

73. Oryschak, M. A., and E. Beltranena. 2016. Feeding canola meal to table egg layers. Flocktalk Lethbridge, AB, Feb 04.

74. Pongmanee, K.* and D. R. Korver. 2016. The effects of dietary phosphorus and calcium, and phytase supplementation on production, eggshell and bone quality in laying hens from 55 to 74 weeks of age. Western Poultry Conference. Red Deer, AB, Feb 29, 2016.

75. Pongmanee, Koonphol* and Douglas R. Korver. 2016. Effects of dietary phytase on production, eggshell quality, and bone traits in laying hens from 55 to 74 weeks of age. Poultry Science Association Annual Meeting. New Orleans, LA. July 11, 2016. Poult. Sci. 95(E-Suppl. 1):10.

76. Ren, J. and Wu, J. (2016). Using aqueous extraction of phosvitin or Ethylenediaminetetraacetic acid (EDTA) to remove iron from egg yolk. The 2016 International Egg Symposium, October 4-6, 2016, Banff, Alberta, Canada.

77. Rizvi, N.; Arshad, M.; Ullah, A*. Production of Amphiphilic Block Copolymers Using Canola Oil Fatty Acids to Incorporate Carbamazepine, WISEST research poster showcase August 16, 2016, U of A, Edmonton, AB, Canada.

78. Robocon, D.R.*, K. Kaur and L.M. McMullen. 2016. The effectiveness of leucocin A to inhibit Listeria monocytogenes on ready to eat meats in the presence of an autochthonous spoilage organism, Brochothrix thermosphacta. International Association of Food Protection Annual Conference, July 30-Aug 4, 2016, St Louis MO

79. Rodriguez, A. M. J. Zuidhof, C. Hanlon, B. Sparling, and G. Y. Bedecarrats. 2016. Effects of main and supplemental light spectrum on broiler breeder growth and maturation. Poultry Sci. 95(Suppl. 1):22.

80. Safder, M.; Temelli, F.; Ullah, A*. Extraction of Lipids from spent fowl and conversion into Bionanocomposites, 14th International Symposium on Bioplastics, Biocomposites & Biorefining: Sustainable Bioeconomy to Marketplace May 31 to June 03, 2016, Guelph, Ontario, Canada.

81. Saitz, R.; Hall, R.; Arshad, M.; Ullah, A*. Producing Polymers from Soybean Oil for Drug Delivery, WISEST research poster showcase August 16, 2016, U of A, Edmonton, AB, Canada.

82. Shang, N. and Wu, J. (2016). Egg white ovotransferrin promotes proliferation, differentiation and mineralization of MC3T3-E1 osteoblastic cells. 2016 International Egg Symposium, October 4-6, 2016, Banff, AB, Canada

83. Silva, F. A.*, R. Delgado, M. J. Zuidhof and D. R. Korver. 2016. Effects of 25-OH-D3 on growth and laying performance and egg shell quality of brown egg layers. Western Poultry Conference. Red Deer, AB, Feb 29, 2016.

84. Silva, Felipe A. *, Ramiro Delgado, Oscar Ortiz, Carlos A. Lozano, Diego F. Aldana, Martin J. Zuidhof, and Douglas R. Korver. 2016. Effects of 25-OH-D3 on performance, egg quality, and bone traits of brown egg layers. Poultry Science Association Annual Meeting. New Orleans, LA. July 12, 2016. Poult. Sci. 95(E-Suppl. 1):55.

85. Son, M., Wu, J. Beneficial effect of egg white protein biopeptides on insulin resistance in type 2 diabetes. 2016 PRC Annual Meeting, April 21, 2016, Edmonton, Alberta.

