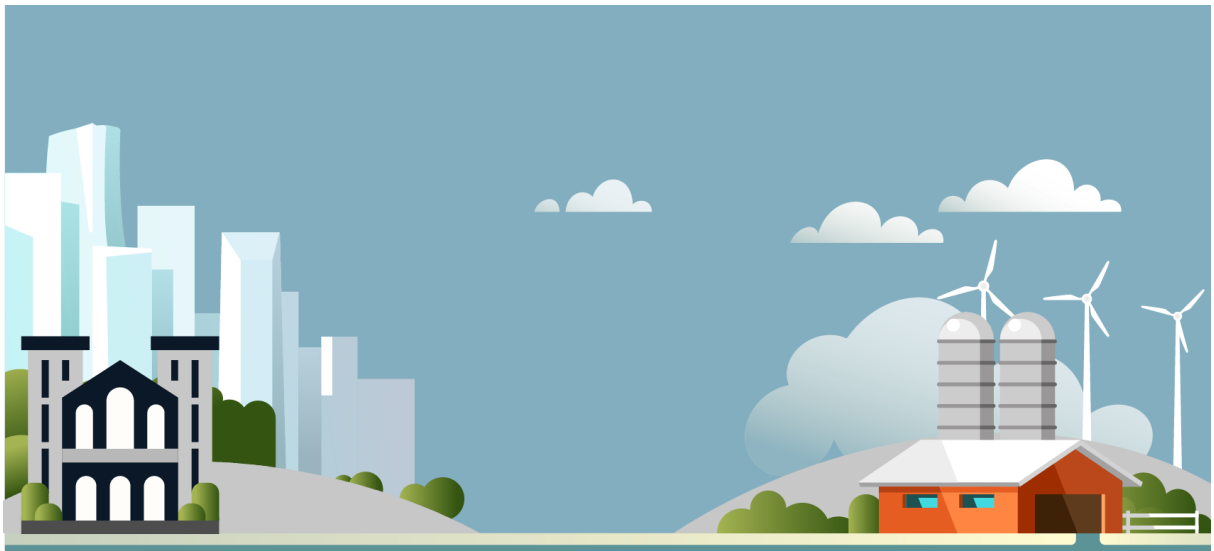
SPARK 2.0

Collaborate-Incubate-Ignite

October 17,2022

Poultry Innovation Partnership



Bridging the Gap

We are better together. What is your role?
It isn't enough to put knowledge out into the world and expect people to pay attention. We all have a role to play in advancing knowledge in the poultry industry.

Spark 2.0 brought to the table key players in the continuous improvement of the poultry industry. Together we defined the challenges and opportunities, connected with others who play a role, and developed collaborations and strategies that will lead to practical solutions. This document summarizes the discussions and information shared in Red Deer. To support continued collaboration and connection, a contact list was shared with participants.

Spark 2.0 was brought to you by:

POULTRY INNOVATION PARTNERSHIP
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Introduction to Knowlege Mobilization

Did you know that it takes an average of 17 years for healthcare research to be mobilized into practice? How can we do better in agriculture?

The old paradigm for extending research results onto the farm was by publishing a scientific paper, presenting at a scientific conference, writing an article for a trade publication or presenting at an industry meeting.

Knowledge mobilization (or KMb) is the process of moving evidence into action. It involves taking what people know (research results) and making it useful to other groups (end-users like farmers, policy makers or even other researchers, to name a few).

A more useful way to think of knowledge mobilization could be: bringing knowledge, people and action together to create value.

In agriculture, KMb goes far beyond the dissemination of knowledge from scientists to farmers.

There are several approaches to KMb. The **push** approach is commonly known as the 'if you build it, they will come.' The onus is on the knowledge creator to get their work in front of end-users. In the **pull** approach knowledge users seek out new information.

An ideal model for KMb in the Canadian poultry industry will embed knowledge generation (creation) and knowledge use within the core structure of farms, industry associations and researchers. This is also known as the **linkage** approach.

The continuous improvement model below is just one example that can help you you understand where you fit. Your participation can happen at any point in the continuous improvement cycle.

We are better together!

Discussion Groups

Spark 2.0 participants broke into 3 groups to discuss our roles in advancing knowledge mobilization.

How do you contribute to mobilizing knowledge to action?

Information sharing:

- Directly to producers – if information goes to feed reps, nutritionists and vets, they will be a trusted source for producers
- Encourage producers to sit on research committees and funding organizations
- Build research priorities and connect with researchers, subject matter experts
- Fund research, provide opportunities for students, researchers, and professors to attend events
- Student exchange across the country, research committee meetings
- Peer to peer learning
- Young Farmer Program
- Attending events like SPARK or Flock Talk (See below)
- Netherlands example: students complete agriculture degrees – work in industry for a few months and then come back to the university to share what is actually needed on the ground. University researchers formulate projects based on this. Students continue to work with both industry and university researchers
- Tech transfer formats for sharing information: webinars, newsletters, conferences, flock talks, symposium. producer and allied industry meetings
- Open access to research – critically important
- Simplify research – bullet points for producers that are relevant and applicable
- Alberta Chicken Producers – research committee has representation from all walks of industry

Crisis motivates change. Producers can be risk averse.

- Peer to peer communication is very helpful, especially with follow-up from allied industry.
- Practicality is important.

Barriers to Knowledge Use

Generally, there are four main barriers to knowledge use, or reasons for the K2A gap (Bennett & Jessani, 2011). Knowledge gaps occur when the intended users of knowledge:

- **Don't know** that the information exists, or what action to take;
- **Don't understand** the information, what it means, or why it is important;
- **Don't care** about the information, seeing it as irrelevant or not beneficial to their agenda; and/or
- **Don't agree** with the implications of the information, believing the knowledge to be misguided or false.

Flock TALK

What is a Flock Talk?

Flock Talk is a one day peer-to-peer event that brings together farmers and industry experts to discuss a specific topic. Group sizes are kept intentionally small to support discussion between all participants.

Successful KMb involves overcoming these barriers. Moreover, each type of barrier must be addressed on its own terms:

- **Don't know** – If your audience only lacks knowledge and is waiting for the evidence you have to share, then enabling action may be as straightforward as creating and disseminating knowledge products. You'll have to make your KMb interesting and encourage people to stop and take notice.
- **Don't understand** – If your audience doesn't understand the evidence, you need to make your knowledge clear and credible. You need to ensure that people understand the knowledge that you're sharing.
- **Don't care** – If your audience doesn't care about the evidence, work to make your KMb relevant. You have to ensure that your target audience views your knowledge as meaningful to their agenda.
- **Don't agree** – If your audience doesn't believe your evidence, the process of moving knowledge to action will be longer and slower. You'll have to make your KMb compelling and ensure your target audience wants to do something about the knowledge you share. You may need to find a messenger/champion and message channel that your audience will trust.

Discussion questions round 2:
How do we leverage our strengths to build a linkage and exchange approach? What are the opportunities and barriers?

Need more opportunities to gather together in person.

- Bring expertise from outside to gatherings

Synergy

- Model of Flock Talks very effective – producer led discussion, hands-on activities
- Sitting down together at a table to converse and share
- Ability to visit farms and labs could create knowledge exchange

Collaboration within industry professionals needs improvement.

- Importance of transparency and openness at every level
- Can operate in silos.
- There can be an antagonistic or competitive attitude at times. Gathering at the same table could help with this.
- Investing in supply chain improvements – are there solutions unique to Alberta here?
- There is a cost barrier to analysis and testing – potential for CAP funding to help?
- Need to streamline data sharing up the pipeline and strategic data use.
- Sharing agreements with potential sharing costs of production

Consortium of variety of industry, academic, research and government voices

- Can work together to fund research that is needed on the ground
- Training future experts and leveraging relationship trust with the industry
- The 'publish or perish' thinking at universities – a barrier that can change the focus of research and devalue tech transfer initiatives

Extension: Help producers to adapt new technologies

- Try to introduce research technology and concomitant risk. One solution would be to build a research farm owned by the poultry board to test new technologies
- PIP is a great model to mobilize knowledge. It does not have skin in the game in terms of profit.
- Nimble messaging and knowing your audience is critical
- Producers doing 'own' research on farm with monitoring systems in place

WELCOME TO

SPARK 2.0

Collaborate-Incubate-Ignite

October 17, 2022 10AM-4 PM MT Red Deer, AB

CANADIAN AGRICULTURAL PARTNERSHIP
Innovate. Grow. Prosper.

POULTRY INNOVATION PARTNERSHIP
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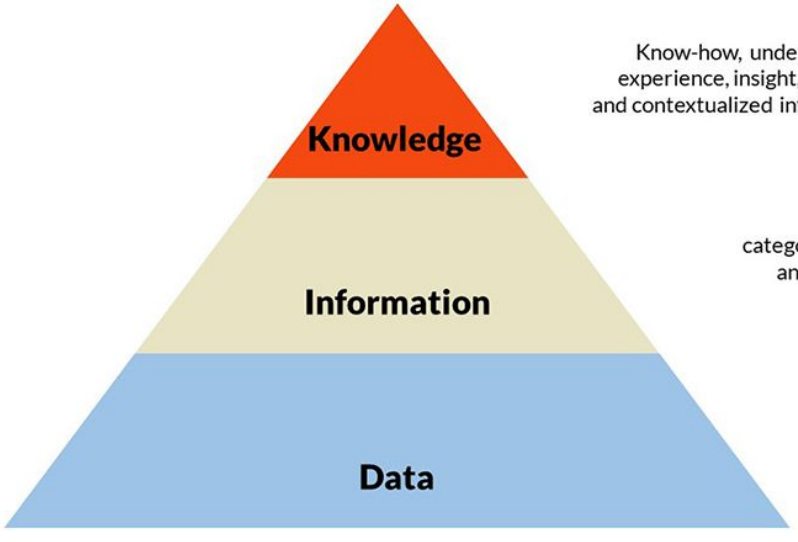
RDAR
Results Driven Agriculture Research

Introduction To Knowledge Mobilization

We are drowning in information and starving for knowledge.

John Naisbitt



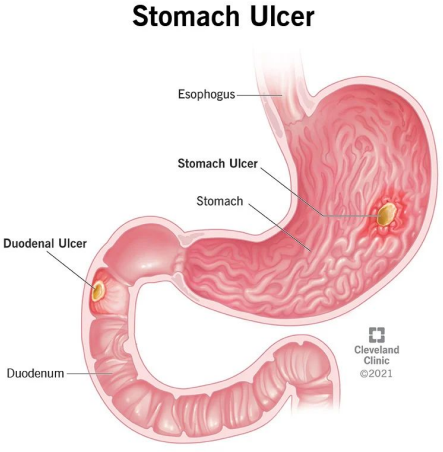
Know-how, understanding, experience, insight, intuition, and contextualized information

Contextualized, categorized, calculated, and condensed data

Facts and figures which relay something specific, but which are not organized in any way.

Knowledge to Action **Gap**

- It isn't enough to put knowledge out into the world and expect people to pay attention
- Morris, Wooding & Grant (2011) found that only 14% of healthcare research is ever mobilized into practice
  - It takes an average of 17 years

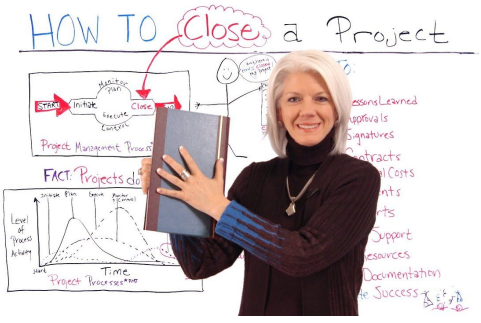


Push, Pull and Exchange **KMb Approaches**

- Push
  - If you build it, they will come
- Pull
  - Knowledge users are the drivers of action
- Linkage & Exchange Approach
  - Utilizes push and pull
    - This could include a knowledge broker

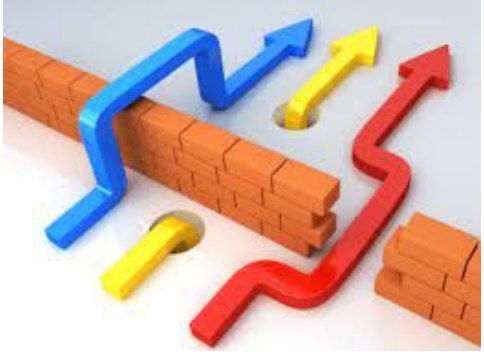
End-of Project & Integrated **KMb Approaches**

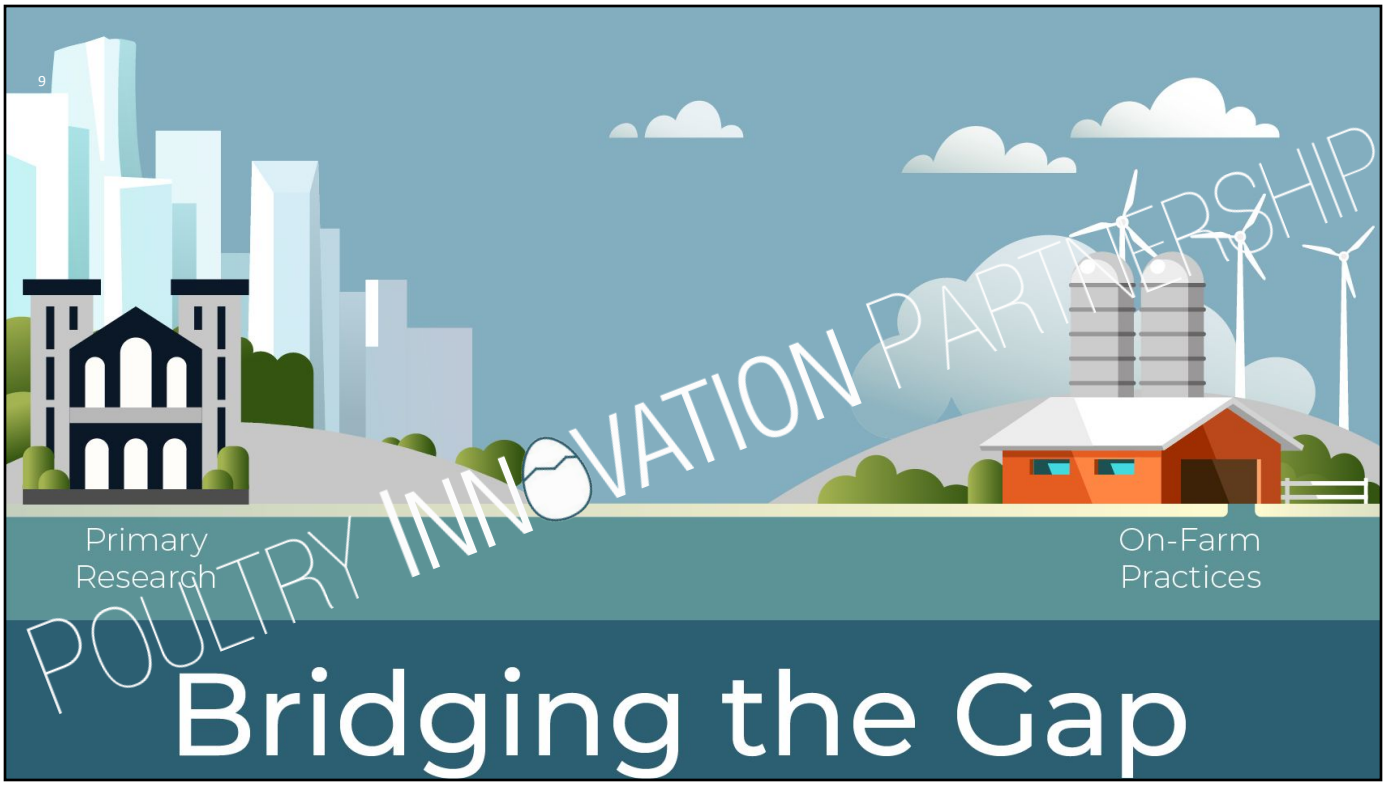
- **End of Project**
  - Mobilizes research that has been conducted
  - Likely uses a push approach
- **Integrated**
  - Focuses on collaborative and/or participatory approaches



