Unlocking the microbiome
Mastering the microbiome, transforming lives
Delivering healthier lives through innovation in gut health, microbiology and food
Exploring the relationship between food and health
My journey
Director, Microbiome Solutions
Director, Strategic Alliances
Head of Business Development
Chief Business Officer
Director, Strategic Alliances
Director, Microbiome Solutions
Microbiome network
Enterobiotix
Cancer
Food & Nutrition
Microbiome
Scientist
Cancer Microbiome
PUBLIC
About Eagle Genomics

Deep Tech scale-up business in the TechBio space
- Driving the Bioeconomy through the digitization of science

Applying Microbiome Network Science
- Changing the face of One Health across various players in the ecosystem

Driving sustainable systems change
- Promoting and protecting the health of humans, animals and the environment

e[datascientist]™
- Award-winning AI-augmented knowledge discovery platform
- Leverages AI and network science, surfacing scientific connections and exploring multi-causal relationships
Challenges for future food production

Growing demand
- World population growth: 10 billions in 2050
- Increasing demand from developing countries

Limited resources
- >25% of food wasted in production, processing and consumption
- Water and arable land are becoming scarce resources

Lack of consumer trust
- Missing transparency in food production and processing
- Insufficient food safety in some regions

Lack of integration along the value chain
- Fragmented market

Food production and processing must become more...

- Efficient
- Sustainable
- Transparent
- Personalised
- Integrated
Animal Health & Welfare
From analog to digital

1st Industrial Revolution
Water & steam

2nd Industrial Revolution
Electricity
Mass production

3rd Industrial Revolution
Automation

4th Industrial Revolution
Digitalisation

PHYSICAL ENVIRONMENT

VIRTUAL ENVIRONMENT

Physical Asset
Sensors (inc. Fecal microbiome)

DATA

INFO

Digital Twin
Computer
Future integration of multi-omics measurements

## Microbiota, Gut Health and Chicken Productivity

### HOST FACTORS
- Genetic background
  - Bird species
  - Type
  - Breed
  - Sex
- Gut development and maturation
  - Immune system
  - Gut morphology
  - Microbiota acquisition
  - Gut region

### ENVIRONMENTAL FACTORS
- Seasonal climate changes
- Geographical climate changes

### GUT HEALTH
- Nutrient assimilation
- Intestinal barrier integrity
- Immune response efficiency
- Inflammatory balance
- Susceptibility to enteric pathogens (E. coli, Salmonella, Campylobacter, C. perfringens)

### FARM MANAGEMENT
- Stress/Welfare
  - Stocking density
  - Temperature
  - Photoperiod
  - Ventilation
  - Access to range
- Health interventions
  - Antibiotic growth promoters
  - Therapeutic antibiotics
  - Vaccination
  - Probiotics / Prebiotics
  - Plant bioactives
- Litter management
  - Litter components
  - Humidity
  - Reuse / Removal cycles
- Feed management
  - Feed access
  - Water access
  - Feed changes
  - Feed quality

### NUTRITION
- Feed components
- Particle size
- Fiber source
- Protein source
- Micronutrients
- Enzymes

### LITTER MICROBIOTA

### GUT MICROBIOTA

### Functional output
- Production of SCFA
- Added metabolic potential
- Competitive exclusion of pathogens

### Composition
- Richness of species
- Population structure and complexity
- Balance between commensal and detrimental microorganisms
- Competitive exclusion of pathogens

### CHICKEN HEALTH & WELFARE
- Energy balance
- Feed efficiency
- Growth rate

Adapted from: https://www.mdpi.com/2076-2607/7/10/374
Our approach: create a data fabric from siloed data...
... and enrich it with additional data assets...
... including from our existing knowledge & technology partners
Step1: Onboarding measurement data and knowledge

Data curation

Study onboarding & management

Analyzed measurements e.g., signatures

Onboarding public & premium datasets
Step 2: Analyzing and classifying raw measurement data

Selecting bioinformatics pipelines

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metagenomics (WGS) assembly based</td>
<td>Processes metagenomic paired-end whole genome sequencing data to generate contig assemblies, gene predictions, taxonomic classification and functional annotation.</td>
</tr>
<tr>
<td>Metagenomics (WGS) read based</td>
<td>Processes metagenomic paired-end whole genome sequencing data and matches reads against references to generate taxonomic classification and functional annotation.</td>
</tr>
<tr>
<td>Illumina 16S</td>
<td>Processes 16S targeted sequencing data to generate prokaryotic taxonomic classifications and phylogeny.</td>
</tr>
<tr>
<td>Illumina 18S</td>
<td>Processes 18S targeted sequencing data to generate eukaryotic taxonomic classifications &amp; phylogeny.</td>
</tr>
<tr>
<td>ITS marker gene</td>
<td>Processes ITS targeted sequencing data to generate fungal taxonomic classifications &amp; phylogeny.</td>
</tr>
<tr>
<td>Illumina QC visualisation</td>
<td>Marker gene QC visualisation. Processes targeted sequencing data and performs quality assessment of the inputs.</td>
</tr>
<tr>
<td>Single isolate / Clonal Assembly</td>
<td>Processes single isolate genome sequences and generates complete whole genomes for individual bacterial strains. Provides characterisation including functional annotation, prediction of secondary metabolite gene clusters &amp; antimicrobial resistance genes</td>
</tr>
</tbody>
</table>

Configuring pipelines
Step 3: Carry out foundational microbiome analyses in Analysis Hub

- Feature Abundance
- Rarefaction
- Hypothesis Testing
- Alpha Diversity
- Beta Diversity
- Differential Abundance
Step 4: Network based analysis of measurement data

Network-based analysis pipelines

Networked omics data exploration

Identify hubs, biomarkers and controllers by exploring networked properties and functional clusters
Step 5: Enriching networks with information from the Knowledge Graph
Connecting known links to diseases, KEGG compounds and literature references
e[datascientist]™: Workflows enabling **insight generation and impact**...
Feature importance for 21-days old chickens
The microbiome is the next frontier in PLF

Thank you

www.EagleGenomics.com  Christian.Roghi@EagleGenomics.com
Collaboration with livestock

• The health and wellness of livestock is critical to the economic success of the livestock industry
• There is no vehicle to address livestock health problems quickly.

Balanced Gut improves Livestock Health
A balanced and diverse gut microbiome promotes efficient digestion, better growth, and overall health.

Optimize Livestock Performance
A well-balanced livestock microbiome can improve production efficiency, allowing for body weight gain and increased production of eggs, milk, etc.

Efficiently Manage Disease
Identifying the specific microorganisms that are associated with disease could help prevent or treat disease outbreaks in livestock.

Enhance Feed Efficiency
Monitoring the effects of ingredients on gut health could help identify ways to enhance feed efficiency, leading to cost savings and improved sustainability.