86. Sun, X. and Wu, J. (2016). Ovomucin derived peptides as anti-adhesive agents against infectious diseases. 251st ACS National Meeting & Exposition, March 13-17, 2016, San Diego, CA, USA. (Invited)

87. Teixeira, J., L.M. McMullen and M. Ganzle. 2016. Effect of pressure and spoilage microbiota on survival and post-pressure growth of Listeria monocytogenes on ham. 9th International Conference on High Pressure Bioscience and Biotechnology, July 25-29, Toronto, ON.

88. Torres, C. A.* and D. R. Korver. 2016. Influences of maternal flock age and trace mineral nutrition on avian embryo bone development. Poultry Science Association Annual Meeting. New Orleans, LA. July 14, 2016.

89. Ullah, A*. Monomers, Biopolymers and Bio-nanomaterials from Renewable Lipids, International Conference & Exhibition on Advanced & Nano Materials, August 1-3, 2016, Montreal, Quebec, Canada.

90. Ullah, A*; Arshad, M; Zhang, S. Conversion of Lipids into Monomers and Conjugates/Block Copolymers, 14th International Symposium on Bioplastics, Biocomposites & Biorefining: Sustainable Bioeconomy to Marketplace May 31 to June 03, 2016, Guelph, Ontario, Canada.

91. Ullah, A.* Conversion of lipids into biopolymers and conjugates, 2nd World Congress on Biopolymers, August 04-05, 2016 Manchester, UK

92. van der Klein, S.A.S., C. A. Ouellette, and M. J. Zuidhof. 2016. Diet induced thermogenesis in broilers: A precision feeding approach. Poultry Sci. 95(Suppl. 1):52.

93. van der Klein, S.A.S., C. A. Ouellette, and M. J. Zuidhof. 2016. Precision feeding layer pullets: How does it affect feeding behaviour? Proceedings of the XXV World's Poultry Congress. Beijing, China. September 5-9, 2016.

94. Wang, J., Wu, J. (2016). Purification and characterization of antioxidant peptides from cooked eggs using a dynamic in vitro gastrointestinal model. Poster presentation at 2016 International Egg Symposium, Banff, Alberta, Canada, October 4-6, 2016.

95. Wang, L, Wu, J. (2016). Modulatory effect of egg white ovotransferrin-derived tripeptide IRW (Ile-Arg-Trp) in vascular smooth muscle cells against angiotensin II stimulation. Oral presentation at the 2016 annual conference and exhibition Functional Foods, Nutraceuticals, Natural Health Products and Dietary Supplements (ISNFF), October 9-13, Orlando, FL, USA.

96. Wu, J. (2016). Antioxidant peptides identified by ORAC method did not show activity in cells. 9th International Symposium of Food Science, July 30-31, Shenyang, Liaoning, China. (Invited)

97. Wu, J. (2016). Recent Progresses on egg nutrition and value-added uses. Oral presentation at the 13th China Egg Science and Technology Conference & 3rd International Symposium of Egg Science & Technology, October 21-23, Nanchang, Jiangxi, China. (Invited)

98. Wu, J. (2016). Revisit the mechanisms of ACE inhibitory peptides from food proteins. Food Bioactives and Health Conference, September 13-15, Norwich, UK (I prepared the PPT and had asked Dr. Chibuike Udenigwei to present at the conference on my behalf) (Invited)

99. Wu, J. (2016). The potential of meat proteins as a source of bioactive peptides. International Workshop of Meat Quality and Processing Technology. August 10-12, Beijing, China. (Invited)

100. Wu, J. Revisit the mechanisms of ACE inhibitory peptides. University of Limerick, Ireland, May 23, 2016. (Invited)

101. Zubair, M.; Wu, J.; Ullah, A*. Protein Derived Biodegradable Food Packaging Material from Poultry Byproduct, 107th AOCS Annual Meeting & Expo, May 1–4, 2016, Salt Palace Convention Center Salt Lake City, Utah, USA.

