Infant Health

National SCIENCE Challenges

HIGH-VALUE NUTRITION

Ko Ngā Kai Whai Painga

INFANT HEALTH - Update

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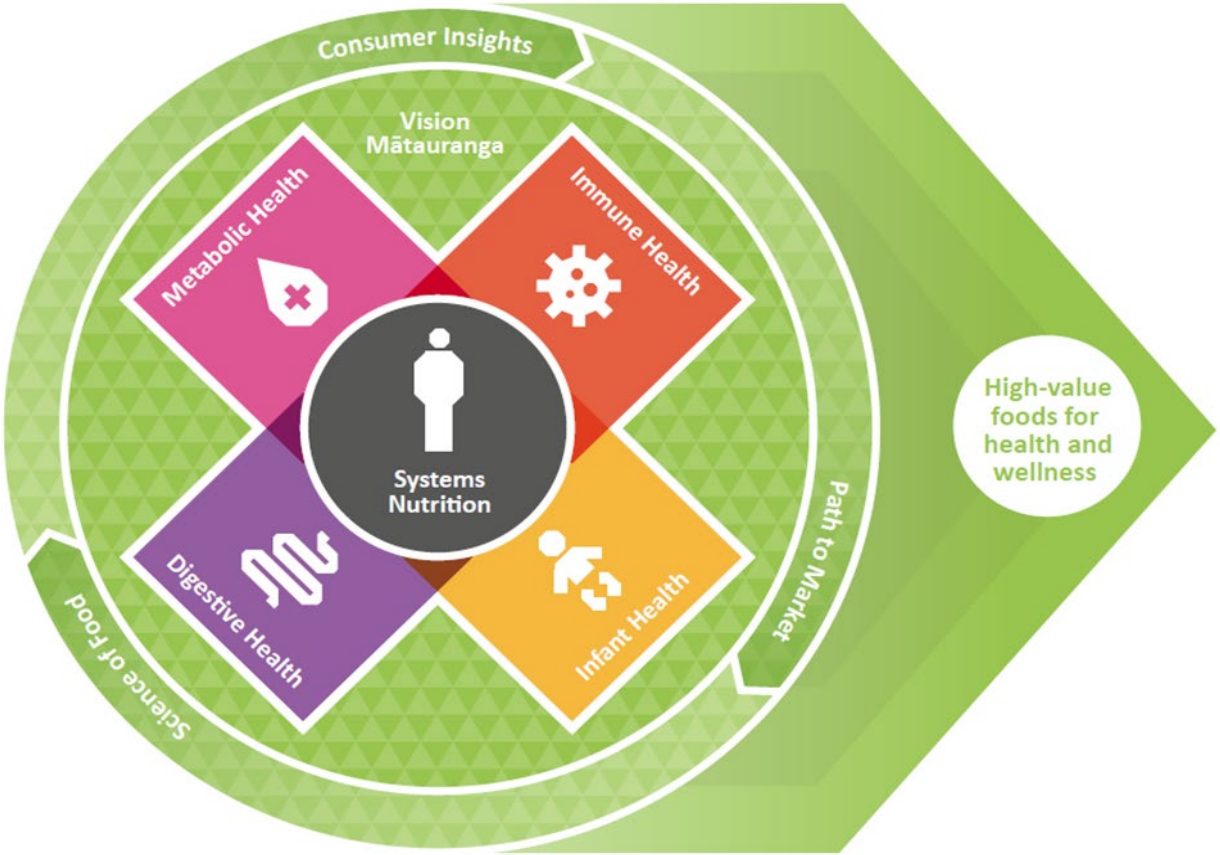
On behalf of the HVN Infant Health Team

Challenge Host

Challenge Collaborating Parties



Outline

- Background
- IFH Programme
- Pilot Study
- Trials

Gluckman PD, Hanson MA. Living with the past: evolution, development, and patterns of disease. Science. 17;305(5691):1733-6.

