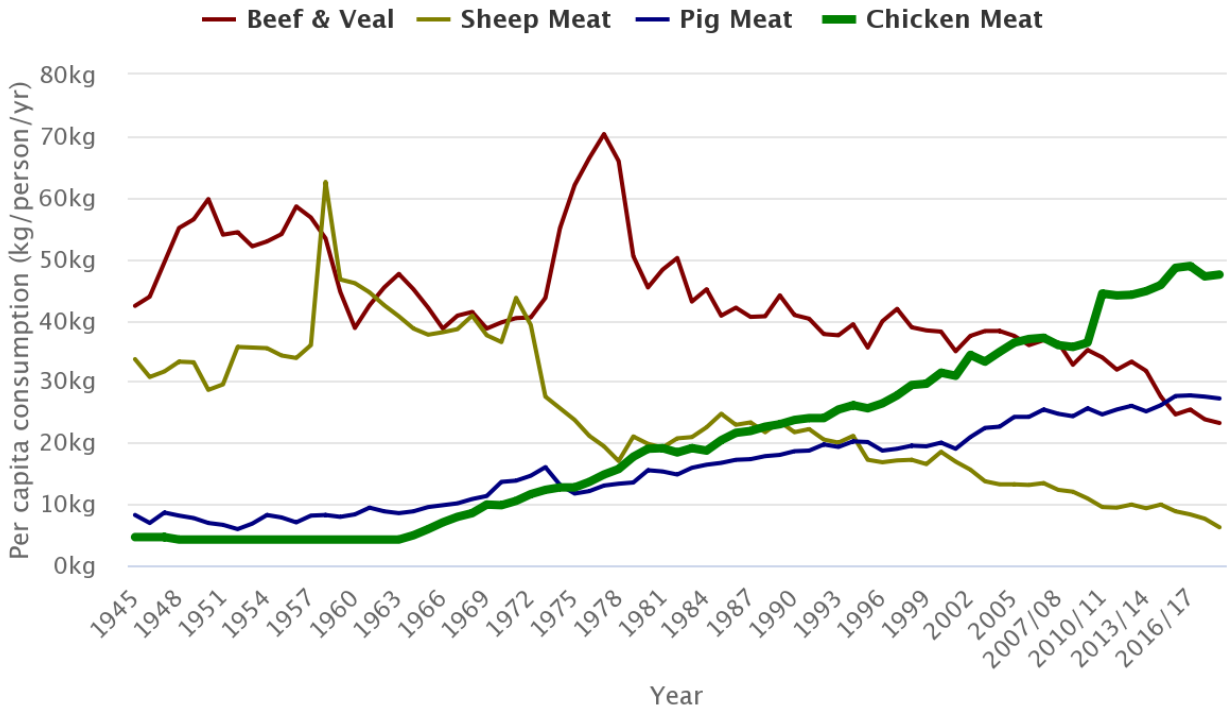
Chicken Nutrition, Gut health and Environment Consortium

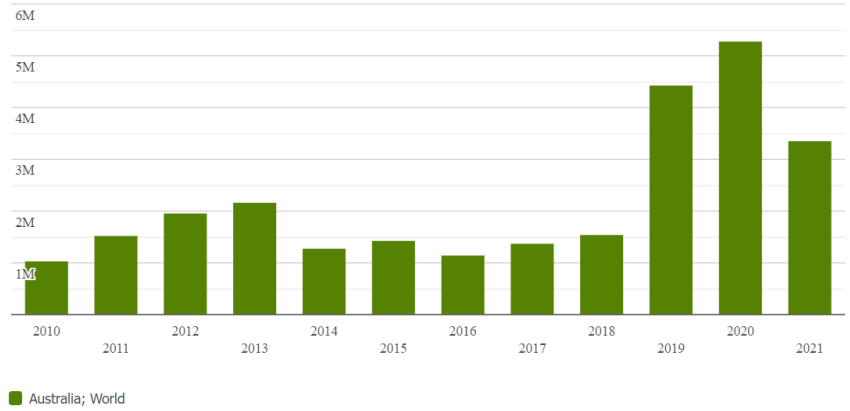
APSS, February 2023

Chicken meat production and consumption trends



Source: Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES; "Australian Commodities, March Quarter 2020")