102. Zubair, M.; Wu, J.; Ullah, A.*. Protein derived bionanocomposites for food packaging. 14th International Symposium on Bioplastics, Biocomposites & Biorefining: Sustainable Bioeconomy to Marketplace May 31 to June 03, 2016, Guelph, Ontario, Canada.

103. Zuidhof, M. J. 2016. Broiler breeder feeding management: Do NOT do what you've always done. Saskatchewan Hatching Egg Producers. Saskatoon, SK. March 17, 2016.

104. Zuidhof, M. J. 2016. Critical update on net energy research and implementation status in poultry. Informal Nutrition Conference, New Orleans, LA. July 11-14, 2016.

105. Zuidhof, M. J. 2016. Optimum feeding of pullets. Multi-State Poultry Meeting, Indianapolis, IN. May 24-26, 2016. 6 pp.

106. Zuidhof, M. J. 2016. Overview of poultry research in Alberta: Poultry Research Centre. Presentation to Turkey Farmers of Canada Strategic Research Forum. Edmonton, AB. June 7, 2016.

107. Zuidhof, M. J. 2016. Precision Feeding Update. Presentation to Alberta Hatching Egg Producers board and staff. Edmonton, AB. August 30, 2016.

108. Zuidhof, M. J., P. R. Carneiro, S. Hadinia, S. A. S. van der Klein, A. Rodriguez, and G. Y. Bedecarrats. 2016. Precision Poultry Nutrition. 52nd Eastern Nutrition Conference, Guelph, ON. May 11-12, 2016. 9 pp.

BOOKS AND BOOK CHAPTERS (N = 1)

Korver D, LM McMullen. 2017. Egg production systems and *Salmonella* in Canada, pg 59-69. *In* Ricke SC and RK Gast (ed.), Producing Safe Eggs: Microbial ecology of *Salmonella.* Elsevier, NY.

RESEARCH REPORTS (N = 21)

1. Bench, C.J. and Korver, D.R. 2016. Effect of commercial housing type on laying hen welfare and bone characteristics in Alberta. ALMA/ACP Final Report. November 30. 44 pages.

2. Bench, C.J., Korver, D., and Erickson*, C. 2016. Individual laying hen producer research data reports. February 2016.

3. Bench, C.J., Korver, D., Crowe, T., Hunter*, J., and Yeboah, E. 2016. Individual broiler producer research data reports. January 2016.

4. Bench, C.J., Korver, D.R., and Crowe, T. 2016. 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 Interim Report. April 30, 2016. 17 pages plus attestations.

5. Bench, C.J., Korver, D.R., and Crowe, T. 2016. Improving foot pad quality in commercial broilers: Benchmarking and practical strategies. ALMA/EFA Final Report. November 30. 55 pages.

6. Fatemi, S. A., C. Fitzsimmons, J. L. Saunders-Blades, M. J. Zuidhof and D. R. Korver. 2016. Characterization of the effect of 25-OH vitamin D3 on breast meat yield, innate immune function and bone development. Final project report to DSM Nutritional Products. January 2016. 69 pages.

7. Final report “2016 International Egg Symposium”, submitted to Alberta Government, 4 pages.

8. Final report for “Improving omega-3 nutritional egg yolk particle content through ingredient formulation shifting from a feed strategy to a processing strategy”, submitted to the sponsor, 17 pages.

9. 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, 6 pages

10. 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), 12 pages.

11. M. Betti and M. Ndagijimana. 2016. Functionalized peptides for skin care produced from bovine and poultry collagen biomass. Final report (Submitted to ALMA).

12. M. Betti and Z. Pietrasik. 2016. Gelatin: new ideas to obtain added value for an old molecule. Interim report (submitted to ALMA).

13. M. Betti, Z. Pietrasik and M. Gaenzle. 2016. The versatile amino-sugar: glucosamine as a possible new curing and preservative agent in meat products. Interim report (submitted to ALMA)

14. Pongmanee, K. and D. R. Korver. AB Vista Quantum Blue Phytase Progress Report Pullet & Layer Trial 2014. January, 2016. 16 pages.

