High-Value Nutrition – INFANT HEALTH

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On behalf of the HVN ICF Team
Overview

• National Science Challenge
• High Value Nutrition
• Infant Health Programme
High Value Nutrition

• One of 11 National Science Challenges $83.8 million over 10 years
• Funded by Ministry of Business, Innovation and Employment
• Vision for a 10 year programme delivering translational science
• Hosted by University of Auckland – with many participating parties
High-Value Nutrition National Science Challenge

The High-Value Nutrition National Science Challenge builds the science excellence and knowledge New Zealand needs to create and deliver foods to the world that people choose to stay healthy and well.

Highlighted KPI: >1Bn pa additional F&B export revenue from funded, aligned and related research by CY 2025.
Early Life Nutrition

- Optimal Growth, health and Development
- Altered growth, metabolism and development
- Healthy Adults
- Disease

-9 months  Birth  Weaning
Weaning: Introduction of Solid Food

• Development of feeding skills
• Taste
• Nutrients
• Gut maturation
• Immune maturation
Introduction of Solids

MONTHS
0 6 12 24

Breast Milk (formula)

MONTHS
6 24

Breast /Cows Milk/Toddler Milk

WHO, 2001
MoH, 2008
Host-Microbe Metabolism

Pathways by which gut microbiota link host diet to physiology and behavior.

Kevin D. Kohl, and Hannah V. Carey J Exp Biol 2016;219:3496-3504
Why use Systems Biology?

- We do not eat single nutrients...
- Nutrition is not Pharma...
- We are all different.

- We eat diets.
- Multiple subtle effects act together.
- Our genes interact with our environment.
Infant Immunity & Microbiota

• Immune system co-evolves with microbiota.

Questions

• How do microbiota-immune interactions in early life regulate immune homeostasis?
• Can establishment of the pioneer microbiota in early life have lifelong consequences for the function of the host’s immune system?
Infant Health Programme – Collaborative steps

- Microbiome data mining - Identify candidate “prebiotic”
  - Liggins Institute
  - Riddet Institute

- Food Science: design and deliver experimental “prebiotic”
  - Mallaghan, Ag Research, Liggins and UoA

- Clinical: pilot trial
  - UoA, Liggins

- Microbiomics, metabolomics, immune parameters incl. BCR seq
Infant Microbiome and Immunity @ Weaning

**Systems Biology & Reverse Genomics**
- Immune benefits
- Probiotics around weaning
- Probiotic metabolism
- Prebiotic feed
- Prebiotic source
- Prebiotic candidates

**Experimental Diet**
- Safety
- Palatability
- Acceptance
- Compliance

**Pilot CT**
- 40 infants
- 30 Food
- 10 Probiotic Control

**Omics and Cell Biology**
- Metabonomics
- Microbiomics
- Immunology
- Clinical Assessment

**Prebiotics → Probiotics → Immune Benefits**

**Full CT**
- Design 2018
- Conduct 2019+

**Molecular and Clinical Phenotypes**
- Microbiome
- Immunity
- Metabolism
Bioinformatics

- > 32’000 PubMed microbiome publications
  ➔ ~2000 papers on infant gut microbiome & immunity
  ➔ ~50 bacterial genera ~500 bacterial species in human gut
  ➔ ~8 bacterial genera ~80 bacterial species related to infant gut microbiome & immunity

- Including positive controls
e.g. Lactobacilli and Bifidobacteria
Bioinformatics: Exogenous Metabolites

Metabolic Network from Virtual Metabolic Human (http://vmh.uni.lu/)

Netseed

Identification of metabolites that cannot be synthesized from other compounds → Exogenous metabolites

Example: Bacteroides fragilis
# Pilot Study Timelines

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**Omics and Cell Biology**
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- Microbiomics
- Proteomics
- Immunology
- Clinical Assessment
• Determine the optimal age and food for increasing intestinal microbial diversity

• To optimize effects on gut microbiota, immune maturation and later health outcomes.