Barriers and **KMb Solutions**

- Knowledge & Awareness
  - They don't know about it
- Motivation
  - They don't care
- Acceptance and Attitudes
  - They don't believe you
- Practical
  - No time, money or resources

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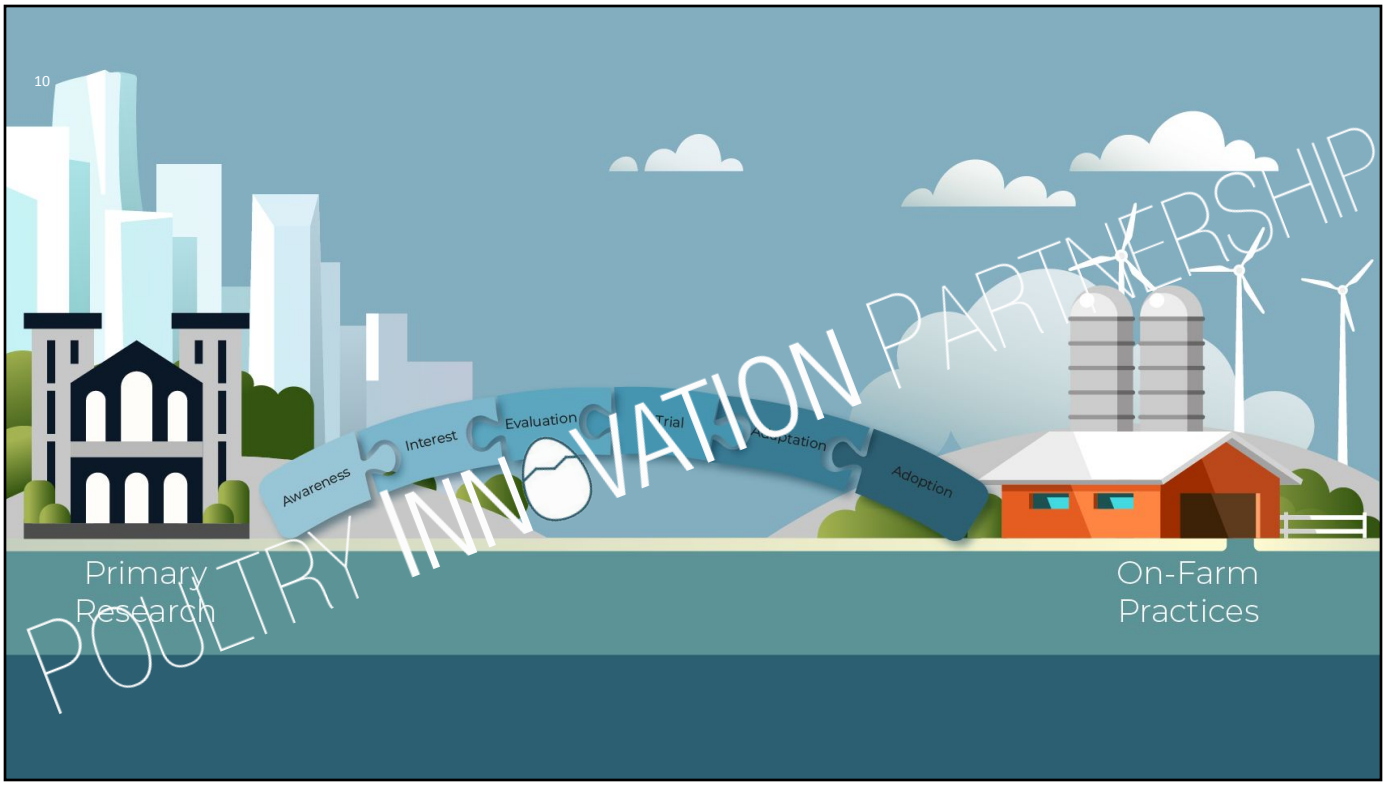
POULTRY INNOVATION PARTNERSHIP
Primary Research
On-Farm Practices
Bridging the Gap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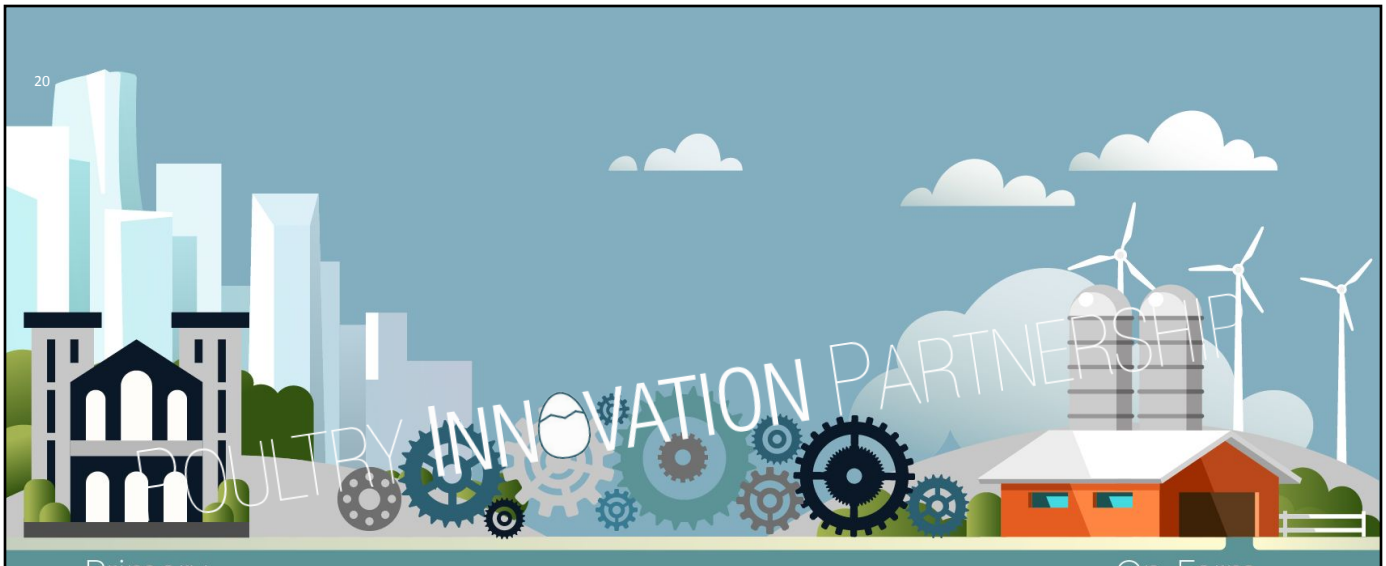
Awareness
Interest
Evaluation
Trial
Adoption
POULTRY INNOVATION PARTNERSHIP
Primary Research
On-Farm Practices



Primary Research

On-Farm Practices

Relationships are built on trust. Successful extension utilizes the strengths and experience of all partners.

So why are we here today?

GOAL: Poultry research and extension outcomes that transform the poultry industry

- Improve the poultry industry's current and future competitiveness, profitability, productivity, and sustainability.

OBJECTIVES:

- Create a culture of shared responsibility and benefit through engagement in research and extension activities
- Improve the relevance, applicability and accessibility of research outcomes
  - Define challenges and opportunities
- Develop a collaborative community to support continuous improvement of the poultry industry

Stories from the Field

Spark!
Research Priorities

EFA's research priorities are used to support the Research Committee in reviewing proposals and making investment decisions.

1. What are ideal lighting conditions to maximize hen and pullet productivity and welfare?
    - Specifically, this is related to issues such as flickering, managing in alternative housing systems, and using different light spectrums to manage behaviour.
2. What management practices reduce dust and what are the impacts of dust on production, bird health, and welfare?
3. What factors impact vaccine effectiveness in Alberta?
    - There is interest in both bird and non-bird factors including issues such as proper procedures and water quality
    - How does the environment (ex. dust in loose housing) impact effectiveness?
4. What is the prevalence, cause, and impact of emerging layer diseases in Alberta?
    - What is the impact of the shift to more production in alternative housing?
    - What is the impact of strains that are migrating to Western Canada?
    - There is special interest in Shelless Egg Syndrome (SES), Focal Duodenal Necrosis (FDN), and Peritonitis/E.Coli
5. What is the impact of extending flock cycles on economics, sustainability, and welfare?
    - Of the strains used in Alberta, which are best suited to longer flock cycles?
    - What is the impact of the Alberta laying hen diet on extending flock cycles?
    - What management practices used in Alberta can best improve the likelihood of success?
6. Which genetics and strains of birds are the "best fit" for different alternative housing systems?
    - How do we use genetics to reduce behaviours such as cannibalism, feather pecking, flightiness, and huddling?
7. How can nutrition be used to help prevent, mitigate, or alleviate behavior concerns?
8. Can we enrich spent hen tissue (offal) with nutrients for harvesting as a human health supplement?
9. Characterizing the risks and attributes of Salmonella strains that are prevalent in Alberta:
    - Which ones are relevant (positive or negative) to bird and human health?
    - Which ones are not prevalent elsewhere, and why?
10. Understanding the management factors impacting defense against Salmonella colonization

What is the prevalence, cause, and impact of emerging layer diseases in Alberta?

- What is the impact of the shift to more production in alternative housing?
- What is the impact of strains that are migrating to Western Canada?
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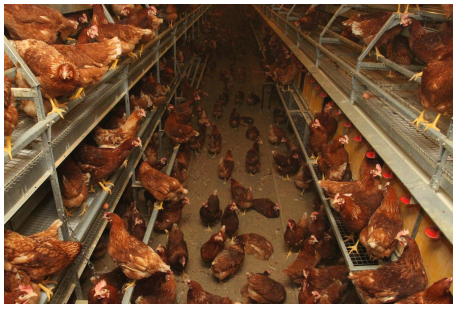
What management practices reduce dust and what are the impacts of dust on production, bird health, and welfare?



Which genetics and strains of birds are the "best fit" for different alternative housing systems?

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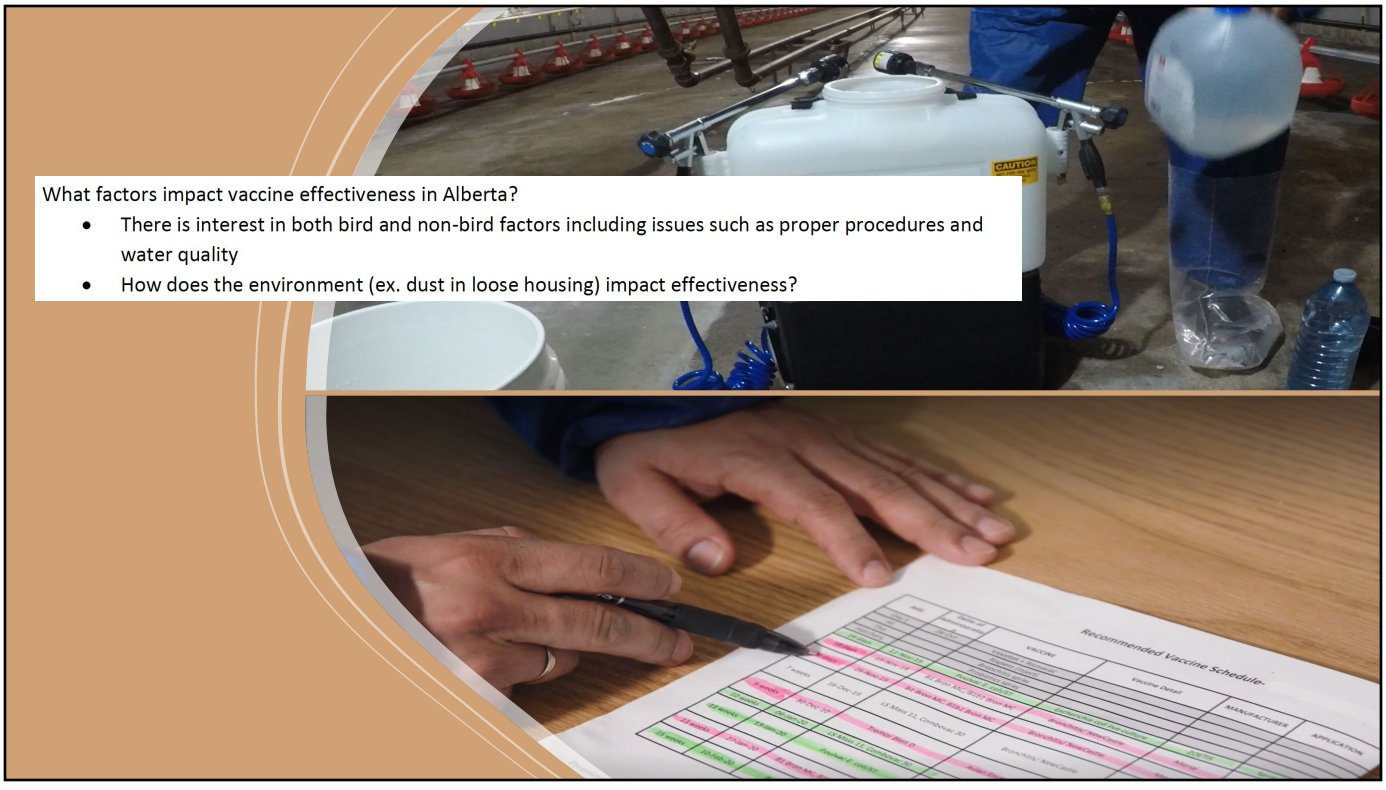

What factors impact vaccine effectiveness in Alberta?

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- How does the environment (ex. dust in loose housing) impact effectiveness?

Blue Skies

- EFA's Research Fund is used to support research priorities that have been established by EFA (the Board and Research Committee).
- Special consideration is given to non-priority projects by the Research Committee during review and approval of projects at Quarterly meetings.

We don't know what we don't know – and things can change quickly!

Feed

- Recent challenges and opportunities

Thank You!