15. Torres, C. A. and D. R. Korver. 2016. The influence of maternal dietary Cu, Zn and Mn on embryo and chick bone development from hens of different ages. Final report to Novus International, Inc. March, 2016. 51 pages.

16. Zuidhof, M. J. 2015. The Poultry Research Centre Annual Report (2015-2016). The Poultry Research Centre, The University of Alberta, Edmonton, AB, T6G 2P5. 45 pp.

17. Zuidhof, M. J. 2016. Precision Broiler Breeder Feeding System. Final Report to Alberta Livestock and Meat Agency. Project #2011F121R. March 10, 2016. 48 pp.

18. Zuidhof, M. J. 2016. Precision Feeding Layers for Improved Uniformity, Production, and Sustainability. Interim report to Agriculture Funding Consortium. Project #2015E016R. February 7, 2016. 10 pp.

19. Zuidhof, M. J. and A. Kulinski. 2016. Poultry Research Centre – Support for business director. Interim report to AI-Bio. Project #BIO-12-002. October 12, 2016. 4 pp.

20. Zuidhof, M. J., and G. Y. Bedecarrats. 2016. Optimizing Lighting for Precision Broiler Breeder Feeding. Interim report to Canadian Poultry Research Council. Project #PWB078. November 30, 2016. 12 pp.

21. Zuidhof, M. J., and G. Y. Bedecarrats. 2016. Optimizing Lighting for Precision Broiler Breeder Feeding. Interim report to Alberta Agriculture and Forestry. Project #2014F182R. December 31, 2016. 12 pp.

PATENT APPLICATIONS (N = 1)

Zuidhof, M. J., M. V. Fedorak, C. C. Kirchen, E. H. M. Lou, C. A. Ouellette, and I. I. Wenger. 2016. System and method for feeding animals. PrecisionZX, Inc., assignee. Pat. No. United States Patent Application No. 15/283,125. 74 pp.

Financial Report 2016-2017

PRC – OVERALL REPORT[1]

Income 2016 -2017

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
AI-BIO	100,000.00		100,000.00
ALMA			0.00
UofA		1,552,480.00	1,552,480.00
Sub-total	**398,549.00**	**1,925,080.00**	**2,323,629.00**
Opening balance - Industry	115,489.73		115,489.73
Opening balance - AAF	0.00		0.00
Opening balance - AI-BIO	49,366.07		49,366.07
Opening balance - ALMA			0.00
TOTAL PRC	**563,404.80**	**1,925,080.00**	**2,488,484.80**

Expenses 2016 - 2017

	Cash	In-Kind*	Total
Salaries and benefits (2 academic staffs)	315,269.78	1,890,080.00	2,205,349.78
Salaries and benefits (2 support staffs + Bus. Dev)	212,990.17	35,000.00	247,990.17
Supplies and Services	44,066.59		44,066.59
Repairs and Maintenance	0.00		0.00
Equipment	0.00		0.00
Others (incl. travel, overhead)	5,474.10		5,474.10
Total Expenses	**577,800.64**	**1,925,080.00**	**2,502,880.64**

Revenue/Expense Summary 2016 - 2017

	Cash	In-Kind*	Total
Total Income (incl. carryover)	563,404.80	1,925,080.00	2,488,484.80
Total Expenses	577,800.64	1,925,080.00	2,502,880.64
Subtotal from Industry Grant			**(14,395.84)**
Refund to AIBIO	(44,932.12)		(44,932.12)
UofA contribution - Academic salary and Benefits	52,214.06		52,214.06
UofA contribution - Support Staff salary and Benefits	540.00		540.00
Total carryover to 2017/18			**(6,573.90)**

[1] The overall 2016-17 PRC financial report is the combination of the individual 2016-17 financial report for Industry, AAF and AI-BIO 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 FTE equivalents of academic staffs involved in the PRC activities. The UofA in-kind support of $385,750 (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 FINANCIAL REPORT 2016 - 2017