Weaning: Introduction of Solid Food

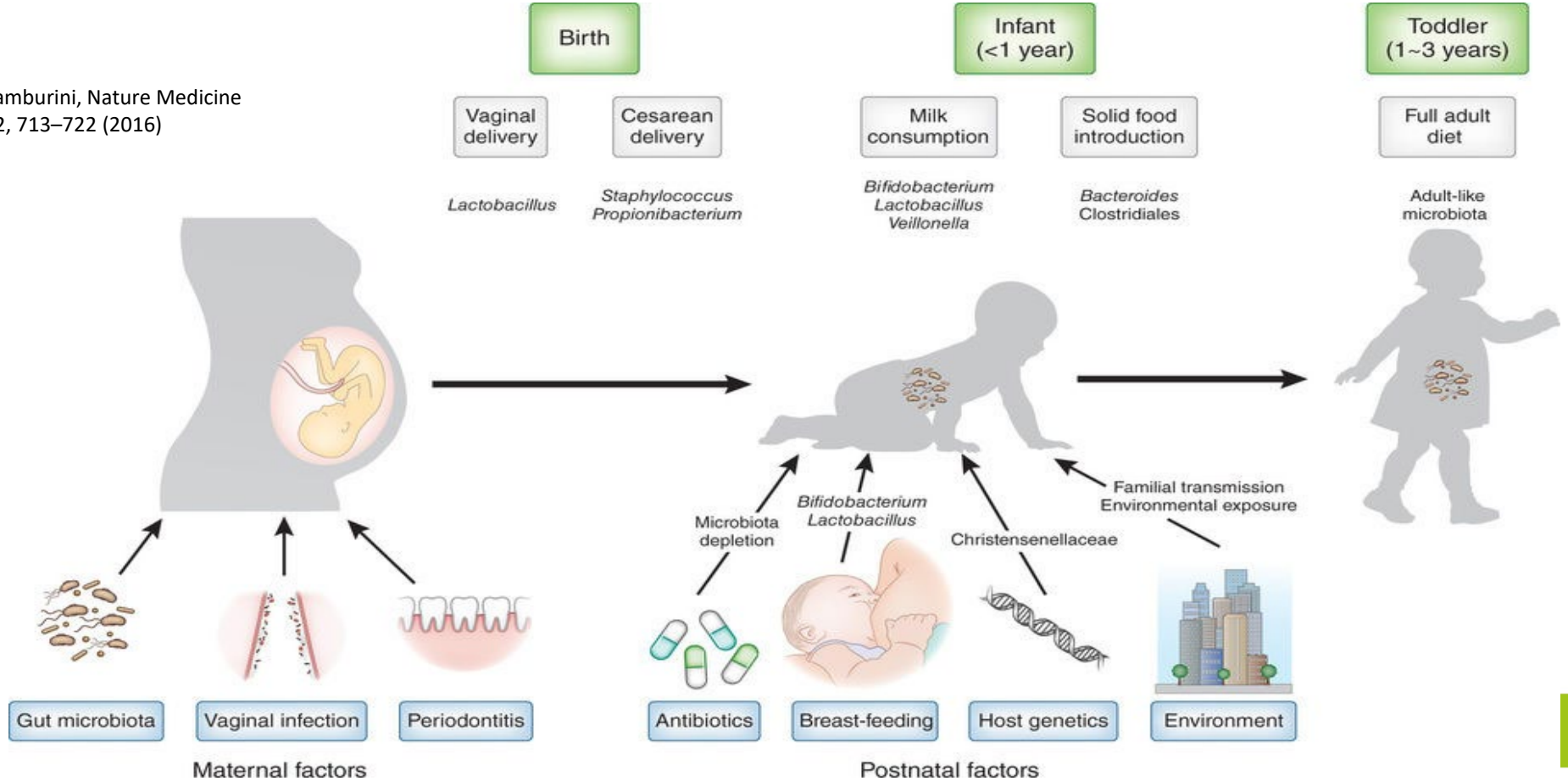
- Development of feeding skills
- Taste
- Nutrients
- **Gut maturation**
- **Immune maturation**

*Global baby food market estimated to reach **US$ 70 B** by 2016 (Euro Monitor 2012 – From cradle to school: opportunities for babies' food and children food.*

*Approximately US$ 50 B in milk formula and further **US$ 20 B** in prepared and other baby/infant foods*