Alberta Hatching Egg Producers

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CHEP Research Priorities

Spark 2.0
Red Deer, Alberta
October 17, 2022

CHEP Research Priorities

1. Production-based Research
2. Breeder welfare
3. Environmental Research
4. Poultry Health and Disease
5. Alternatives to antimicrobials
6. Control of Foodborne Pathogens/SE

Top Research Priorities

Ammonia

***Salmonella* Enteritidis (SE) reduction**

CHEP Research Priorities

- **Production-based Research**
  - Methods to increase fertility and number of saleable chicks
    - Differences in fertility and paid hatch
    - When is it most beneficial to add spiking roosters?
    - Research on new and emerging technology to assess on-farm, real-time fertility

CHEP Research Priorities

- **Breeder Welfare**
  - Ammonia control – 4 areas of top concern

Breeder Welfare – Ammonia Control (1)

- Developing more accurate methods to measure ammonia on-farm, and validating existing ammonia measurement equipment (such as the ammonia meters used by auditors)

Breeder Welfare – Ammonia Control (2)

- Establishing baseline ammonia levels on the farm, and once a consistent methodology is established, have CHEP compile national data to inform decisions going forward

Breeder Welfare – Ammonia Control (3)

- Validating benchmarks (such as those referenced in the code, or those determined as a result of on-farm baseline data), including the study of the impacts of different levels of ammonia concentration on the health and well-being of birds and humans in order to determine appropriate level(s) of ammonia to include in the animal care program as maximum thresholds depending on climate and temperature

Breeder Welfare – Ammonia Control (4)

- Cost-effective methods to control ammonia

CHEP Research Priorities

- **Breeder Welfare (continued)**
  - Density
  - Euthanasia
    - Methods for birds >3kg, including low atmospheric pressure stunning (LAPS)
      - Is LAPS practical for on farm application?
    - Efficient and quick way to euthanize breeder flocks in an emergency situation

CHEP Research Priorities

- **Breeder Welfare (continued)**
  - Aggression
    - Feed energy and male aggression
    - Research linking specific genetic traits with male to female aggression
  - Early mortality of breeder hens (*E. coli*, staphylococci)
    - *E. coli* and staphylococci more likely to post peak mortality association
  - Physical alterations
    - Toe-trimming, beak trimming: ideal methods and timing for procedures
    - Cost-effective, practical management practices that can eliminate physical alterations

CHEP Research Priorities

- **Breeder Welfare (continued)**
  - Transporting newly hatched chicks
    - Length of time that newly hatched chicks are sustained by the yolk sac
    - Effectiveness of hydration/nutrient products used prior to and during transit
  - Effects of vaccination programs on breeder welfare
    - Current status
    - Maximum thresholds – how much is too much?

CHEP Research Priorities

- **Environmental Research**
  - Effects of temperature control on egg handling and holding, and egg transfer vehicles, including egg sweating and links to rots after eggs leave the farm.
  - Effects of lighting on broiler breeder production, fertility, and bird health
    - LED lighting long-term
    - Light intensity, spectrum, colour temperature (K)
  - Environmental impact and effects of climate change as related to broiler hatching egg production

CHEP Research Priorities

- **Poultry Health and Disease**
  - Variant bronchitis-impact on breeder production and fertility
  - White chick syndrome
  - More efficient vaccination programs
  - Effect of probiotics
  - M*ycoplasma synoviae*
- **Alternatives to antimicrobials**

CHEP Research Priorities

- **Control of Foodborne Pathogens/SE**
  - Control of *Salmonella* by vaccination (methods and effectiveness)
    - Newer *Salmonella* vaccinations or supplemental adjuvants to improve vaccine efficacy
  - Sources of infection
    - What is transferred to the chick? How does egg incubation affect *Salmonella* cells?
  - Possible barn differences, what type of construction, material, insulation, volume of air, angle to the sun (infrared radiation)

CHEP Research Priorities

- **Control of Foodborne Pathogens/SE (continued)**
  - Prevalence
  - Population density
  - Control of *Campylobacter jejuni*
  - On-farm strategies to reduce and prevent *Salmonella* while birds are in production
    - Reduce/prevent *Salmonella* via competitive exclusion (probiotics and antagonistic bacterial species for controlling foodborne pathogens)

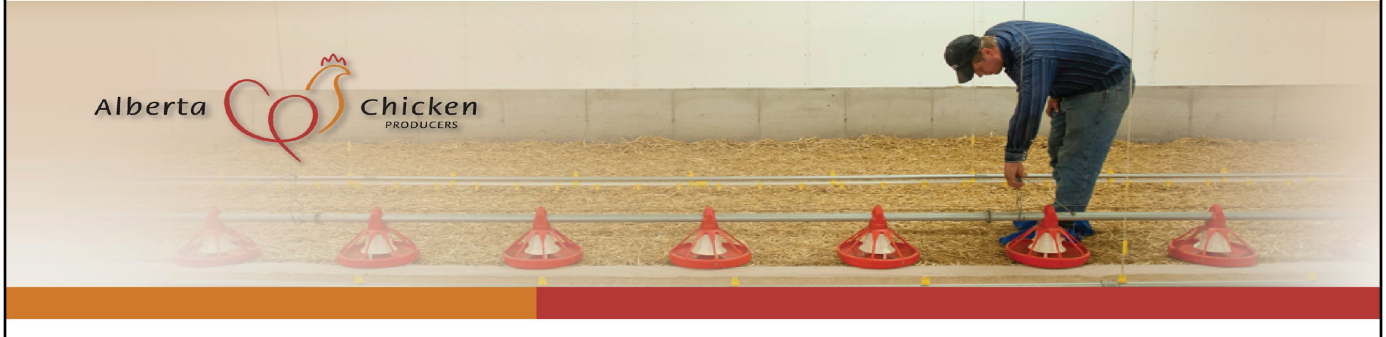
Current research projects and initiatives

- Measurement of Ammonia Concentrations (University of Guelph)
- Impact of ammonia and dust concentrations on worker and animal health and well-being in Canadian hatching egg production (Université Laval and Université de Montréal)
- Improving early feed intake of newly hatched broiler chicks raised without antibiotics using light during incubation (Dalhousie)

Current research projects and initiatives

- Canadian Poultry Research Council
- Swine and Poultry Infectious Diseases Research Centre (CRIPA)

CHALLENGES AND OPPORTUNITIES IN THE BROILER INDUSTRY



Rob Renema

August 23, 2018

Industry Size

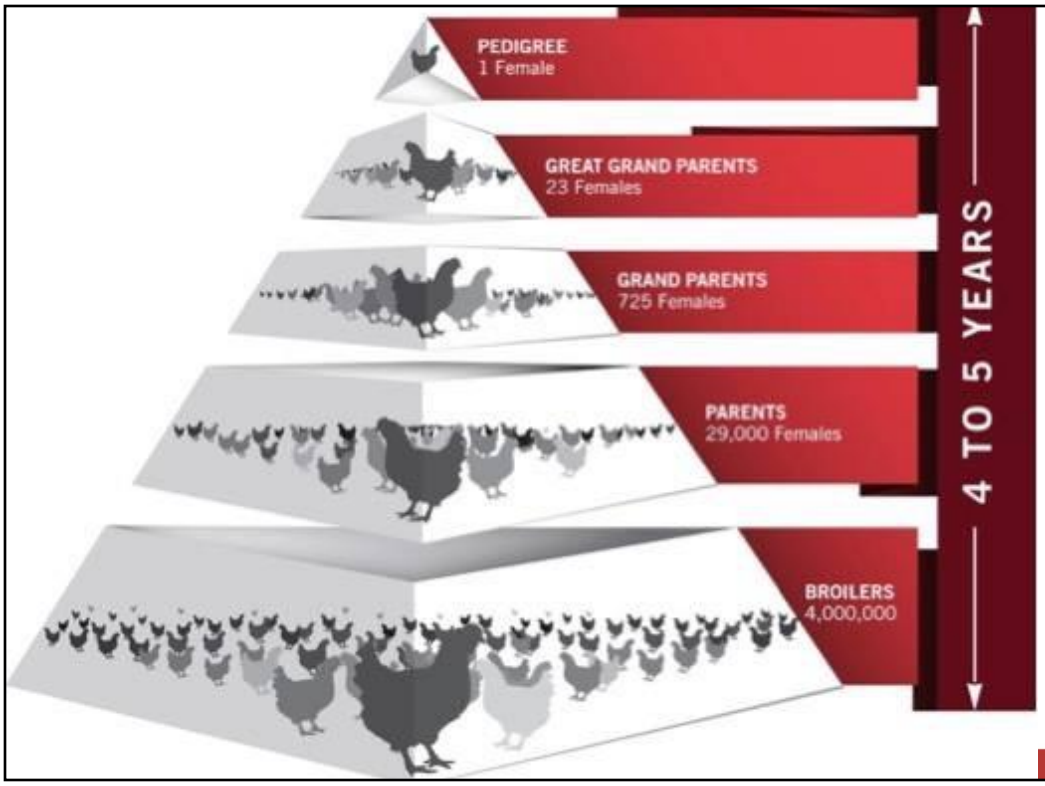
Canada

- 2,836 Registered Farms
- 1.55 billion kg chicken annually
- 2.40 billion Farm Gate

Alberta

- 250 Registered Farms
- 156.7 million kg chicken annually
- $242 million Farm Gate
- 4th largest chicken producing province in Canada

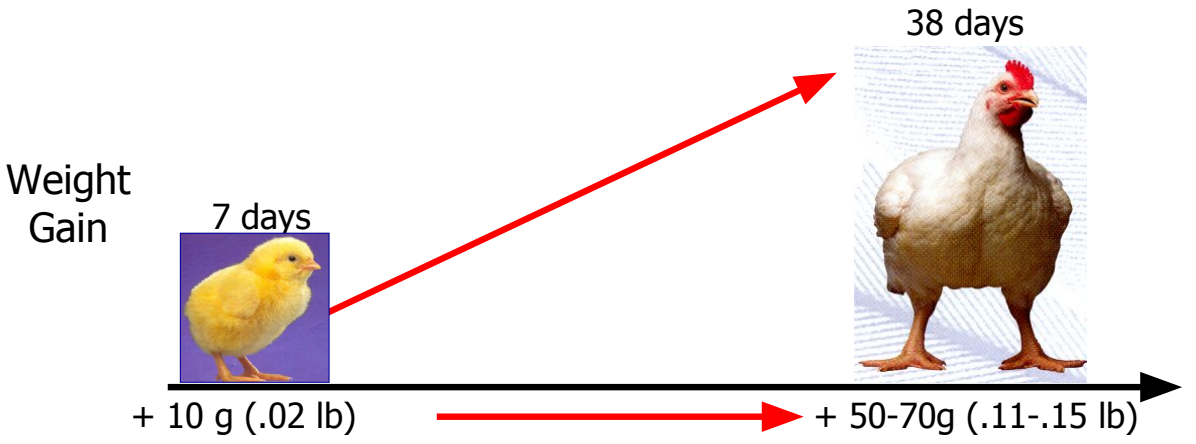
Alberta Chicken Producers



Alberta Chicken Producers

Source: Cobb

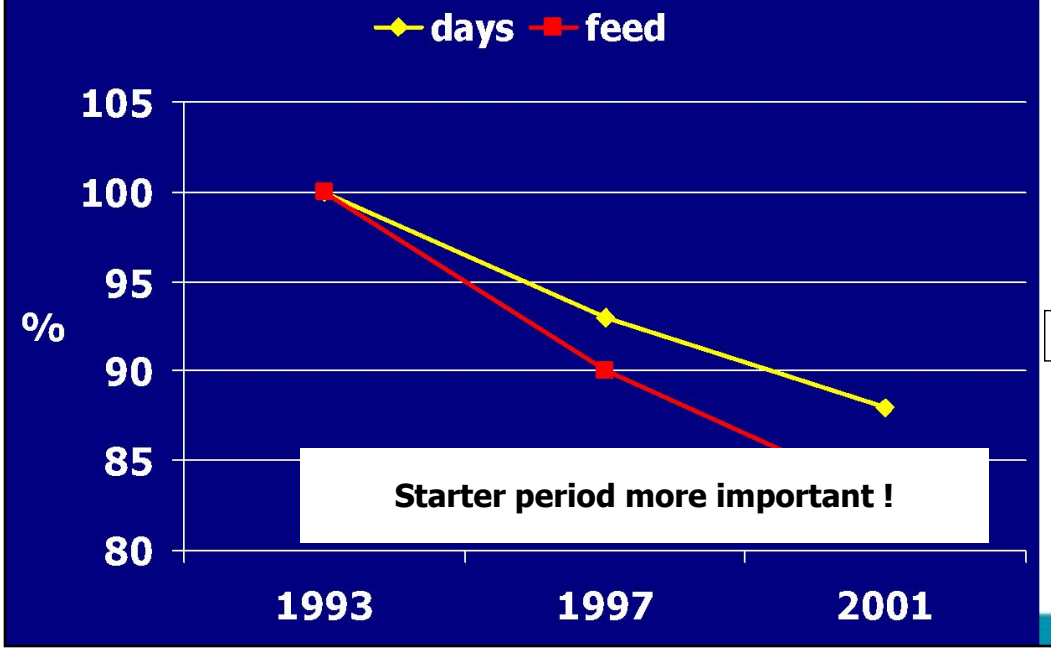
Shorter growth cycle = less tolerance for error



Alberta Chicken Producers

Risk: Funding shift away from production research

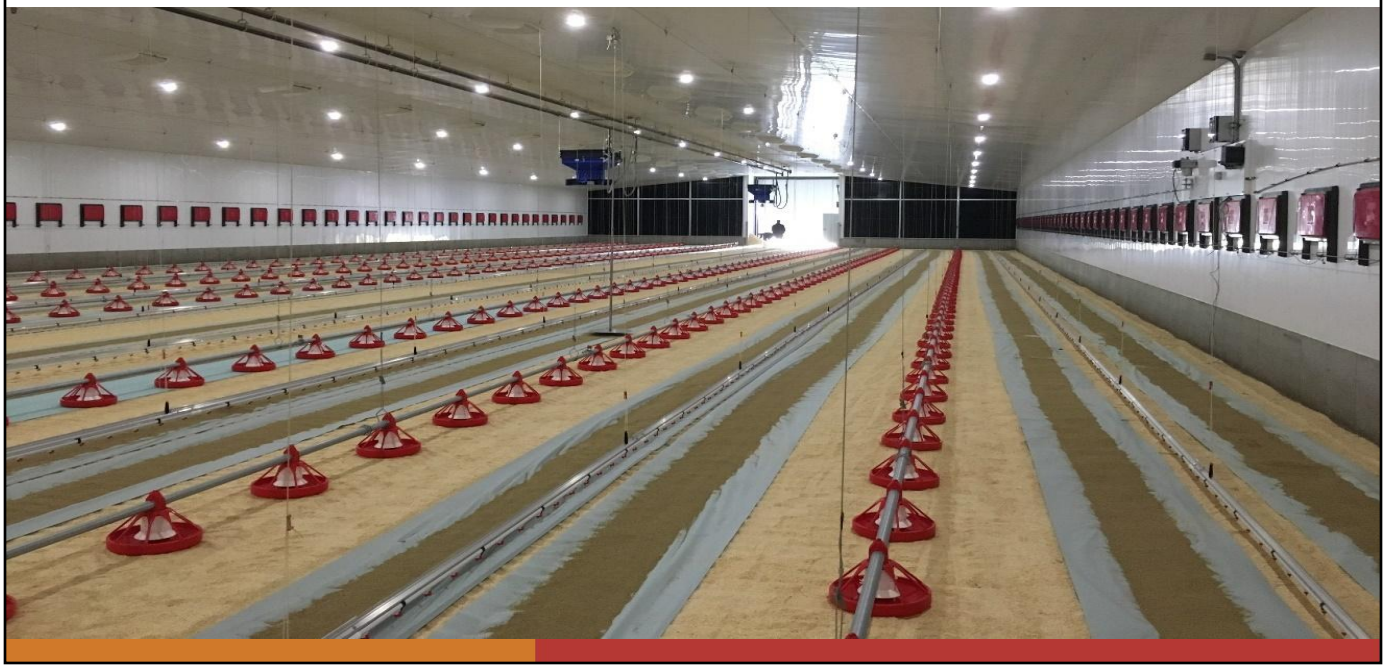
Age & Feed Amount to Produce a 2040 g (4.5 lb) Broiler



- 12%

- 17%

How to manage a changing bird and changing technology?