Income 2016 - 2017	**Actuals as of March 31, 2017**		
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		1,552,480.00	1,552,480.00
Sub-total	**255,549.00**	**1,587,480.00**	**1,843,029.00**
Opening balance	115,489.73		115,489.73
TOTAL INDUSTRY	**371,038.73**	**1,587,480.00**	**1,958,518.73**

Expenses 2016 – 2017	**Actuals as of March 31, 2017**		
	Cash	**In-Kind***	**Total**
Salaries and benefits (2 academic staffs)	315,269.78	1,552,480.00	1,867,749.78
Salaries and benefits (3 support staffs)	109,785.25	35,000.00	144,785.25
Supplies and Services	311.66		311.66
Repairs and Maintenance			0.00
Equipment			0.00
Other (incl. travel and overhead)	5,000.00		5,000.00
Total Expenses*	**430,366.69**	**1,587,480.00**	**2,017,846.69**

Income/Expense Summary 2016 - 2017	**Actuals as of March 31, 2017**		
	Cash	**In-Kind***	**Total**
Total Income (incl. carryover)	371,038.73	1,587,480.00	1,958,518.73
Total Expenses	430,366.69	1,587,480.00	2,017,846.69
Subtotal from Industry Grant	**(59,327.96)**		**(59,327.96)**
UofA contribution - Academic salary and Benefits	52,214.06		52,214.06
UofA contribution - Support Staff salary and Benefits	540.00		540.00
Carryover/Surplus to 2017/18			**(6,573.90)**

*In-Kind support from the UofA includes approximately 4 FTE equivalents of academic staffs involved in the PRC activities. The UofA in-kind support of $385,750 (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 2016 - 2017

Income 2016 - 2017 **Actuals as of March 31, 2017**

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 2016 – 2017 **Actuals as of March 31, 2017**

	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 2016 - 2017 **Actuals as of March 31, 2017**

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 2017/18			**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

PRC - AI BIO AND ALMA GRANT FINANCIAL REPORT 2016 - 2017

Income 2016 - 2017 **Actuals as of March 31, 2017**

Provincial funder	**Cash**	**In-Kind**	**Total**
AI- Bio	100,000.00		100,000.00
ALMA	0.00		0.00
Sub-total	**100,000.00**		**100,000.00**
Opening balance	49,366.07		49,366.07
TOTAL ALMA/AI-Bio	**149,366.07**		**149,366.07**

Expenses 2016 – 2017 **Actuals as of March 31, 2017**

	Cash	**In-Kind**	**Total**
Salaries and benefits (Business Development)	60,204.92		60,204.92
Supplies and Services	43,754.93		43,754.93
Repairs and Maintenance			0.00
Equipment			0.00
Other (incl. travel)	474.10		474.10
Total Expenses*	**104,433.95**		**104,433.95**

Income/Expense Summary 2016 - 2017 **Actuals as of March 31, 2017**

Total Income	149,366.07	149,366.07
Total Expenses	104,433.95	104,433.95
Sub-total	**44,932.12**	**44,932.12**
Refund to AIBIO	(44,932.12)	(44,932.12)
Carryover/Surplus to 2017/18		**0.00**

POULTRY UNIT FINANCIAL REPORT 2016 - 2017

Income 2016 – 2017		**Actuals as of March 31, 2017**	
Poultry Unit	**Cash**	**In-Kind**	**Total**
U of A/AFNS	194,689.15		194,689.15
Poultry Unit (Internal revenue)†	149,225.21		149,225.21
Poultry Unit (External revenue)‡	281,347.92		281,347.92
Sub-total	**625,262.28**		**625,262.28**
Opening balance	138,404.00		138,404.00
Total UofA	**763,666.28**		**763,666.28**