Soybean imports into Australia (2020):
1,180 M tm / 750,000 for poultry feeds



Source: https://trendeconomy.com/data/h2/Australia/1201

NUTRITION GUT HEALTH ENVIRONMENT

AgriFutures® Chicken Meat

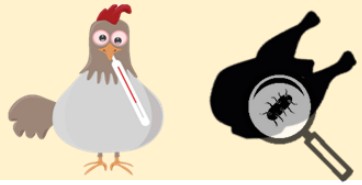
Nutrition, Gut Health and Environment Program

NUTRITION:
What goes in?

Increase **feed efficiency** by refining amino acid and carbohydrate nutrition.
Improve **sustainability** by using local alternatives to soybean meal.

GUT HEALTH:
What happens inside?

Establish a **healthy gut**, reduce undigested feed reaching the hindgut, and reduce chicken pathogen loads improving bird health and **food safety**.



ENVIRONMENT & SOCIETY
What comes out?

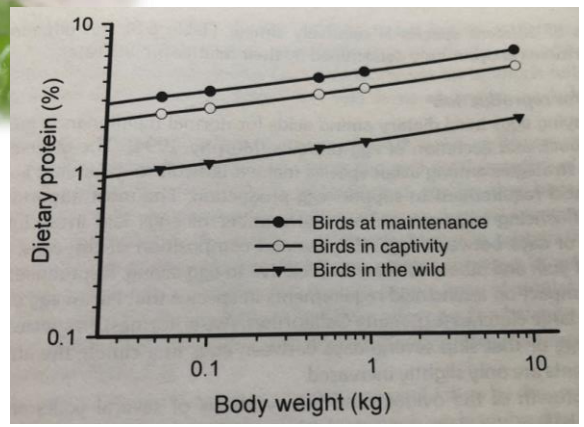
Improve in-shed environment and reduce emissions through novel feed formulations improving **bird health** and **consumer satisfaction**.

NUTRITION GUT HEALTH ENVIRONMENT

Physiological adaptation to diets: from the junglefowl to the broiler

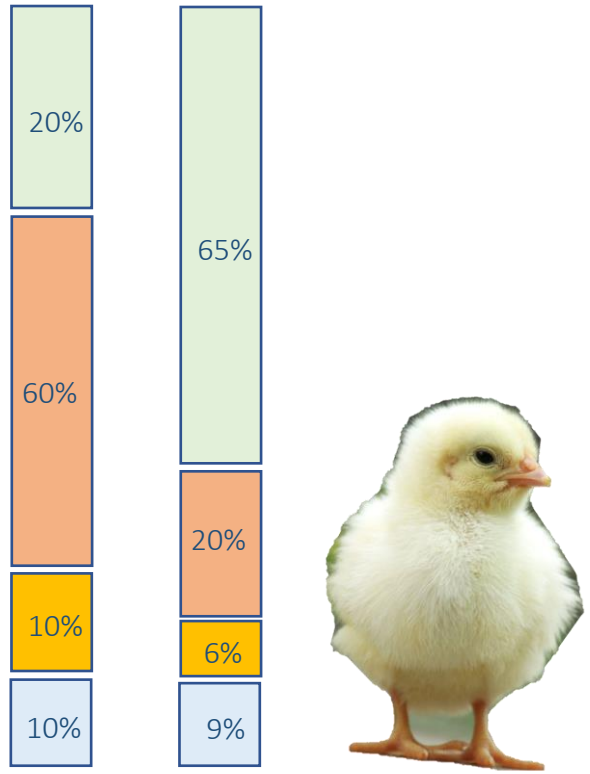
Omnivorous forager

Adults feed mainly plants / insects
(high carb, low protein and fat diets)