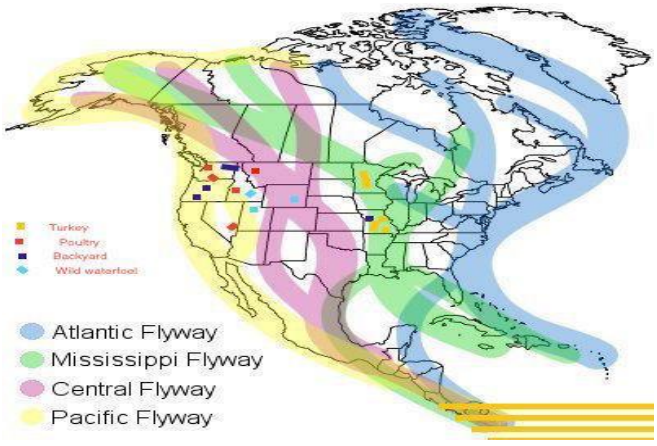


Alberta broiler producers support research

Alberta Chicken Producers

Biosecurity and Disease Risk: Avian Influenza

- Risk in North America:
  - Concentrated poultry production
  - Dwindling surface water = concentration of waterfowl
  - Biggest risk from wild ducks and geese



Alberta Chicken Producers

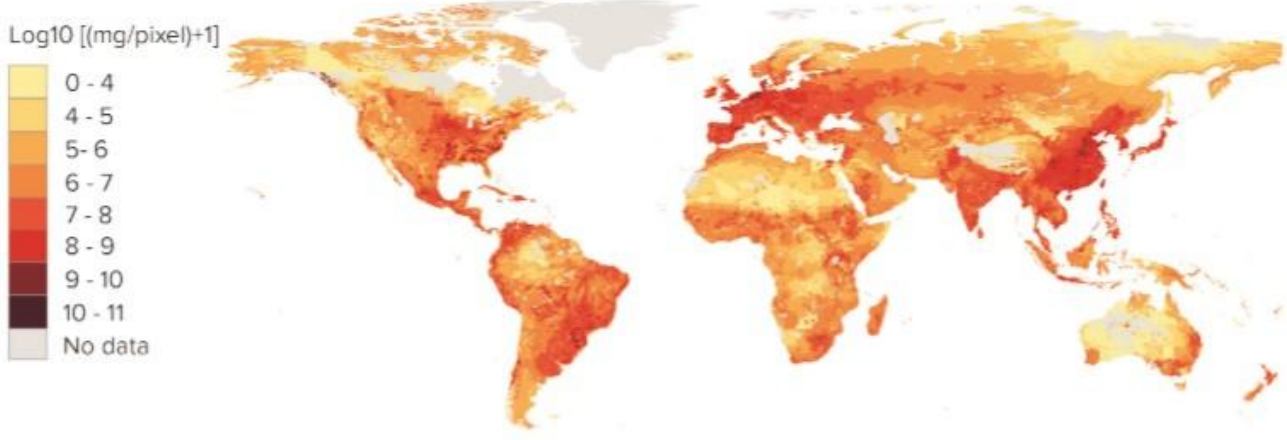


FIGURE 3-1: Global antibiotic consumption in livestock (milligrams per 10 km² pixels) 2010

Source: Van Boeckel et al. 2015

Alberta Chicken Producers

Antibiotics Impacted by Voluntary Canadian Bans in 2018 (Cat. 2) and 2020 (Cat. 3)

- Not an exhaustive list, but those most used in a preventive fashion:

	Drug Family/Name	Brand Name
Antibiotic Use at the Hatchery		
Category II	Lincomycin+Spectinomycin	Linco-Spectin
	Gentamcyin	Gentocin
Antibiotic Use in the Feed		
Category II	Virginiamycin	Stafac, Virginiamycin
	Lincomycin HCL	Lincomix
	Tylosin	Tylan
	Penicillin G Procaine	Pen-P, Penicillin G Procaine
Category III	Bacitracin	BMD, Albac, Zinc Bacitracin
Antibiotic Use in the Water		
Category II	Penicillin+Spectinomycin	Vibiomed Booster, Medivit, Super Booster

Beyond Antibiotic Growth Promoters: Finding our Way Together

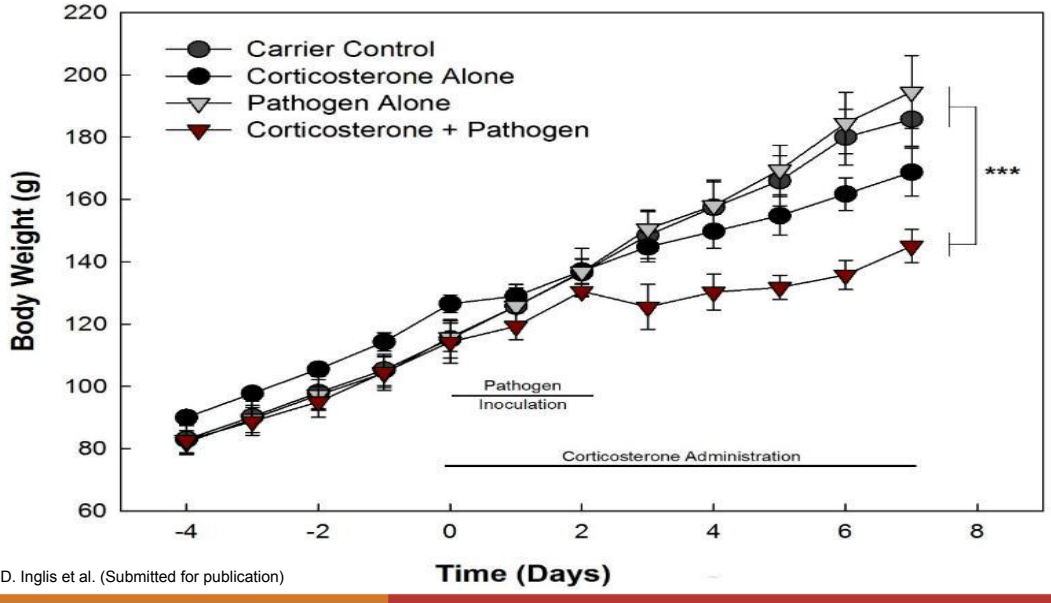
- Disease targets of highest economic importance are necrotic enteritis and coccidiosis.
  - Transient diseases like reovirus
  - Combined strategy of AGP replacement and increase health?
- No single solution that works as well or as consistently as Antibiotic Growth Promoters (AGPs) have worked.
- Need to revisit previously tested products now that we are learning more about how to properly evaluate them.
- Best results when flock management conditions also considered
  - Brooding management
  - Environmental management
  - Water system management
  - Flock Health

Alberta Chicken Producers

Progress in Identifying / Designing Effective AGP Replacements

- To date: Observational empirical methods that have led to variable results for many products that have the potential to work
- Animal environment (density, stress, activity level, diet etc.) will influence both gut microbiota and the host.
- Currently seeing more study of mechanisms involved in AGP function and working to identify alternatives that mimic physiological response to AGPs

Impact of Bacterial Pathogens and Stress on Broiler Growth (AAFC, Lethbridge, AB)



G. D. Inglis et al. (Submitted for publication)

Alternatives to AGPs

- Experiments have shown products that do mimic AGP action in the gut, but not always with growth promotion
  - Only want to pursue solutions that also have a growth promoting aspect?
  - Could be part of a larger solution of enhanced gut/bird health?

- Proven health or growth affect from other commercial and non-commercial products could still be part of a larger solution. Need mix of AGP replacements and enhanced bird health (via feed additives and management).

Alberta Chicken Producers

Half-house Brooding

ACP Research and Knowledge Priorities

Context: Phase-out of Category 2 (2018) and move to judicious/phased use of Category 3 antimicrobials for disease prevention

- Management changes required?
- Unintended impact on flock health and welfare
- Lack of effective alternatives to antibiotics available
- Impact on cost of production vs. consumer pricing?

Alberta Chicken Producers

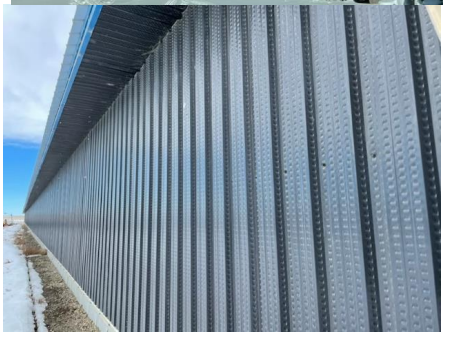
ACP Research and Knowledge Priorities

Covid, AI, volatile feed and energy prices, and global conflict have all demonstrated need for efficiency, resilience, flexibility and ability to quickly adapt to change.

- Ability to produce chicken in a changing environment (input costs, methods, disease challenges) will influence our research needs
- Prevention/control of Avian Influenza?
- Use of AI (the other kind) in poultry production?
- Where does the industry go for help/information?

What is needed on the farm: Research vs. Tech Transfer?

Alberta Chicken Producers



Alberta Chicken Producers

ACP Research and Knowledge Priorities

1. Animal Health and Welfare

- Management without antibiotics (challenges with weight uniformity, disease outbreaks, bird welfare, density, and feed ingredients)
- Chick Quality (from egg handling and incubation, to farm management)
  - Understanding links between chick quality, health, and welfare
  - Methods to increase % of high quality chicks
  - Managing poor quality chicks
- Nutritional and management means of promoting bird health
- Addressing leg and footpad health through nutrition and management strategies
- Farm to processing welfare (barn preparation, culling strategies, handling during bird catching and transfer to processing, cold/hot weather transport)
- Strategies to reduce cellulitis
- Emerging diseases

Alberta Chicken Producers

ACP Research and Knowledge Priorities

2. Food Safety

- Salmonella and Campylobacter control (Notes: farm or processing plant? Issues with no policy on eggs being picked up if SE positive?)
- Pathogen control and reduction strategies (i.e. nutrition, biosecurity, feed preparation, cultivating healthy barn bacteria, disease surveillance)
- Links between pathogens, chick quality, and improved food safety
- Improved methods to clean barns and process birds from salmonella-positive flocks (practical, cost-effective focus)

Alberta Chicken Producers

ACP Research and Knowledge Priorities

3. Uniformity and quality of live birds and product

- Increased processed meat quality (i.e. breast muscle defects, cellulitis)
- Management and nutritional means to improve bird uniformity, carcass composition, and quality
- Impact of lower-value feed ingredients and feed form on growth and quality
- Impact of barn density

Alberta Chicken Producers

ACP Research and Knowledge Priorities

4. Industry sustainability and social commitment

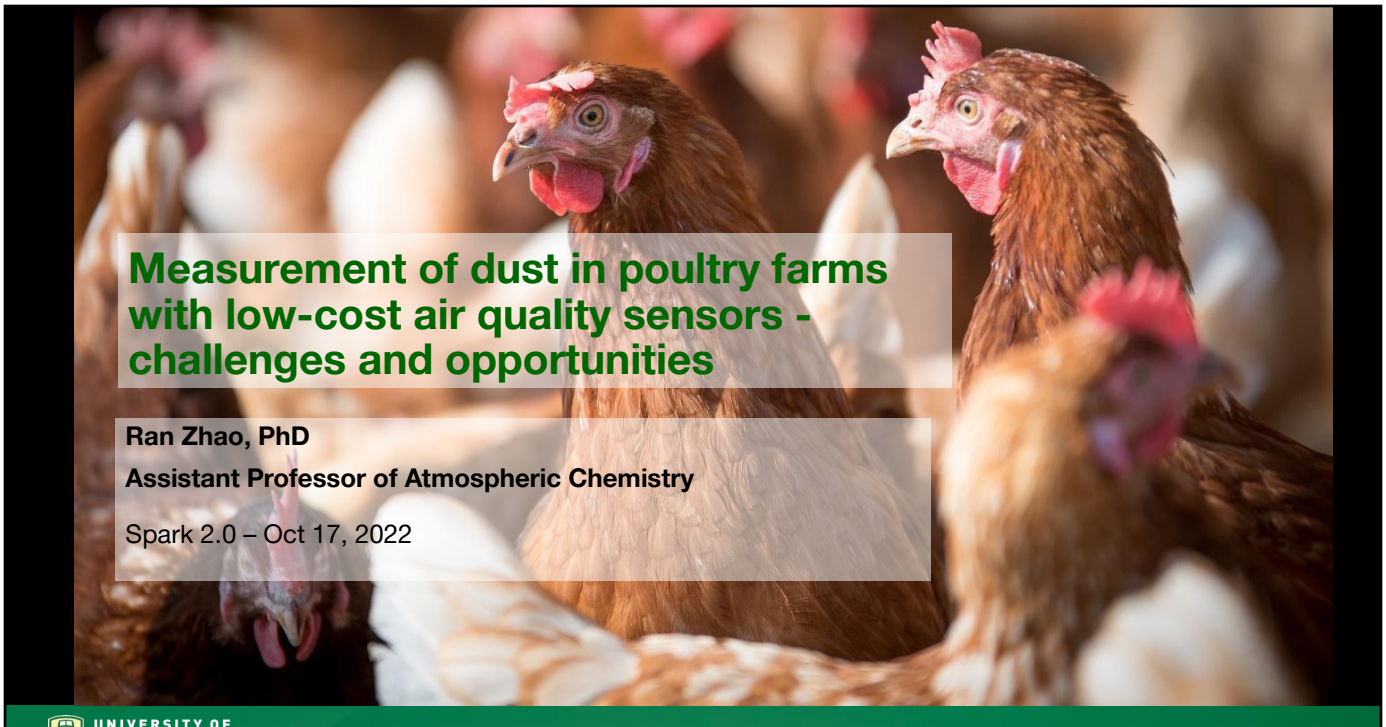
- Environmentally and socially responsible production and processing
- Environmental impact of poultry production practices (i.e. water quality, environmental footprint)
- By-product utilization
- Maintaining consumer trust (i.e. social licence, worker health and safety)
- Impact of AGP-free production on cost of production

Alberta Chicken Producers

A Chain Is Only As Strong As It's Weakest Link

Every Flock Is A Load Test On The Performance Chain

Stories from the Lab



Measurement of dust in poultry farms with low-cost air quality sensors - challenges and opportunities

Ran Zhao, PhD

Assistant Professor of Atmospheric Chemistry

Spark 2.0 – Oct 17, 2022

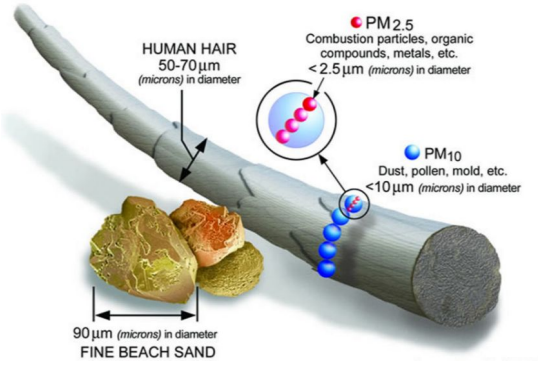
Outline

- What I study and why – dust in farms.
- What I try to bring – low cost dust sensors.
- How things are working – a brief presentation about an ongoing project.