Expenses 2016 – 2017		**Actuals as of March 31, 2017**	
	Cash	**In-Kind**	**Total**
Salaries and benefits (3 support staffs)	327,076.36		327,076.36
Supplies and services (incl. feed cost)	190,858.03		190,858.03
Repairs and Maintenance	7,630.29		7,630.29
Equipment	0.00		0.00
Others (incl. communication, travel, finance fees, Rentals)	16,902.80		16,902.80
Total Expenses	**542,467.48**		**542,467.48**

Income/Expense Summary 2016 - 2017		**Actuals as of March 31, 2017**
Total Income (incl. carryover)	763,666.28	763,666.28
Total Expenses	542,467.48	542,467.48
Subtotal from Poultry Unit	**221,198.80**	**221,198.80**
PRC contribution		0.00
Carryover/surplus to 2017/18		**221,198.80**

† Poultry Unit Internal Revenue includes U of A user fees (animal and facilities) related to research projects, bird and egg sale for research and funds from Facility and Operation related to the Turkey Barn demolition.

‡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.

PRC – OVERALL BUDGET 2017-2018

Income 2017 – 2018 (Budget)

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		2,552,550.00	2,552,550.00
Sub-total	**298,549.00**	**2,925,150.00**	**3,223,699.00**
Opening balance - Industry	(6,573.90)		(6,573.90)
Opening balance - AAF			0.00
TOTAL PRC	**291,975.10**	**2,925,150.00**	**3,217,125.10**

Expenses 2017 - 2018 (Budget)

	Cash	In-Kind*	Total
Salaries and benefits (2 Staff + PRC Coord.)	238,000.00	2,925,150.00	3,163,150.00
Supplies and Services	10,000.00		10,000.00
Repairs and Maintenance	13,000.00		13,000.00
Equipment	10,000.00		10,000.00
Others (incl. travel, overhead)	21,000.00		21,000.00
Total Expenses	**292,000.00**	**2,925,150.00**	**3,217,150.00**

Revenue/Expense Summary 2017 - 2018 (Budget)

	Cash	In-Kind*	Total
Total Income (incl. carryover)	291,975.10	2,925,150.00	3,217,125.10
Total Expenses	292,000.00	2,925,150.00	3,217,150.00
Total carryover to 2018/19			**(24.90)**

[1] The overall PRC budget is the combination of the individual budget for Industry, AAF and AI-BIO 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 6.63 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 2017-2018

Income 2017 – 2018 (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		2,552,550.00	2,552,550.00
Sub-total	**255,549.00**	**2,587,550.00**	**2,843,099.00**
Opening balance	(6,573.90)		(6,573.90)
TOTAL INDUSTRY	**248,975.10**	**2,587,550.00**	**2,836,525.10**

Expenses 2017 - 2018 (Budget)

	Cash	In-Kind*	Total
Salaries and benefits (2 Staffs + PRC Coord.)	228,000.00	2,587,550.00	2,815,550.00
Supplies and Services	0.00		0.00
Repairs and Maintenance	5000.00		5000.00
Equipment			0.00
Others (incl. overhead)	16,000.00		16,000.00
Total Expenses	**249,000.00**	**2,587,550.00**	**2,836,550.00**

Revenue/Expense Summary 2017 - 2018 (Budget)

	Cash	In-Kind*	Total
Total Income (incl. carryover)	248,975.10	2,587,550.00	2,836,525.10
Total Expenses	249,000.00	2,587,550.00	2,836,550.00
Total carryover to 2018/19			**(24.90)**

*In-Kind support from the UofA includes approximately 6.63 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 BUDGET 2017-2018

Income 2017 – 2018 (Budget)

Alberta Government	Cash	In-Kind*	Total
AARD	43,000.00	337,600.00	380,600.00
Opening balance	0		0
TOTAL AAF	**43,000.00**	**337,600.00**	**380,600.00**