Source: Klasing 1998 Comparative avian nutrition

Junglefowl chicks feed mainly on worms/larvae
(low carb, high protein and fat diets)



NUTRITION GUT HEALTH ENVIRONMENT

Innovative diet formulation I: for sustainability and productivity

Source: Selle et al, 2022. "Identifying the shortfalls of crude protein-reduced, wheat-based broiler diets"

Impact of dietary crude protein (CP) concentrations in maize-based diets relative to wheat-based diets on weight gain, FCR and relative abdominal fat-pad weight from d 7 to 35 post–hatch.

CP, g/kg	Weight gain, g/bird			FCR			Relative fat-pad weight, g/kg		
	Maize	Wheat	Response	Maize	Wheat	Response	Maize	Wheat	Response
222[1]	2,214	2,403	−7.87%	1.453	1.453	0.00%	6.40	6.40	0.00%
193	2,396	2,386	+0.42%	1.415	1.471	−3.81%	11.10	8.50	+30.60%
165	2,370	1,549	+53.00%	1.473	1.840	−19.90%	12.80	7.50	+70.70%
220[2]	2,690	2,720	−1.10%	1.338	1.314	+1.83%	8.02	6.19	+29.60%
180	2,598	2,510	+3.51%	1.385	1.443	−4.02%	10.16	7.78	+30.60%

[1] From Chrystal et al. (2021).
[2] From Greenhalgh et al. (2022a).

NUTRITION GUT HEALTH ENVIRONMENT

Innovative diet formulation for sustainability and productivity

GOAL: Increase sustainability, efficiency and profit in chicken-meat production by focusing on the two most important dietary components – protein/amino acids and carbohydrates

- How to make low protein wheat-based diets work (3-4% CP reduction)?
- How to utilise local alternative feed ingredients?
- How low protein diets perform under antibiotic-free conditions?

Outcomes:

- Short-term and long-term industry applicable broiler diet with reduced SBM and CP content that can be delivered using existing and future feed mills
- Knowledge to manage gut health and improve litter quality

NUTRITION
GUT HEALTH
ENVIRONMENT

Innovative diet formulations II

GOAL: Optimize digestibility of protein and carbohydrates (i.e., feed processing, enzymes…) that promote the growth of resident bacteria in the large intestine that can limit infection by Salmonella or Campylobacter while maximising the carbohydrate and protein conversion efficiency

