

# Implementation of a gene-level metagenomic reaction network in tandem with host transcriptomics

Host-microbiome interactions help to translate product to commercial viability

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## 1) In-Vitro Phenotype

**Legend:**  
 - No Glycan  
 - Glycan Mixed with Feed  
 - Pure Glycan

- Anaerobic cultivation of cecum microbiome
- Glycan:Feed mixture offers balanced pH
- Lower pH expects to deliver short-chained fatty-acids (SCFA) more efficiently to host
- Expected increase in SCFA via the microbiome

## 2) In-Vivo Study

- 42 days duration
- 21 replicates (40 birds/treatment)
- Compared complex glycan mixture (500 ppm)

- Improved feed efficiency
- Better consistency in performance

**Day 24** | **Day 42**

## 3) In-Vivo Metabolic Network

- Shotgun Metagenomics
- Chicken Gut Database (Huang et al. 2018)
- Metabolic model derived from MetaCyc centered on TCA and Nitrogen metabolism
- Normalized on control and multiple comparison corrected

- Motif 1: link to urea cycle (ammonia)
- Motif 2: acrylate pathway to propionate
- Motif 3: phenylalanine degradation

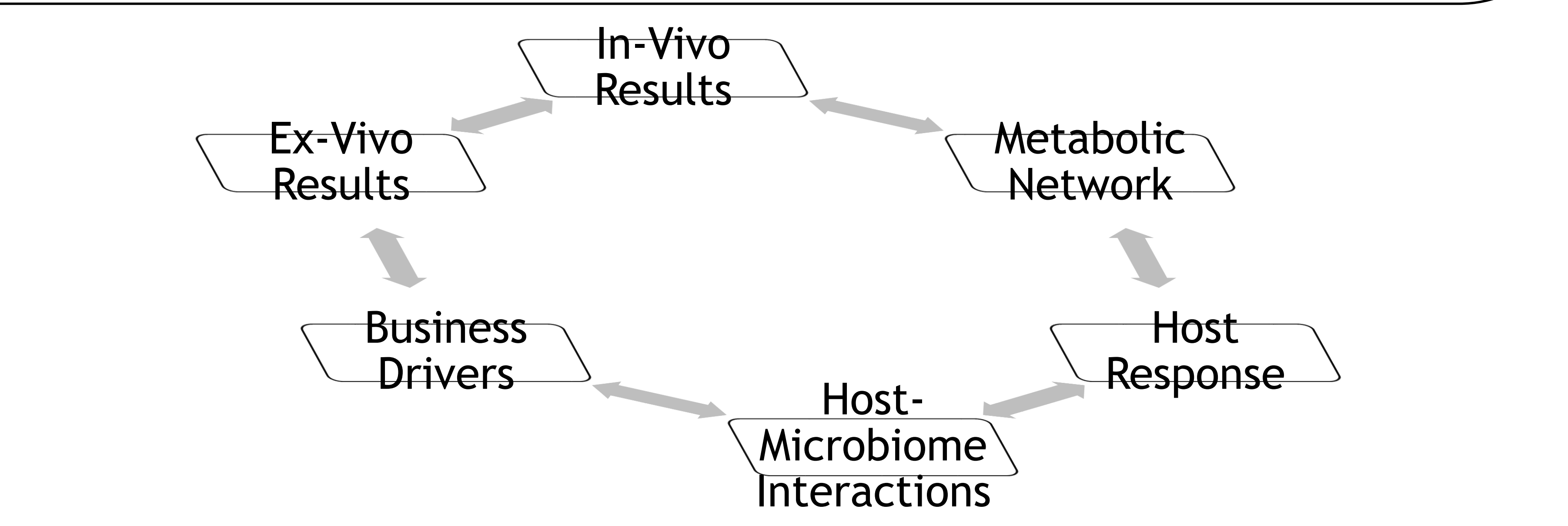
## 6) Connect to Market Drivers

Customer Value Drivers → Targeted Animal Biology → Enabling Local Host Biology → Causative Microbiome Pathways → mBiome Product

- Increased Resilience to Enteric Dysbiosis** (Immune System, Intestines)
- Consistent Performance** (FCR, BW, Uniformity) (Liver, Muscle)
- Less Waste Nitrogen** (Litter quality, footprint welfare & emissions) (Faeces, Hind Gut)

Key pathways: C4, C3, N-Pathway

*Dietary Ingredients proven to modulate intrinsic microbiome pathways that benefit the animal and generate value\**



## 5) Host-Microbiome Interactions

- Molecules connect to host using transcriptomics
- Enrichment of nitrogen pathways in both host and microbiome
- Decreased pH potentially connected to SCFA and nitrogen metabolism
- Product development story evolves to include nitrogen

**HOST - Glutamate**  
**Host - Ammonia**

## 4) Host Response

| Pathway Name                                | Database | Enrichment Score | Enrichment p-value |
|---|----------|------------------|--------------------|
| Nitrogen metabolism                         | kegg     | 4,26101          | 0.014108           |
| Arginine biosynthesis                       | kegg     | 3,99693          | 0.018322           |
| Glyoxylate and dicarboxylate metabolism     | kegg     | 3,76239          | 0.023228           |
| Tyrosine metabolism                         | kegg     | 3,49073          | 0.030479           |
| Alanine, aspartate and glutamate metabolism | kegg     | 3,49073          | 0.030479           |
| Steroid hormone biosynthesis                | kegg     | 3,13118          | 0.043666           |
| Biosynthesis of amino acids                 | kegg     | 2,94542          | 0.05258            |
| Necroptosis                                 | kegg     | 2,18319          | 0.112682           |
| Phagosome                                   | kegg     | 2,03148          | 0.131141           |
| Neuroactive ligand-receptor interaction     | kegg     | 1,50868          | 0.221201           |
| Metabolic pathways                          | kegg     | 1,46255          | 0.231645           |