Expenses 2017 - 2018 (Budget)

	Cash	In-Kind	Total
Salaries and benefits (PRC Coord.)	10,000.00	337,600.00	347,600.00
Supplies and Services	10,000.00		10,000.00
Repairs and Maintenance	8,000.00		8,000.00
Equipment	10,000.00		10,000.00
Others (incl. travel)	5,000.00		5,000.00
Total Expenses	**43,000.00**	**337,600.00**	**380,600.00**

Revenue/Expense Summary 2017 - 2018 (Budget)

	Cash	In-Kind	Total
Total Income (incl. carryover)	43,000.00	337,600.00	380,600.00
Total Expenses	43,000.00	337,600.00	380,600.00
Total carryover 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 BUDGET 2017 - 2018

Income 2017 - 2018 (budget)

	Cash	In-Kind	Total
U of A/AFNS	196,000.00		196,000.00
Poultry Unit (Internal revenue)†	65,000.00		65,000.00
Poultry Unit (External revenue)‡	180,000.00		180,000.00
Sub-total	**441,000.00**		**441,000.00**
Opening balance	221,198.80		221,198.80
Total UofA	**662,198.80**		**662,198.80**

Expenses 2017 - 2018 (budget)

	Cash	In-Kind	Total
Salaries and benefits (3 support staffs)	320,000.00		320,000.00
Supplies and services (incl. feed cost)	185,000.00		185,000.00
Repairs and Maintenance	45,000.00		45,000.00
Equipment	30,000.00		30,000.00
Others (incl. communication, travel, finance fees, Rentals)	10,000.00		10,000.00
Total Expenses	**590,000.00**		**590,000.00**

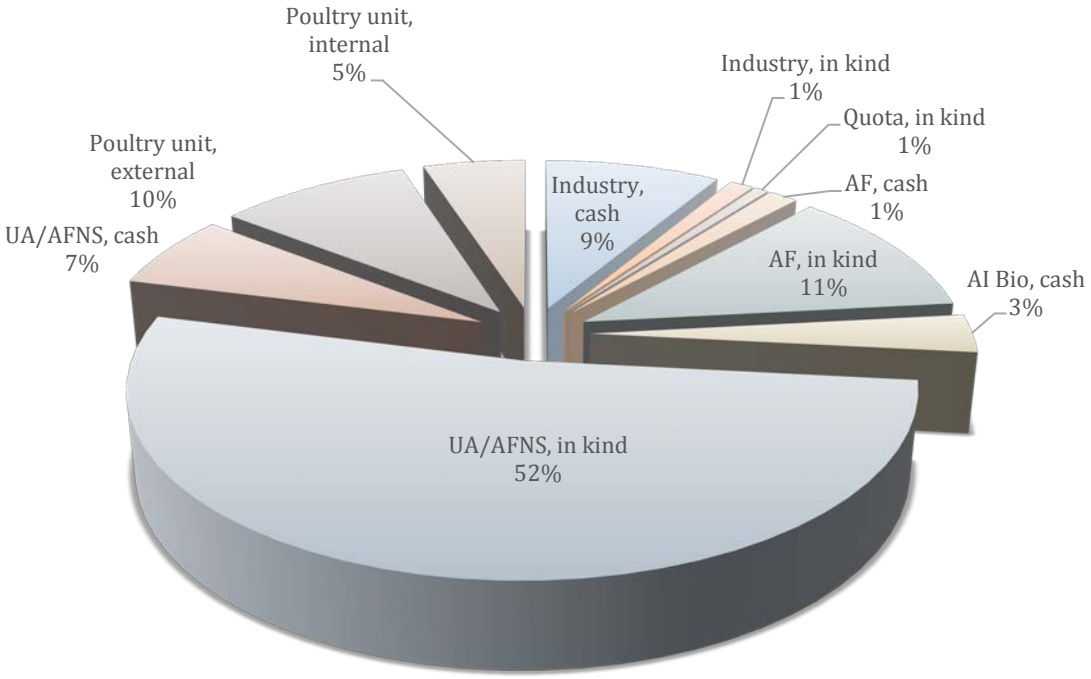
Income/Expense Summary 2017 - 2018 (budget)