Source: Bryan and Classen, 2020

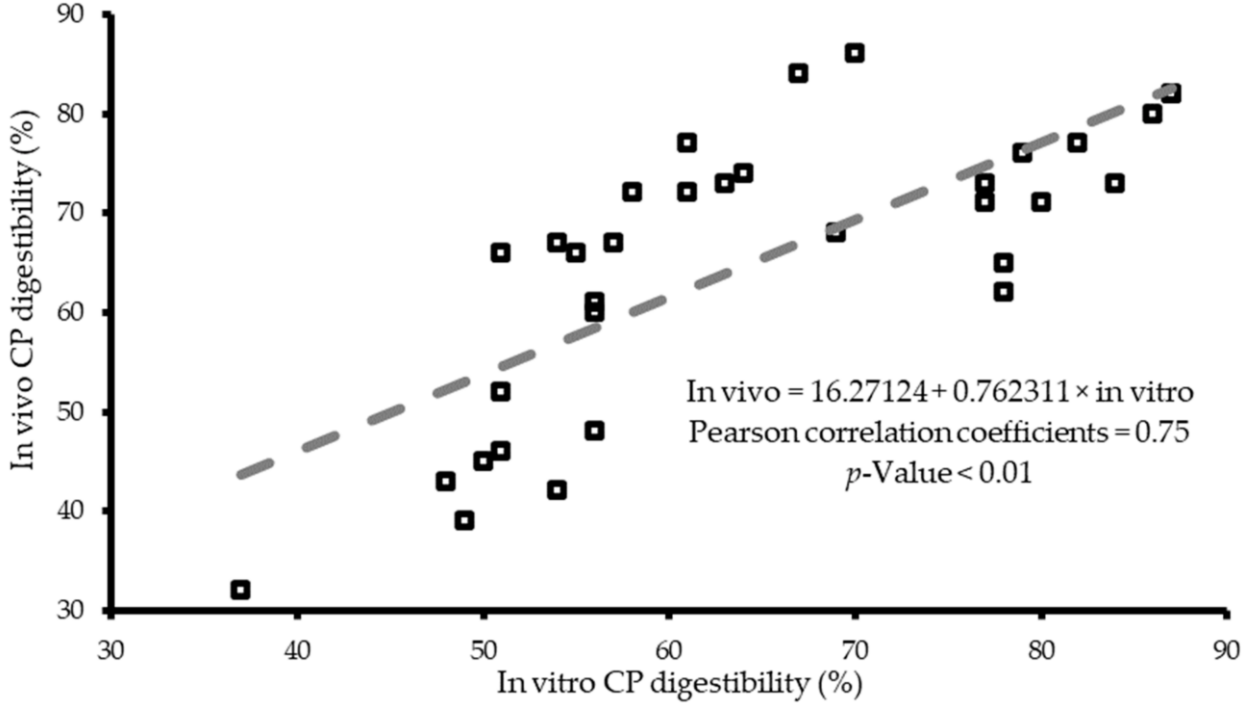


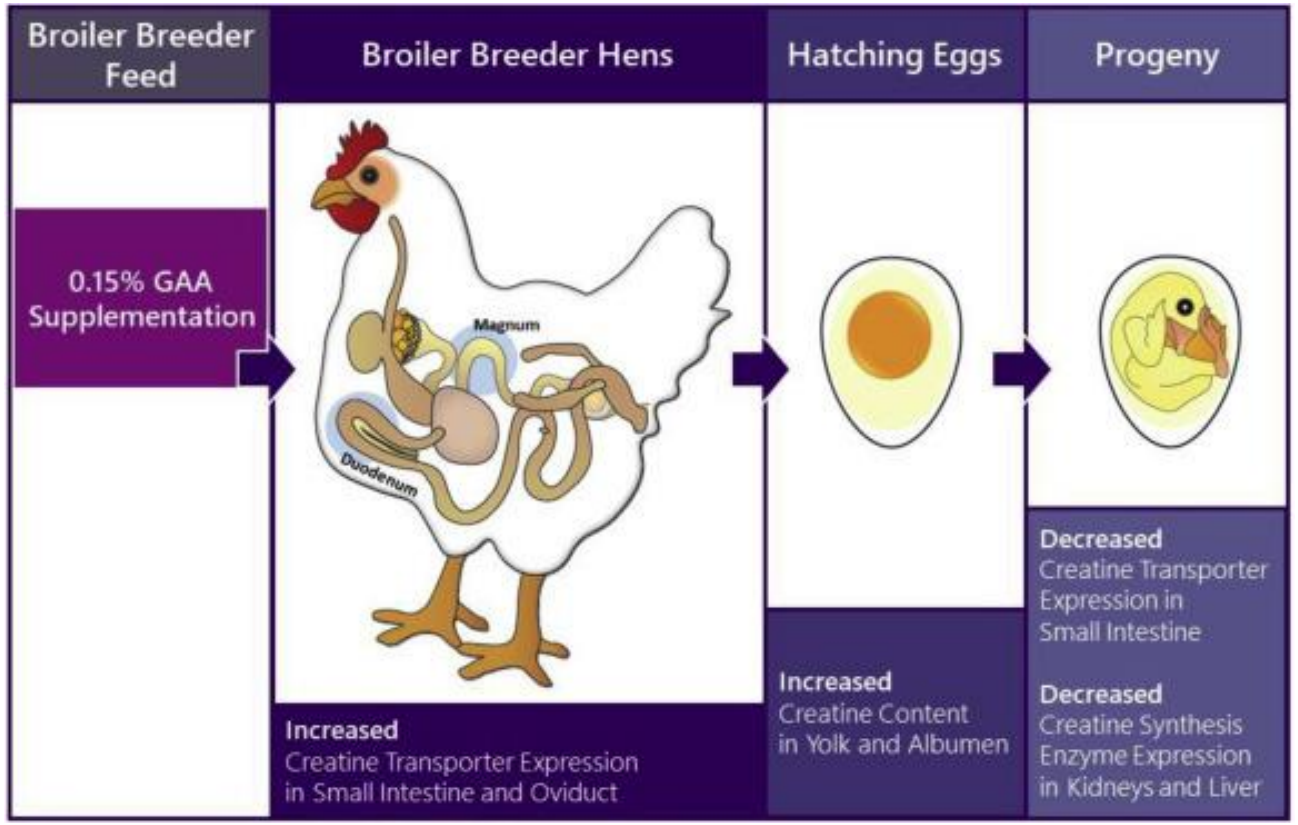
Figure 1. Plot of correlation between in vivo and in vitro crude protein (CP) digestible of nine high protein poultry feed ingredients.