Dust in Poultry Farms

Dust, also called **particulate matter (PM)** or **aerosol** can:

- Be a carrier of disease.[1,2]
- Affect the health of workers.[3]
- Affect the health and productivity of birds.



Source: US Environmental Protection Agency

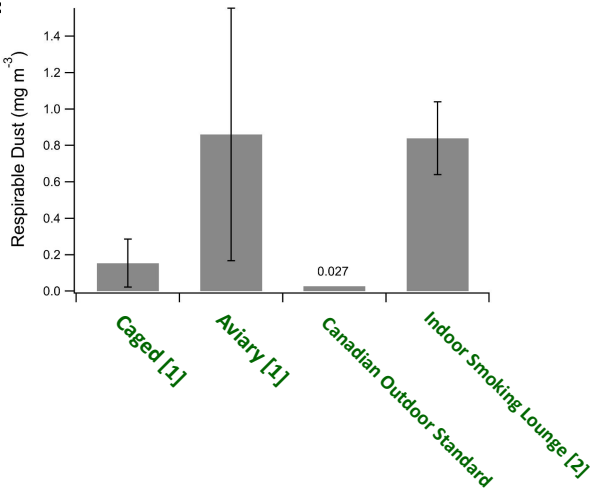
In the outside atmosphere, aerosol can:

- Cause lung and heart diseases to humans.
- Affect the health of mothers and newborns.

[1] Chen et al. **2010**. *Environ. Health Perspec.* [2] Bailey et al. **2020** *PILOS Bio.*
[3] Viegas et al. **2013** *J. Toxicol. and Environ. Health*

Concentration of Dust

- Concentration of dust in poultry farms can be much higher than outside.
- Dust in farms should be monitored!
- My job as an atmospheric chemist is to understand everything about the air.
- Size and amount of dust
- Chemical composition
- (future) Microbiology of dust



[1] David et al. **2015**. *Animals* [2] Huang et al. **2022** *Environ. Sci. Technol. Lett*

How Do We Measure Dust Particles?

Research-grade instruments we have

Optical Particle Counter
$20,000

Picture from Grimm website

Aerodynamic Particle Sizer
$60,000

Picture from TSI website

Pros:
- "You pay for what you get"
- Accurate
- Reliable

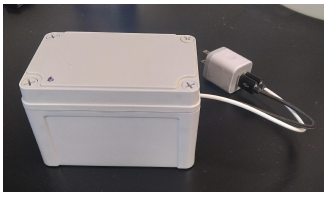
Cons:
- Expensive
- Requires specialization
- Cannot have many of them

More affordable options?

More Affordable Alternatives

Alphasense Optical Particle Counter, $500

Picture from Alphasense website



Low-cost light scattering sensor, $180

Assembled by my team

Applications

Pros:

- Affordable
- Can have more than one
- Easy to setup
- Widely used these days

Cons:

- Never been verified in farms

Wildfire smoke

Student residence

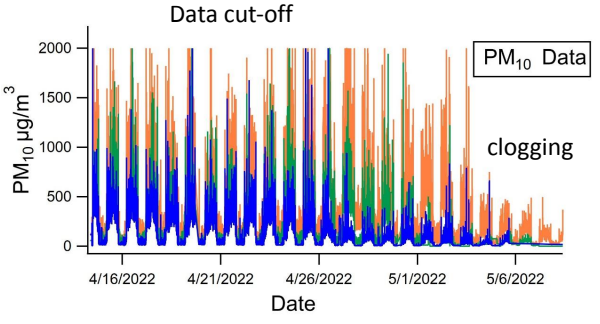
Children's health

An Ongoing Project

- Primary Investigator: Ran Zhao (me)
- Co-Investors: Martin Zuidhof (U of A), Val Carney (PIP), Martine Boulianne (U of Montreal)
- Collaboration with Poultry Research Centre (PRC) at the University of Alberta
- Objectives:
- Phase I: Testing Low-Cost Sensors at PRC farms
- Phase II: Deployment at a commercial farm

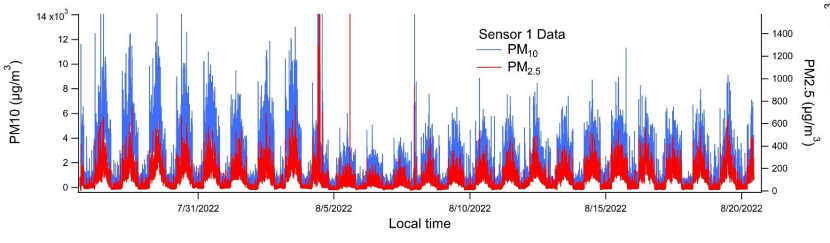
Challenges Faced

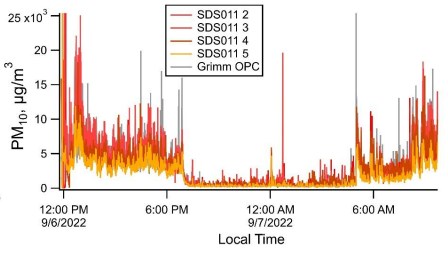
- High dust load in the PRC farm resulted in reduced sensor lifetime, signal saturation (overshooting), and inaccuracy.

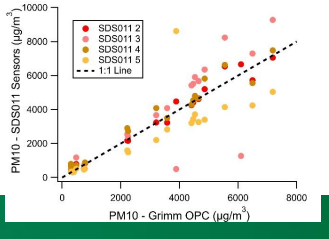


Promising Results

After many trials, we managed to reach good longevity and reasonable accuracy using our low-cost sensor.



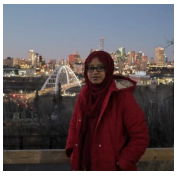




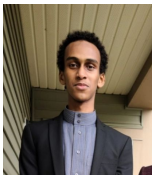
What's next?
Looking forward to deploying our sensor in a commercial farm starting Nov 2022!

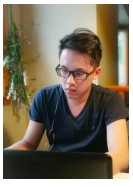
Acknowledgement

- Poultry Research Centre: Kerry Nadeau, Kim Thorsteinson, Chris Ouellette and others
- Poultry Innovation Partnership
- My Team


Rowshon Afroz


Timothy Guo


Sohaib Omar


Wayne Cheng

Who am I?

Pasteur Institute, Paris, France

Microbiologist (PhD, University of Paris XI, Paris, France)

Current:

- Directs the Microbial Research laboratory, Lethbridge College, Lethbridge
- Teach Microbiology, Human nutrition, Cell Biology
- Adjunct professor at the University of Lethbridge, Lethbridge

Past:

- Senior Scientist (tenure) at Pasteur Institute, Paris, France (10 years)

Microbial Research Laboratory Goals

- To bring solutions to the poultry industry
  - By identifying phytobiotics to control infection
  - By identifying plant extracts to remove bacteria from wastewater farm

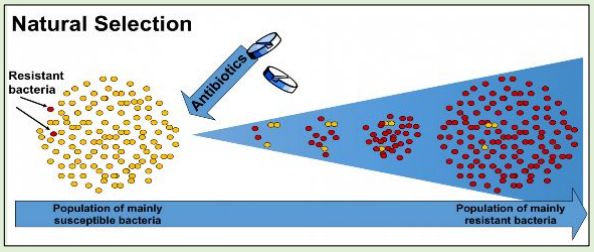
Why?

World Antimicrobial Awareness Week
18-24 November
SPREAD AWARENESS
STOP RESISTANCE

Because antibiotic resistance is a major concern

The poultry industry

-is limiting the usage of antibiotics for prophylaxis
-is looking for alternating solutions to maintain animal health while improving feed conversion



Antibiotics select drug resistant bacteria.

We have used antibiotics since 1940
(Penicillin discovered by Sir Alexander Fleming)

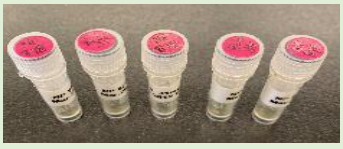
WHY PHYTOBIOTICS?

- More than 50% of our medicines come from natural products. (Aspirin, taxol….)
- Some food have natural antibiotic properties
- Plants have been used as traditional medicine worldwide
- Estimate 250 000 to 500 000 species of plants on earth
- Only a small fraction of the existing plants have been investigated for their medicinal properties
- **No Canadian plants are used as phytobiotics**

Dogwood

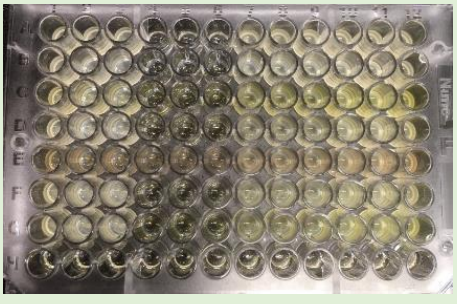
Plant collection-Plant extracts library

1- collected in sustainable way
2- collect under permit
3- numerical number



200 extracts

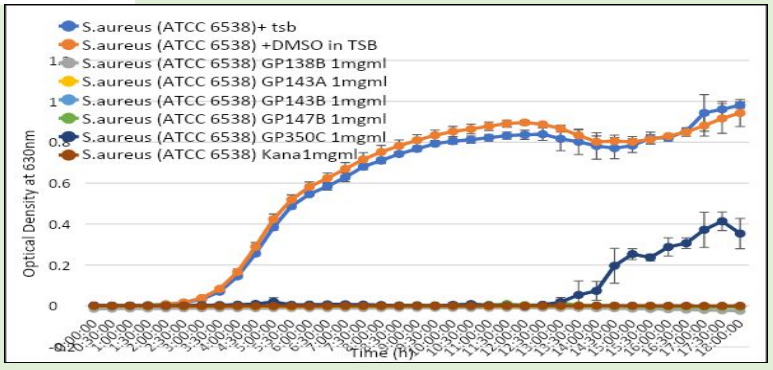
Antibiotic testing
A fast, efficient and economic technique

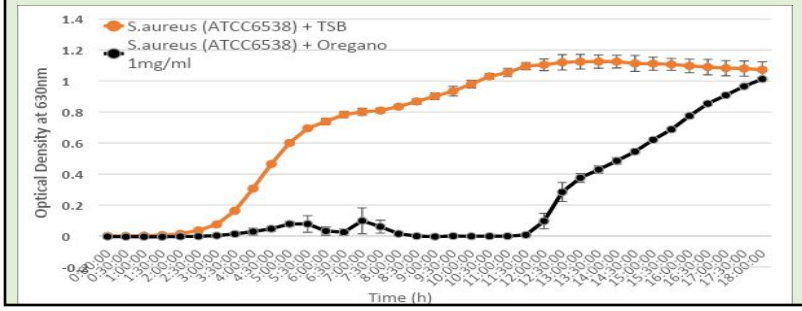


96 well plates

-Allow testing 13 plants at once for their antibiotic properties using a very small amount of plant *(1 gram of dried plants allow to perform around 75 tests)*
-Perform 18-hour time course.

Antibiotic testing
A fast, efficient and economic technique





Staphylococcus aureus

Responsible of Staphylococcosis

Bumblefoot

We have many active phytobiotics

Family	extracts	*Staphylococcus aureus*
Fabaceae	PP170A	3
	NP010L	28
	NP010F	1
	PP140A	0
	pp120	74
Rosaceae	NP 940LF	83
	PP040A	95
Caprifoliaceae	PP240 beta	27
Ranunculaceae	PP080B	41
	NP 950F	4
	NP 950L	1
Asteraceae	PP360B	52
	PP493	98
	PP180	34
	PP520	3
Onagraceae	PP380A	60
Apiaceae	NP920F	78
	NP920L	19
Liliaceae	PP270A	2
Asparagaceae	PP130A	1
Polygonaceae	NP821	100
	NP822	96
Brassicaceae	NP825	35
Boraginaceae	PP410A	16

Percentage of inhibition of the bacteria at 18 hours with 1 mg/ml of extract

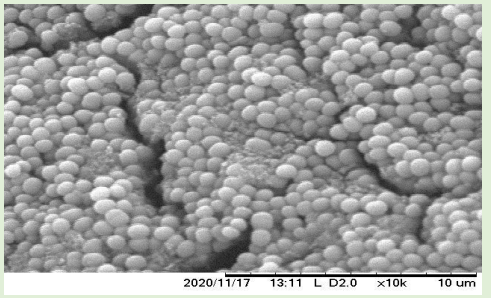
How to select the best ones for the in vivo experiments?

- Active at a low concentration
- No cytotoxicity on animal or human cells (collaboration Natural Product laboratory Dr. Roy Golsteyn, Uof L)
- Easy to grow in a good quantity

Clumping activities in plant extracts

S. epidermidis

S. epidermidis & Plant extract NP 856



-Clumping of bacteria by plant extracts

-NP856 clump 99% of the bacteria

-NP856 start clumping the bacteria after 5-10 min

-Potential application in removing bacterial contaminants in water

What can we bring to the poultry industry?

- **A safe, economical, local, solution to the poultry industry**
  - An efficient fast and economic technique to identify the best phytobiotics for the poultry industry on the bacteria of interest (Avian *E.coli, Salmonella*…)
  - A selection of the best plant extracts to be tested in an in vivo test (Dr. Douglas Korver, University of Alberta)
  - Phytobiotics that are adapted to our climate and that could be produced locally.
  - Clumping plant extracts to reduce bacterial contamination in water.