	Cash	In-Kind	Total
Total Income (incl. carryover)	662,198.80	0.00	662,198.80
Total Expenses	590,000.00	0.00	590,000.00
Subtotal from Poultry Unit	73,331.65	0.00	73,331.65
PRC contribution			0.00
Carryover (surplus) to 2018/19			**72,198.80**

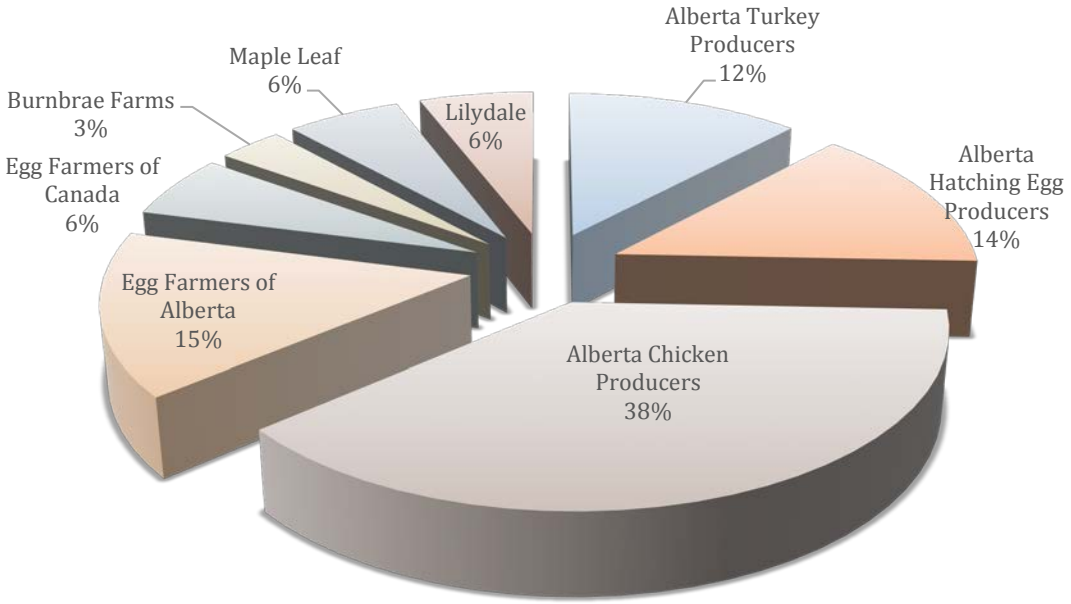
† Poultry Unit Internal revenue includes user fees (animal and facilities) related to research project, bird and egg sale for research and funds from Facility and Operation related to the Turkey Barn demolition.

‡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.

PRC FUNDING: ALL SOURCES RECEIVED IN 2016-2017 ($)



PRC FUNDING: INDUSTRY CASH SOURCES RECEIVED IN 2016-2017 ($)



Acronyms and Abbreviations Used

Abbreviation	*Definition*
ACP	Alberta Chicken Producers
AF	Alberta Agriculture and Forestry
AFNS	Department of Agricultural, Food and Nutritional Science
AHEP	Alberta Hatching Egg Producers
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
ATP	Alberta Turkey Producers
CPRC	Canadian Poultry Research Council
EFA	Egg Farmers of Alberta
EFC	Egg Farmers of Canada
FGSR	Faculty of Graduate Studies and Research
GSA	Graduate Students Association
HCP	Heritage Chicken Program
HQP	Highly Qualified Personnel
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
WPSA	World's Poultry Science Association
U of A or UA	University of Alberta
U/G	Undergraduate

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