NUTRITION GUT HEALTH ENVIRONMENT

Maternal programming and epigenetic mechanisms

GOAL: Develop a nutritional strategy to improve protein utilisation in meat chickens through maternal programming.

Source: Reicher et al., 2020

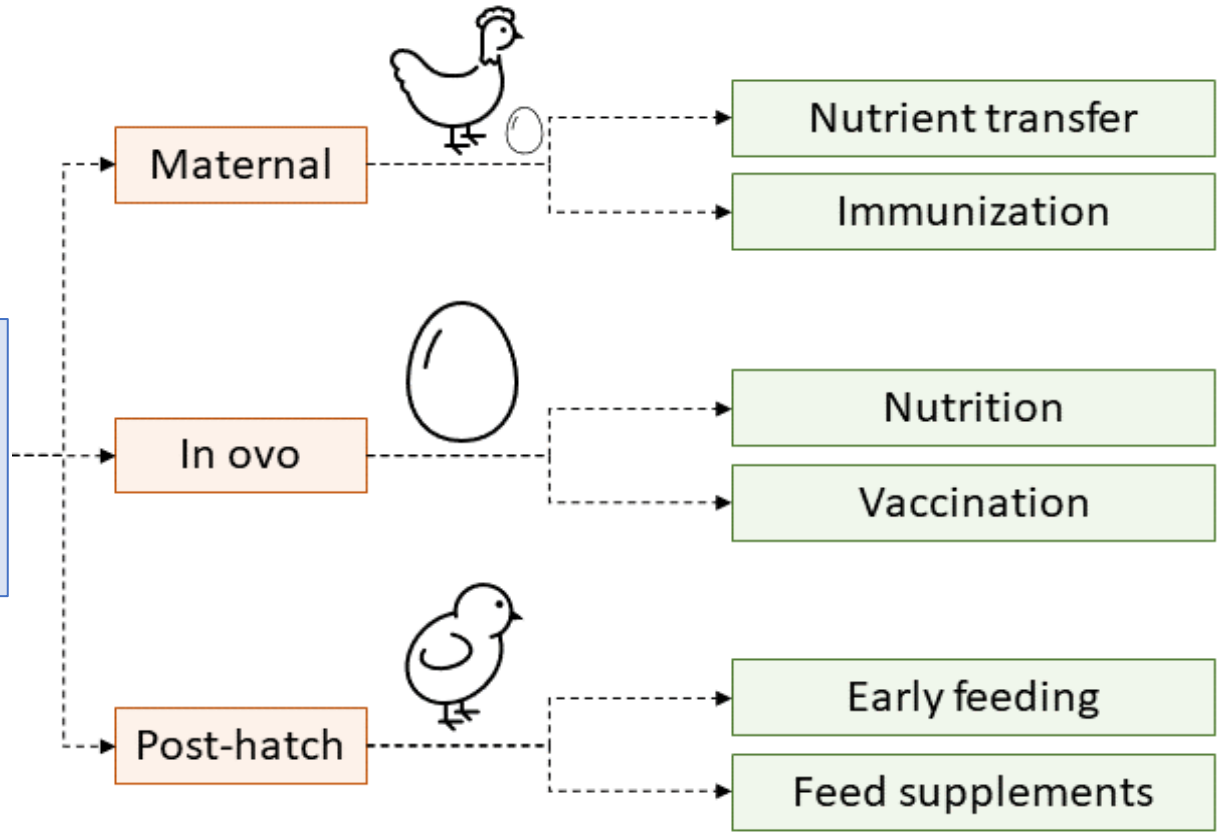


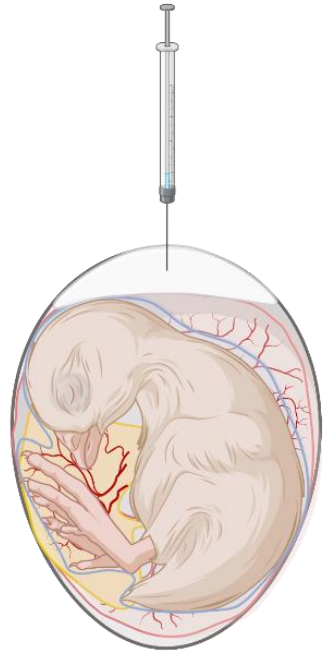
NUTRITION GUT HEALTH ENVIRONMENT

Gut health: Early gut development

GOAL: Identify the key factors involved in early gut colonisation in meat chickens, and develop strategies for optimisation to increase beneficial bacteria and reduce the presence of pathogenic bacteria

Strategies to improve gut development (including GALT) and gut health early in live