Microbial Research Laboratory Students (2016- now)


Deserae Tailfeathers


Michaela Prozniak


Lane Richardson


Karli Tremel

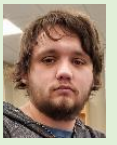

Hari Koriala


Carlee Ayley


Chad Beck

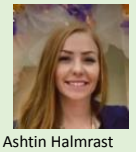

Sean Sander


Davey Li


Dwain Friesen


Bethwel Chumba


Megan Puchbauer


Ashtin Halmrast


Craig James


Apsara Srinivas

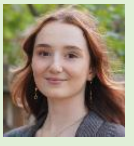

Kevin Kaurir


Khouloud Ayari


Nadia Hand


Kaitlyn Grisnich


Tianna Gerber


Audrey Golsteyn


Rebecca Bylsma


Mathew Webster

Microbial Research Laboratory Collaborators

Ms. Leanne DuMontier, Technician, Lethbridge College

M. Byrne Cook, Chair of agriculture, Lethbridge College

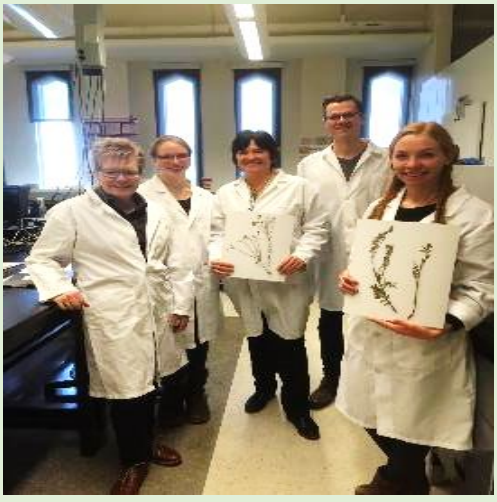
Dr. Douglas Korver, poultry nutrition expert, University of Alberta, Edmonton

Dr Roy Golsteyn, Cell biologist, Natural Product Laboratory, University of Lethbridge, Lethbridge

Dr Raymond Andersen, Dr David Williams, Natural product chemists, University of British Columbia, Vancouver

M. William Singer III, knowledge keeper, member of the Blood Tribe/Kainai of the Blackfoot Confederacy

Thank you



Lethbridge College

NSERC CRSNG

University of Lethbridge

McCain

Lethbridge College

If you want to know more ….

RESEARCH ROOTED IN THE LOCAL LANDSCAPE

College researchers investigate 'one of the biggest threats to global health, food security and development'.

WIDER HORIZONS WINTER 2019

When the blanket of snow recedes from southern Alberta and the first of the region's hardy prairie plants begin to dot the naturescape, Lethbridge College microbiology senior research scientist Dr. Sophie Kernéis and lab technician Leanne DuMontier will be ready to work with some macroscopic views.

The sweeping springtime vista of the prairie is quite a different sight than they're accustomed to from their regular work space – a fourth floor research lab in the

and plains produce a diversity of plant life Kernéis and DuMontier have been studying since 2016, one plant at a time, in hopes of identifying sources for new antibiotics.

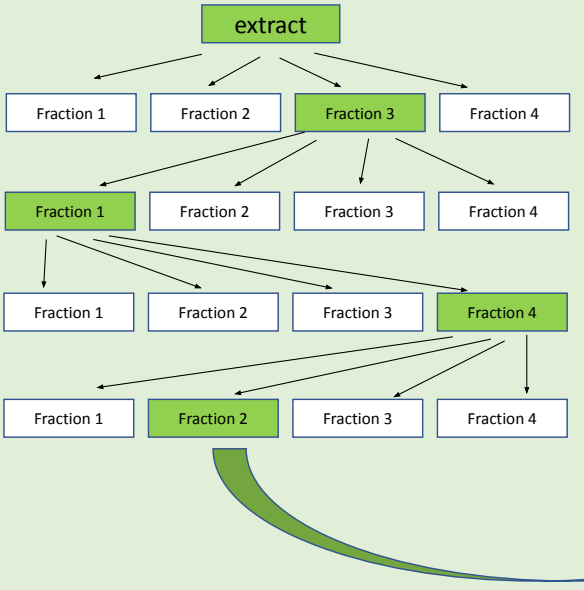
With the support of about $56,000 in grants from Lethbridge College's Centre for Applied Research and Innovation Fund, their Alberta Antibiotic Plant Project has been testing flora for antimicrobial properties. Their research could have wide ranging application – from providing a potential cure to antibiotic-resistant infections to finding

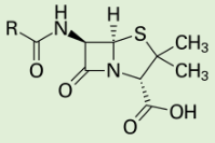
https://lethbridgecollege.ca/index.php/wider-horizons/winter-2019/research-rooted-local-landscape

Ms. Lisa Kozleski, Editor and Senior writer, *Wider Horizons*
Ms. Dawn Sugimoto, Communications Manager

Bioactivity directed fractionation

Collaboration with Dr. Raymond Andersen, Dr David Williams UBC Vancouver





New molecule

?

New activity

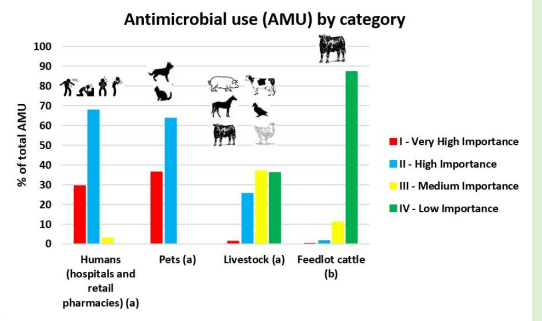
?

3 antibiotic molecules isolated from NP940LF

What is done

Category	Class (example)
Category I Very High Importance	• Carbapenems (Imipenem) • Cephalosporins (3rd &4th gen)(Ceftiofur) • Fluoroquinolones (Enrofloxacin) • Glycopeptides (Vancomycin) • Glycylcyclines • Ketolides • Lipopeptides • Monobactams • Nitroimidazoles (Metronidazole) • Oxazolidinones • Penicillin-β-lactamase inhibitors (Amoxicillin/Clavulanic Acid) • Polymyxin (colistin, polymyxin B) • Therapeutic agents for TB
Category II High Importance	• Aminoglycosides (Gentamicin) • Cephalosporins (1st and 2nd gen - Cefapirin) • Fusidic acid • Lincosamides (Lincomycin) • Macrolides (Tulathromycin) • Penicillins • Quinolones (except fluoroquinolones) • Streptogramins (Virginiamycin) • Trimethoprim/sulfamethoxazole
Category III Medium Importance	• Aminocyclitols (Streptomycin) • Aminoglycosides • Bacitracins • Fosfomycin • Phenicols (Florfenicol) • Sulphonamides (Sulphathiazole) • Tetracyclines (Oxytetracycline) • Trimethoprim
Category IV Low Importance	• Flavophospholipols (Bambermycin) • Ionophores (Monensin)

Health Canada Classification of Antimicrobial Agents Based on Level of Importance in Human Medicine



(a) Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) Annual Report, 2016
(b) Evaluating the potential contribution of beef cattle to antimicrobial resistance (BCRC FOS.10.13)

Source: BeefResearch.ca

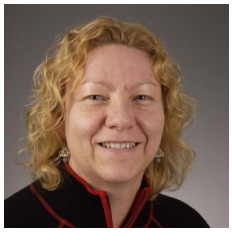
University of Calgary Poultry Research Capabilities

Faizal Abdul-Careem, BVSc, MVM, PhD
Diplomate- American College of Poultry Veterinarians (ACPV)
Diplomate- American College of Veterinary Microbiologists (ACVM)

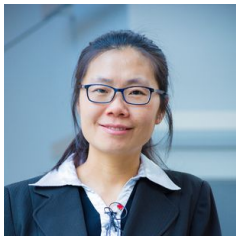
17 October 2022
Spark 2.0
Cambridge Hotel & Conference Centre, Red Deer, Alberta

Faculty of Veterinary Medicine

- World rank (QS ranking): 37 and 3rd in Canada
- Currently: 68 Faculty members about 130 in 3-4 y
- Annually: 50 DVM and around 100 MSc & PhD students are trained annually 100 DVM and about 200 MSc & PhD students
- Poultry focus research and diagnosis:



Karen Liljebjelke



Dongyan Niu

Ashish Gupta

Hans Osthoff

Foothill campus

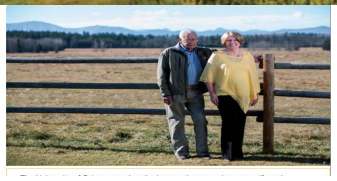
UNIVERSITY OF CALGARY

Spy hill campus

Diagnostic Services Unit (DSU) within Clinical Skills Building (CSB)

UNIVERSITY OF CALGARY

19,000 acres including 1000 heads of cattle ≈ >$ 48 million

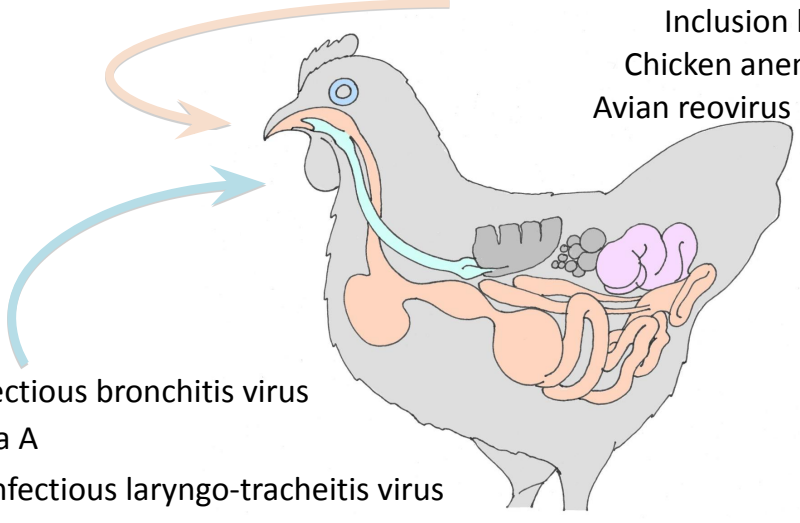


UNIVERSITY OF CALGARY

Generously gifted by Jack Anderson and Wynne Chisholm

Common mucosal viral infections

Infectious bursal disease virus
Inclusion body hepatitis virus
Chicken anemia virus
Avian reovirus



Infectious bronchitis virus
Influenza A
Infectious laryngo-tracheitis virus
Marek's disease virus
Newcastle disease virus

Research Program

- Molecular characterization of economically important poultry viruses
- Elucidating the pathogenesis of these viral diseases
- Understanding the key elements of host responses and
- Developing intervention strategies to prevent or control viral infections in poultry, based on activation of host responses.
- NSERC funding -> fundamental studies in poultry viral immunology
- 12 years of grants from the EFC, EFA, CPRC, ALMA/AAF/RDAR, NSERC alliance, Agriculture and Agri Food Canada and Saskatchewan Agriculture Development Fund, Canadian Agriculture Program (CAP) -> investigations with practical applications for the poultry industry

Projects in progress

- Assessment of impact of Canadian infectious bronchitis coronavirus (IBV) variants originated from breeder flocks on egg production and fertility of chickens
- Collaborators: Davor Ojkic (U of Guelph); Martine Boulianne (U of Montréal)
- Duration: 2018-2023

Agriculture and Agri-Food Canada

EGG FARMERS OF CANADA

Canadian Poultry Research Council
Le Conseil De Recherches Avicoles Du Canada

- Optimization of vaccination strategies for table egg layers controlling egg production problems induced by currently circulating infectious bronchitis virus (IBV) variants
- Collaborators: Davor Ojkic (U of Guelph); Susan Cork (U of Calgary); Susantha Gomis, U of Saskatchewan
- Duration: 2020-2024

EGG FARMERS OF CANADA

NSERC CRSNG

Projects in progress

- Development of novel and alternative approaches using small-RNA based immune- stimulant molecules for control of avian infectious bronchitis virus
- Collaborators:Neda Barjesteh (U of Montreal); Carl Gagnon (U of Montreal); Martine Boulianne (U of Montreal)
- Duration: 2020-2024

- Investigation into constituents of poultry barn bioaerosols with a focus on antimicrobial resistance, bird's respiratory health and vaccine induced immune response
- Collaborators: Hans Osthoff (U of Calgary); Karen Liljebjelke (U of Calgary); Sylvia Checkley (U of Calgary)
- Duration: 2022-2023

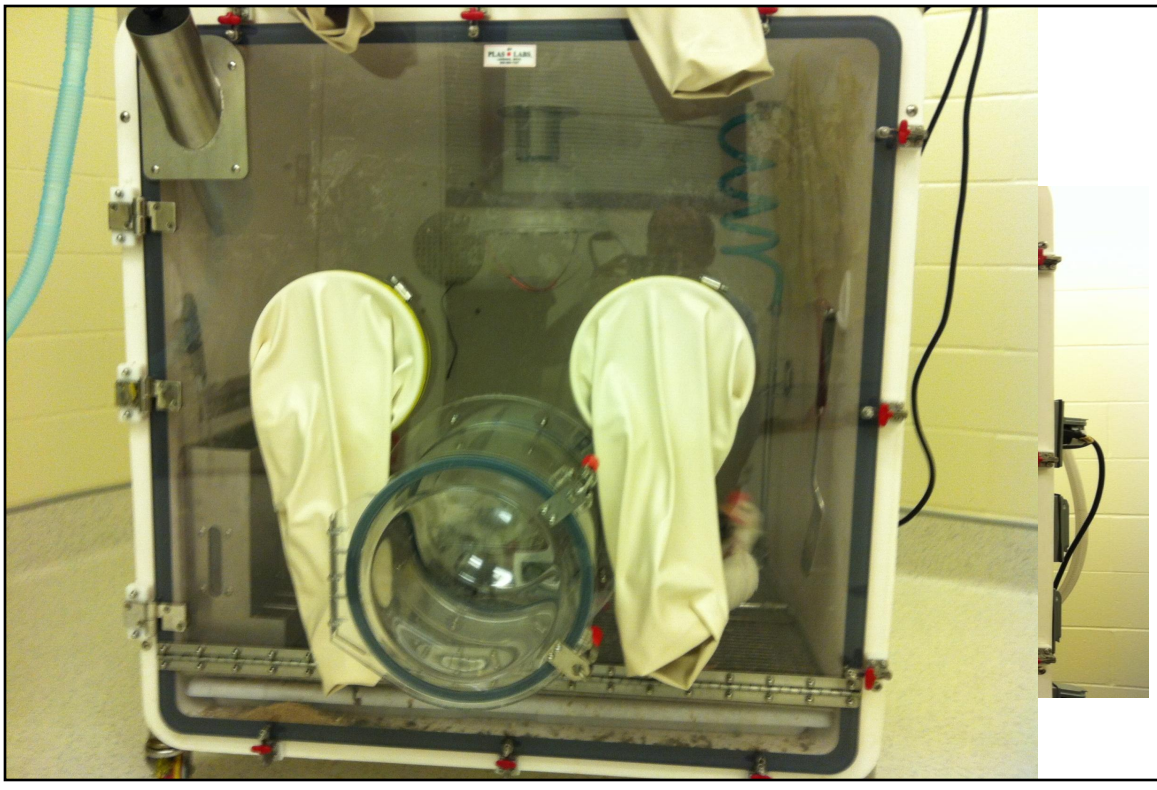
Projects in progress

- Investigation of procedures and water quality impacting vaccine effectiveness in egg layers in Alberta
- Collaborators: Karen Liljebjelke (U of Calgary); Sylvia Checkley (U of Calgary)
- Duration: 2022-2024

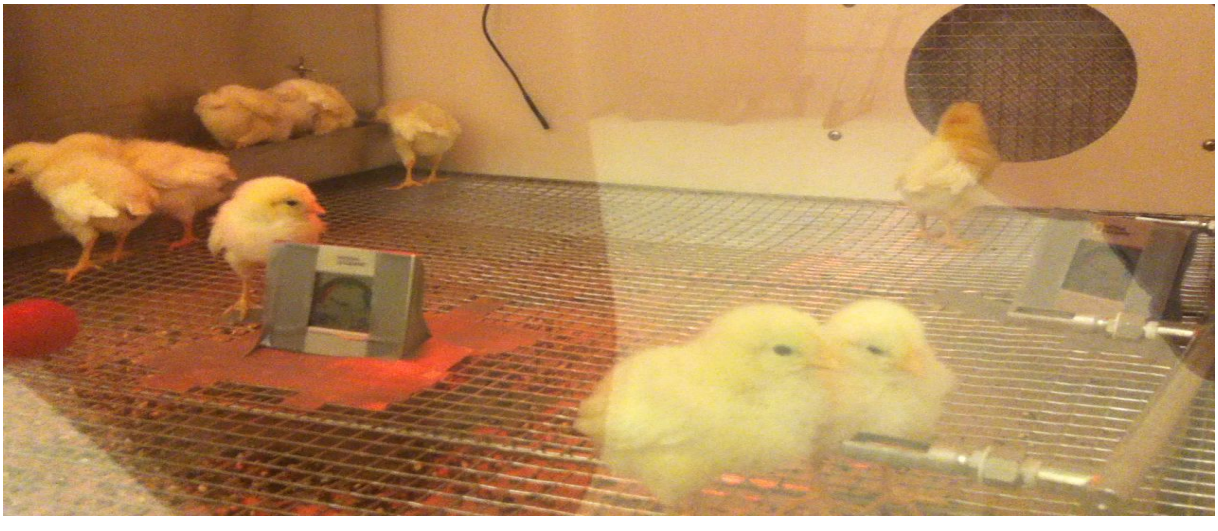
- Role of avian macrophages in the pathogenesis of infectious bronchitis virus infection
- NSERC Discovery grant
- Duration: 2012-2022

Veterinary Science Research Station (VSRS)

High Containment Poultry Isolators



Inside of a high containment isolator



Laboratory capabilities

- Microscopy and Imaging Facility
- Microarray and Genomics Facility
- Antibody Services
- Live Cell Imaging Facility
- Peptide Services
- University Core DNA Services
- Flow Cytometry Core Facility
- Diagnostic Services Unit

Acknowledgements

- Last 12 years >70 HQP trained
  - 37 undergraduate students
  - 20 MSc and PhD students
  - 14 Postdocs, Research Assistants /Technicians, Visiting Scholars and high school students
- Collaborators

get cracking. Egg Farmers of Ontario

Egg Farmers of Alberta

RDAR Results Driven Agriculture Research

EGG FARMERS OF CANADA

Mitacs Accelerate

LRIC Livestock Research Innovation Corporation

Agriculture and Agri-Food Canada

NSERC CRSNG

ALMA Alberta Livestock and Meat Agency Ltd.

Canadian Poultry Research Council / Le Conseil De Recherches Avicoles Du Canada

University of Calgary Veterinary Medicine

Government of Saskatchewan Agriculture Development Fund

University of Calgary Margaret Gunn Endowment-Animal Research

Alberta Agriculture and Forestry

iapt The Institute for Applied Poultry Technologies

POULTRY INNOVATION PARTNERSHIP

Poultry Systems Modeling and Precision Feeding

Martin J. Zuidhof
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PIP SPARK Meeting
Red Deer, AB
October 17, 2022

The team:

Mark Fedorak	P Eng
Thiago Noetzold	PhD
Jo Ann Chew	PhD
Etse Obi	MSc
Camila de Freitas	MSc
James Laidlaw	BEng Intern
Kim Thorsteinson	Technician
Mohsen Kardar	Technician

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POULTRY INNOVATION PARTNERSHIP

Overview

- Precision feeding
- Reproductive efficiency
  - Broiler breeders
  - Laying hens
- Modeling
  - Energy partitioning
  - Growth

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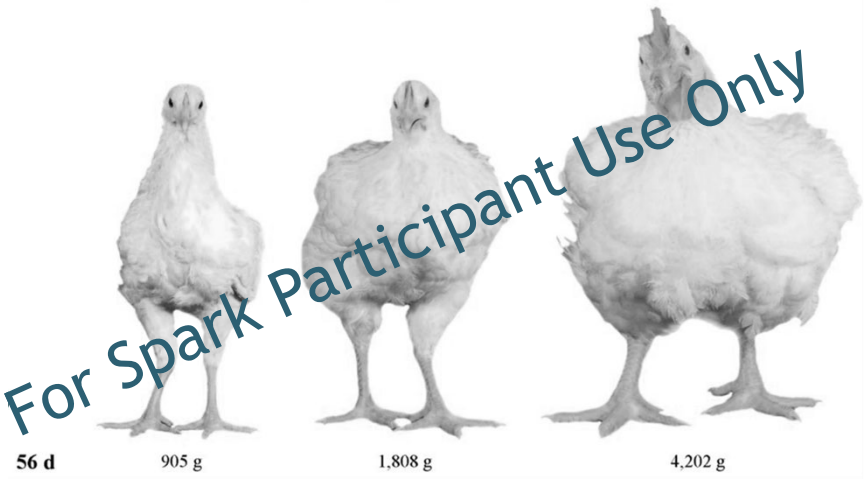
POULTRY INNOVATION PARTNERSHIP

Genetic change has been significant!



Research with our heritage chickens shows that 50 years of selection increased broiler growth rate 400% (Zuidhof et al., 2014).

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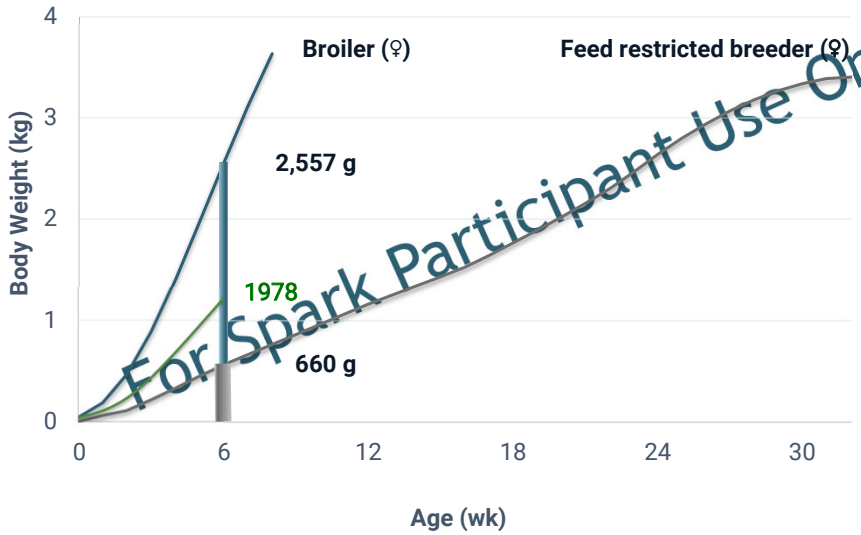
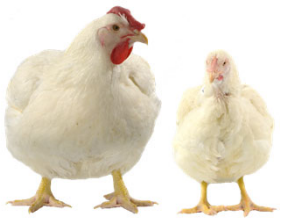
POULTRY INNOVATION PARTNERSHIP

A broiler breeder pullet is restricted to 25% of her potential





Carney et al. (2022)

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POULTRY INNOVATION PARTNERSHIP

Increased Competition for a Limited Resource

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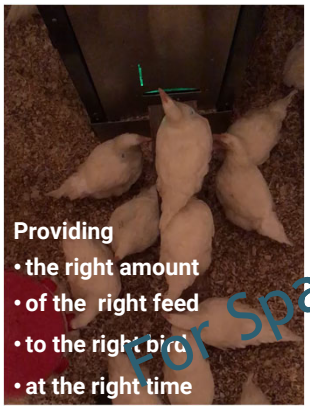
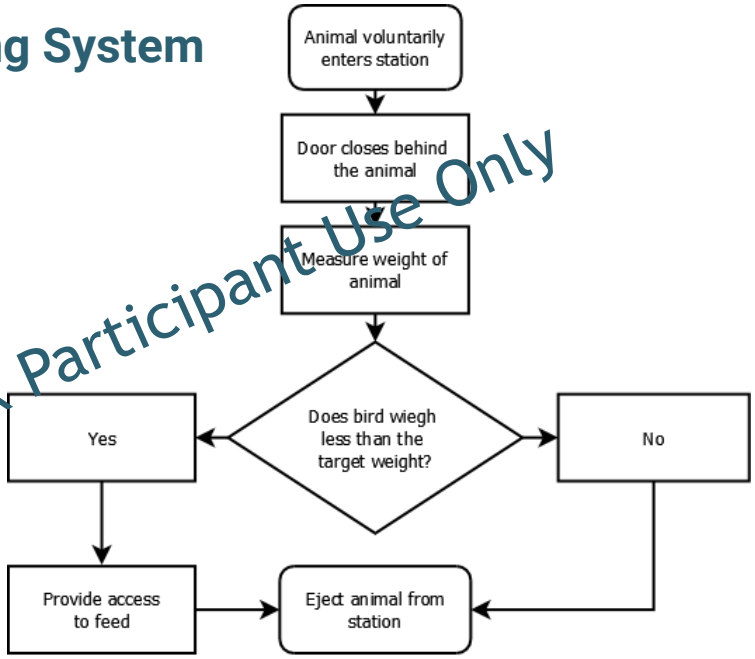
POULTRY INNOVATION PARTNERSHIP

Precision Feeding System



Providing
- the right amount
- of the right feed
- to the right bird
- at the right time



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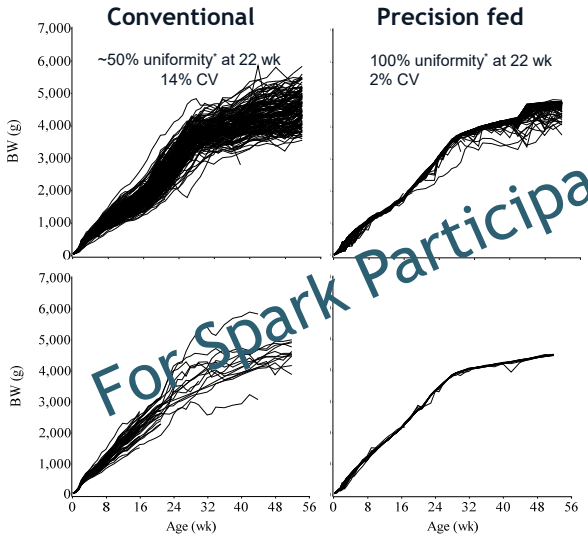
POULTRY INNOVATION PARTNERSHIP

We can grow 100% uniform flocks



*Uniformity: % of birds within ±10% of the mean

Zuidhof, 2018

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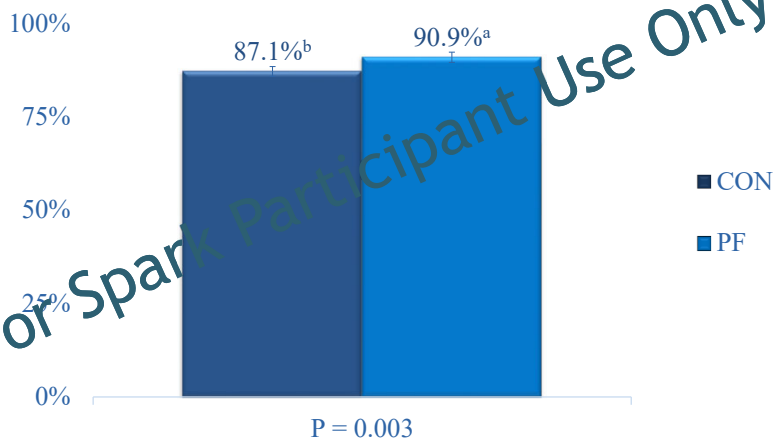
POULTRY INNOVATION PARTNERSHIP

Fertility was 3.8% higher with Precision Feeding



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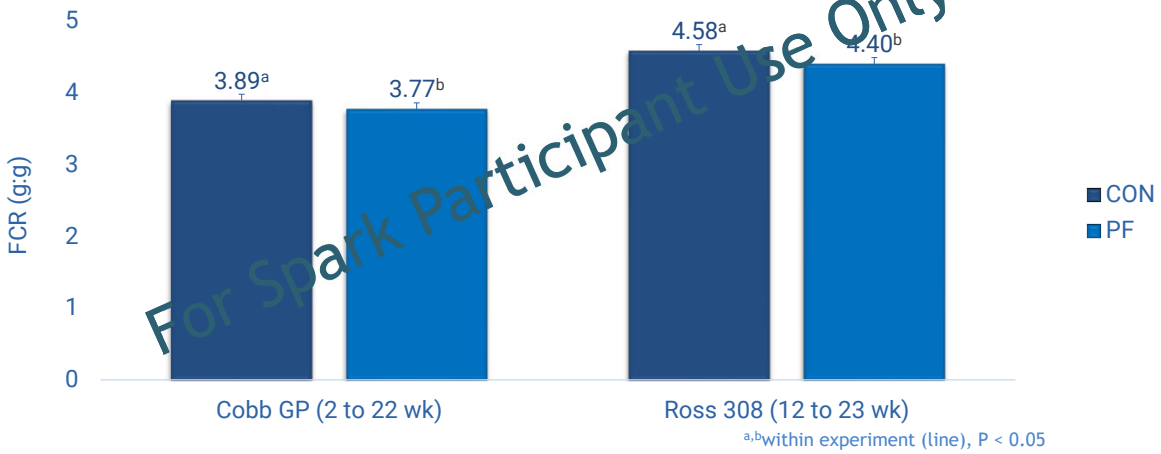
POULTRY INNOVATION PARTNERSHIP

Precision Fed Breeders are 3 to 4% more Efficient



a,bwithin experiment (line), P < 0.05

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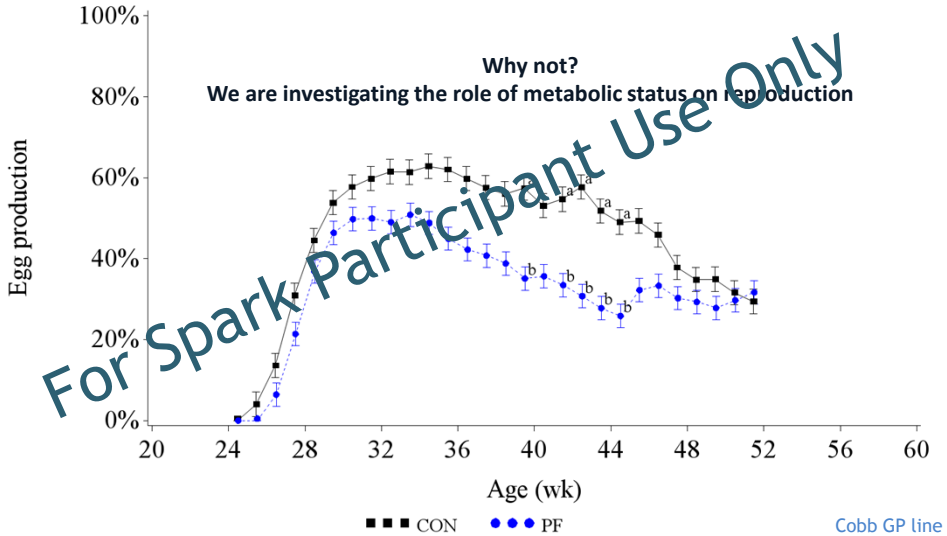
POULTRY INNOVATION PARTNERSHIP