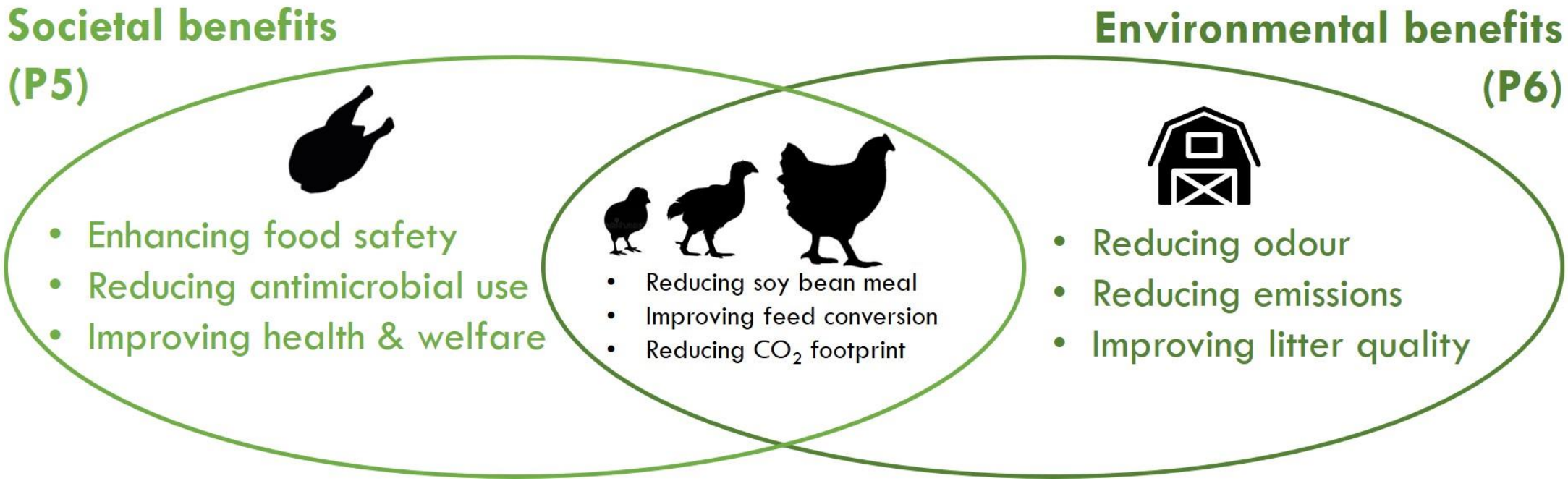


Source: Mila Meijer, PhD candidate

NUTRITION GUT HEALTH ENVIRONMENT

Litter management and integration program

GOAL: Measure the moisture in droppings and litter conditions to quantify the effect of the nutritional and gut-health strategies being researched in the Consortium's other Programs.



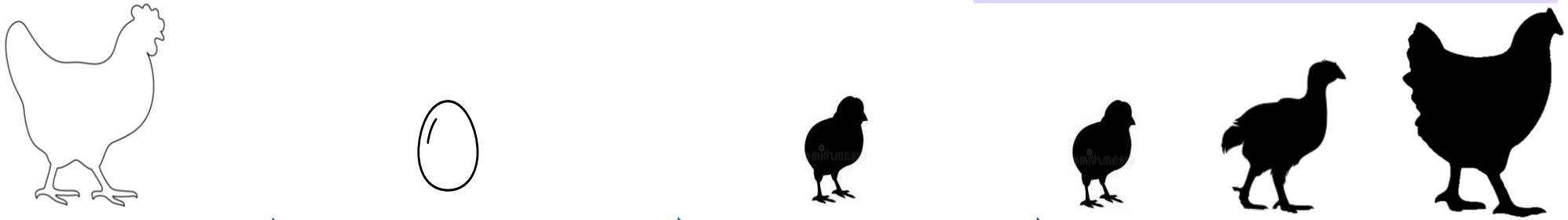
NUTRITION GUT HEALTH ENVIRONMENT

Overall program structure

Program 1 MATERNAL PROGRAMMING & AMINO ACID PRECISION FEEDING

Program 2 CARBOHYDRATE PRECISION FEEDING

Program 3 INNOVATIVE FORMULATIONS



Breeder → *In ovo* → Hatching → Starter-grower

Program 4 EARLY GUT MICROBIOTA

Program 5 ENVIRONMENT

Program 6 INTEGRATION

NUTRITION GUT HEALTH ENVIRONMENT

Who's involved

AgriFutures® Chicken Meat

The University Of Queensland AUSTRALIA

The University of Sydney

Massey University Te Kunenga ki Purehuroa University of New Zealand

CQUniversity Australia

Queensland Government Department of Agriculture and Fisheries

- Program Leaders:
  - Program 1: Prof Eugeni Roura (The University of Queensland)
  - Program 2: Prof Mike Gidley (The University of Queensland)
  - Program 3: Dr Sonia Yun Liu / Peter Selle (The University of Sydney)
    Dr Reza Abdollahi (Massey University)
  - Program 4: Prof Dana Stanley (Central Queensland University)
  - Program 5: Dr Mark Dunlop (Queensland Government)
  - Program 6: Prof Ruth Zadoks (The University of Sydney)

- Main industry partners

Aviagen® DSM LALLEMAND LALLEMAND ANIMAL NUTRITION Lucta MEV NØØVISTA

- Industry contributors: Redox & World's Poultry Science New Zealand

Nutrition Gut Health Environment

	ACADEMIA / INDUSTRY RESEARCHERS
Industry	12
Academics	
Aust NZ	27
International	9
TOTAL	**48**

Program Contacts

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