Precision Fed Hens did not Lay Eggs as Well…



Cobb GP line

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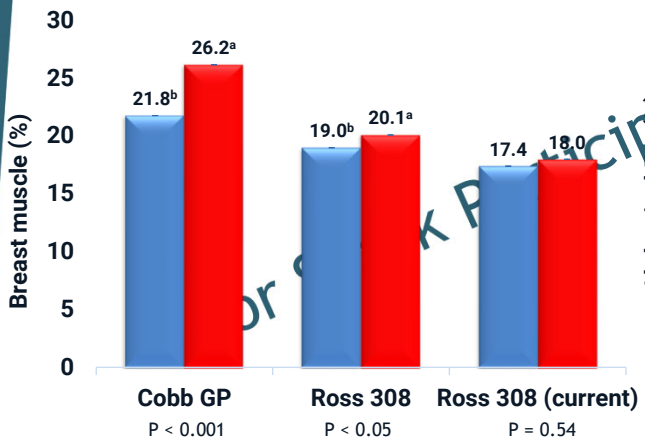
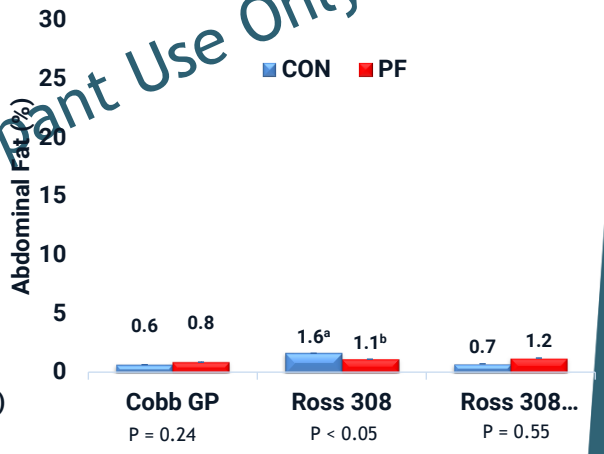
POULTRY INNOVATION PARTNERSHIP

Body composition at photostimulation

At 22 wk, PF birds had more breast muscle…



… and similar (or less) abdominal fat



Carneiro, 2016; Zuidhof, 2018

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POULTRY INNOVATION PARTNERSHIP

Does precision feeding make economic sense?

Scenario	Benefits (broiler breeders)	Net
Females	Chick production Alberta: 130 vs. 115 (>25%) • 15 extra chicks	$11.48/hen
	Assuming 50 hens/station, break even cost* per station: $574	
Males	• ~50 extra chicks per rooster (3.8% ↑ fertility) • No replacement males (no spiking) • Feed efficiency	35.57 10.54 0.70 **$46.81/rooster**
	Assuming 75 roosters/station, break even cost* per station: $3,510	

*Break even cost: What you could pay for a station and make back your money in one breeder cycle

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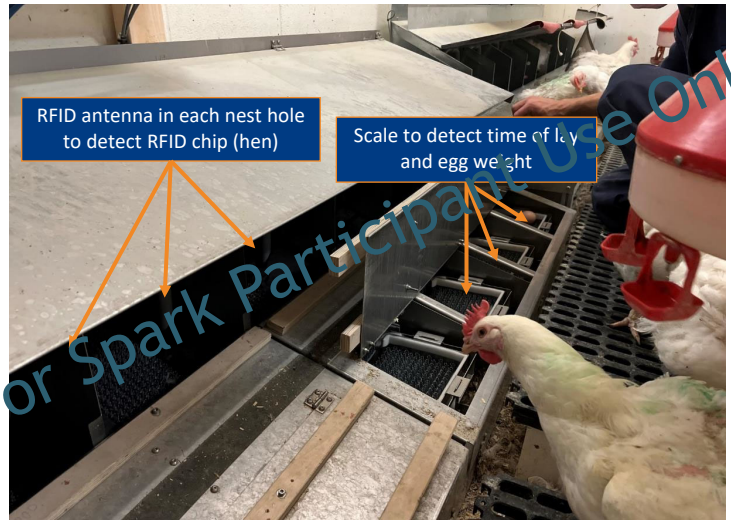
POULTRY INNOVATION PARTNERSHIP

Egg production of individual free-run birds



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POULTRY INNOVATION PARTNERSHIP

Multi feeder feeding station

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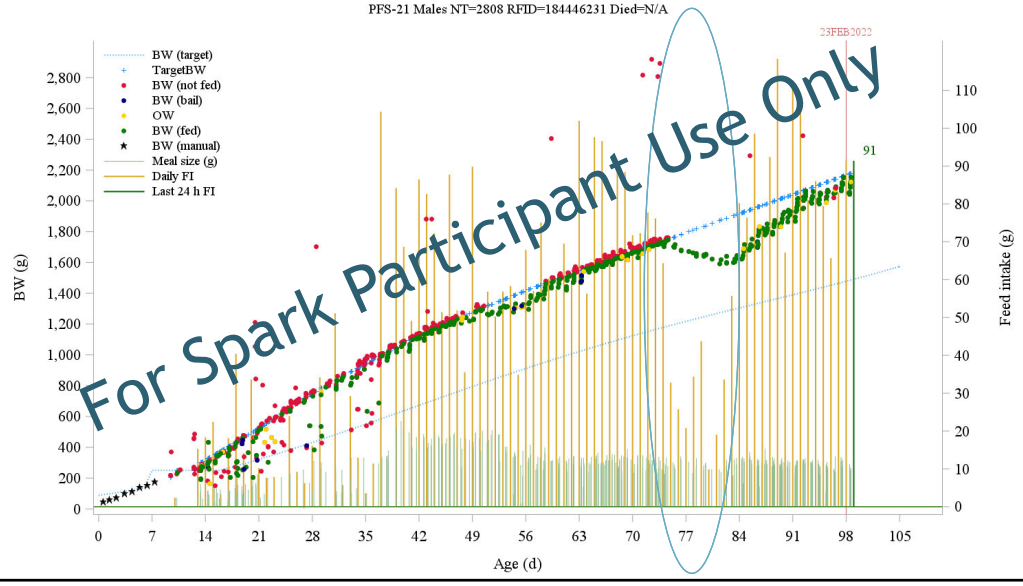
POULTRY INNOVATION PARTNERSHIP

Early detection of problems



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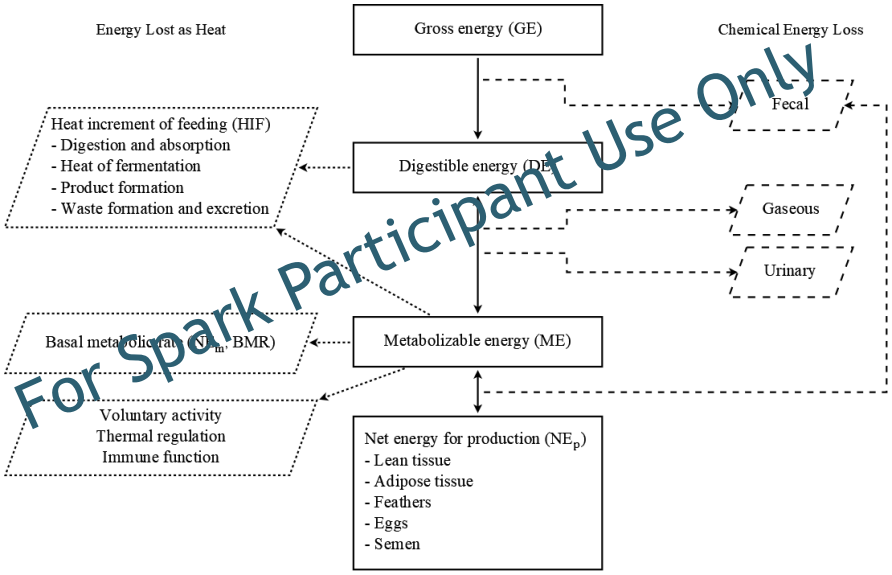
Energy Partitioning



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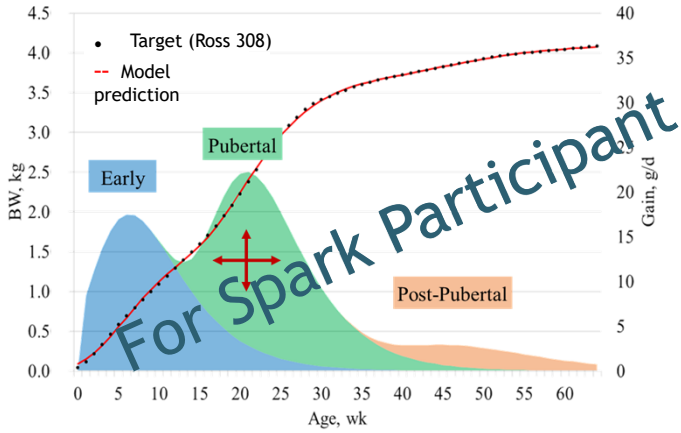
POULTRY INNOVATION PARTNERSHIP

Application of growth models



3-Phase Gompertz Model	
Parameter	Coefficient
Gain (g_1)	1.77 kg
Rate of maturing (b_1)	0.19
Inflection (I_1)	5.8 wk
g_2	1.98 kg
b_2	0.19
I_2	21 wk
g_3	0.37 kg
b_3	0.13
I_3	47 wk

Zuidhof, 2020

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Acknowledgement

Agriculture & Food Council The Catalyst
ALMA Alberta Livestock and Meat Agency Ltd.
Alberta Innovates Bio Solutions
DANISCO
DUPONT
Cobb
Aviagen
EGG FARMERS OF CANADA Dedicated to Quality
Xanantec™
Ontario
Egg Farmers of Alberta
Canadian Poultry Research Council Le Conseil De Recherches Avicoles Du Canada
KARNE MACHINE
LILYDALE
Ontario Broiler Chicken Hatching Egg Producers Association
Thies Electrical Distributing Co.
Alberta Hatching Egg Producers
Canadian Hatching Egg Producers
Les Producteurs d'oeufs d'incubation du Canada
Poultry Industry Council
Alberta Chicken Producers
PRECISIONZX
trouw nutrition a Nutreco company
Canadian Broiler Hatching Egg Producers' Association
Association canadienne des producteurs d'oeufs d'incubation de poulet à chair
RDAR Results Driven Agriculture Research

mzuidhof@ualberta.ca

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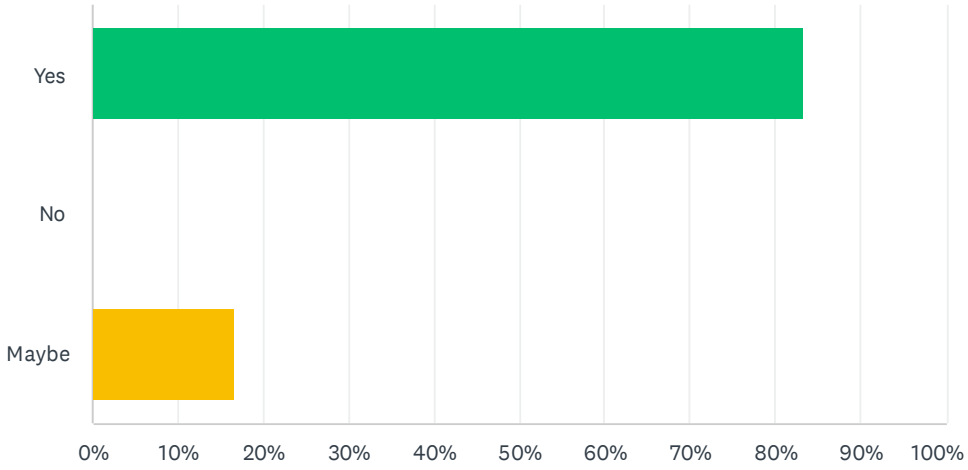
Q1 Do you intend to make any changes in your approach to collaboration as a result of attending this meeting today?

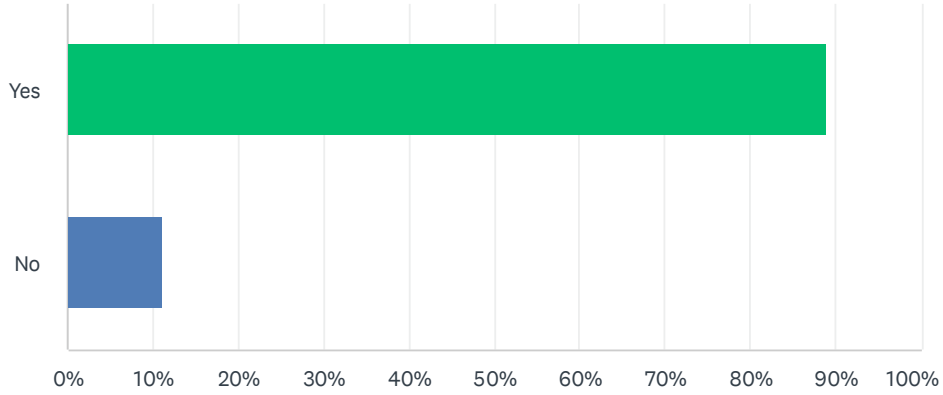
Answered: 18 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	83.33%	15
No	0.00%	0
Maybe	16.67%	3
TOTAL		18

Q2 Did the meeting activities help you expand your network?

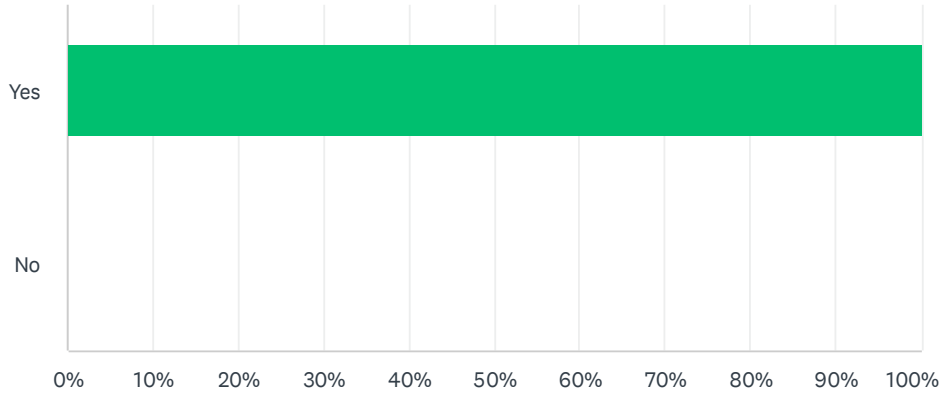
Answered: 18 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	88.89%	16
No	11.11%	2
TOTAL		18

Q3 Would you attend a research & collaboration meeting like this in the future?

Answered: 18 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	100.00%	18
No	0.00%	0
TOTAL		18