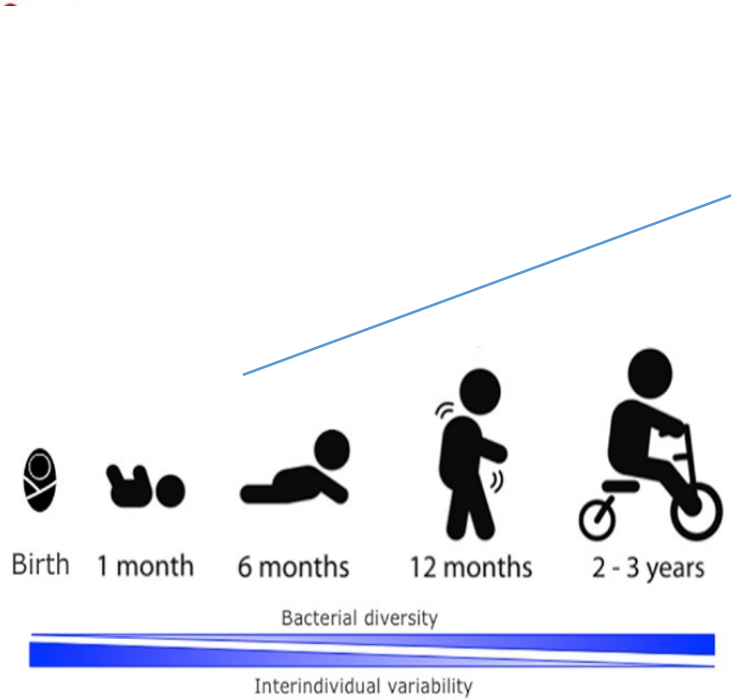
Microbiota in early life

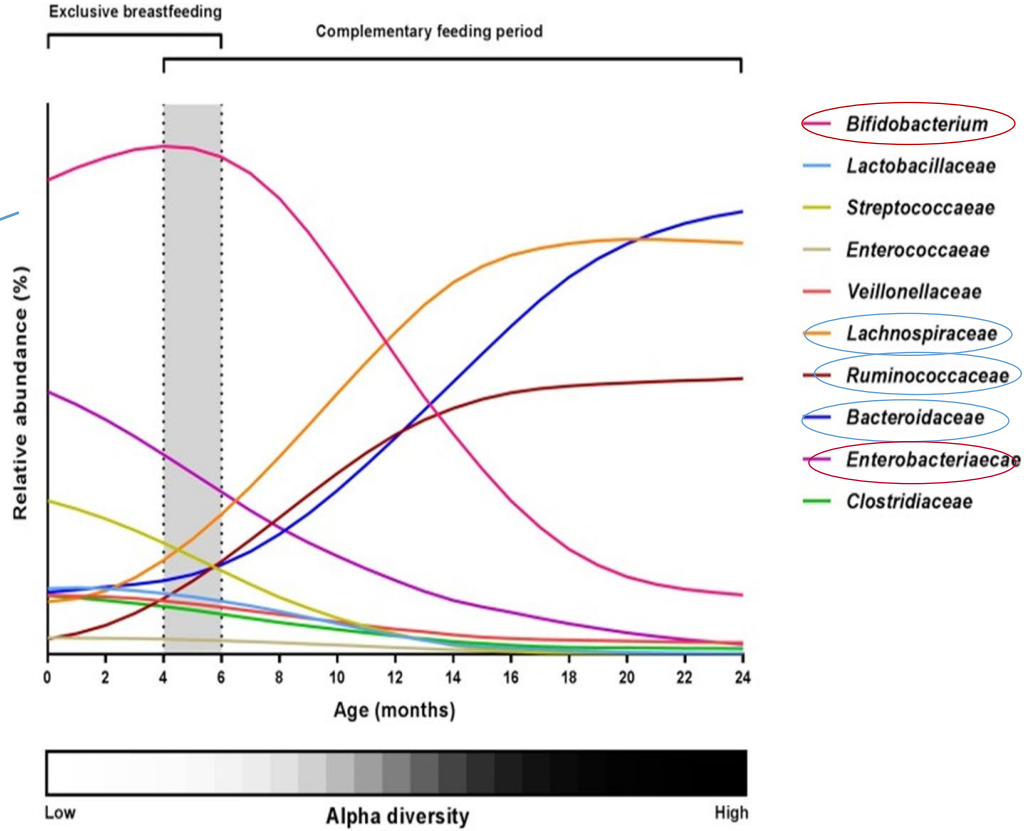
Tamburini, Nature Medicine
22, 713–722 (2016)



Weaning a significant time of change

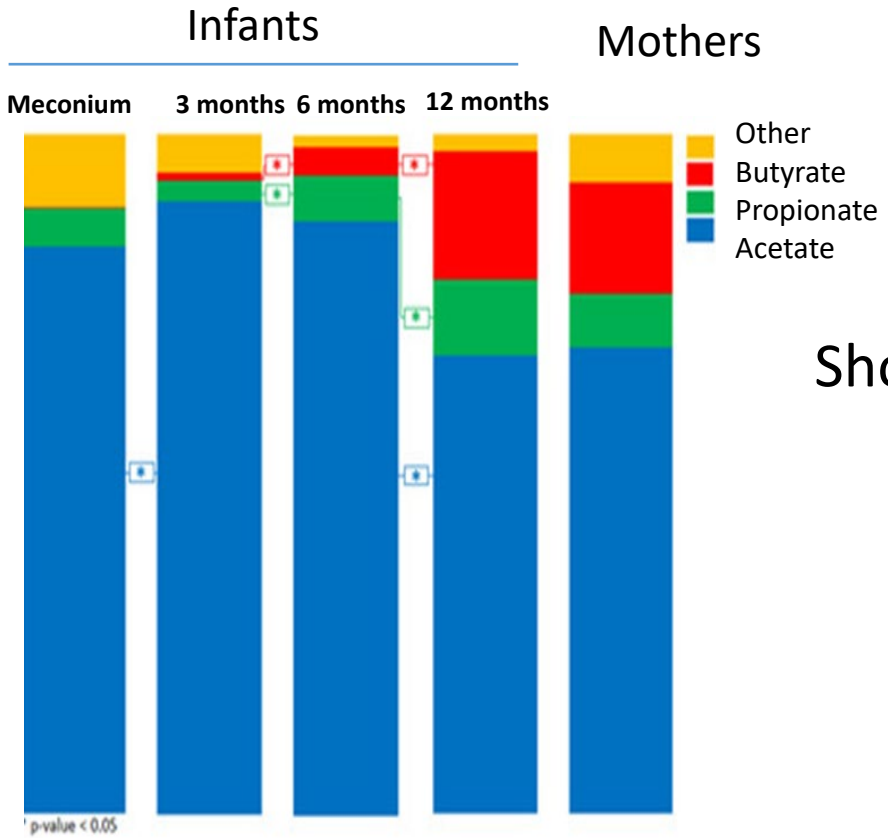
Commensal Microbes





Front. Immunol., 05 September 2014
| https://doi.org/10.3389/fimmu.2014.00427

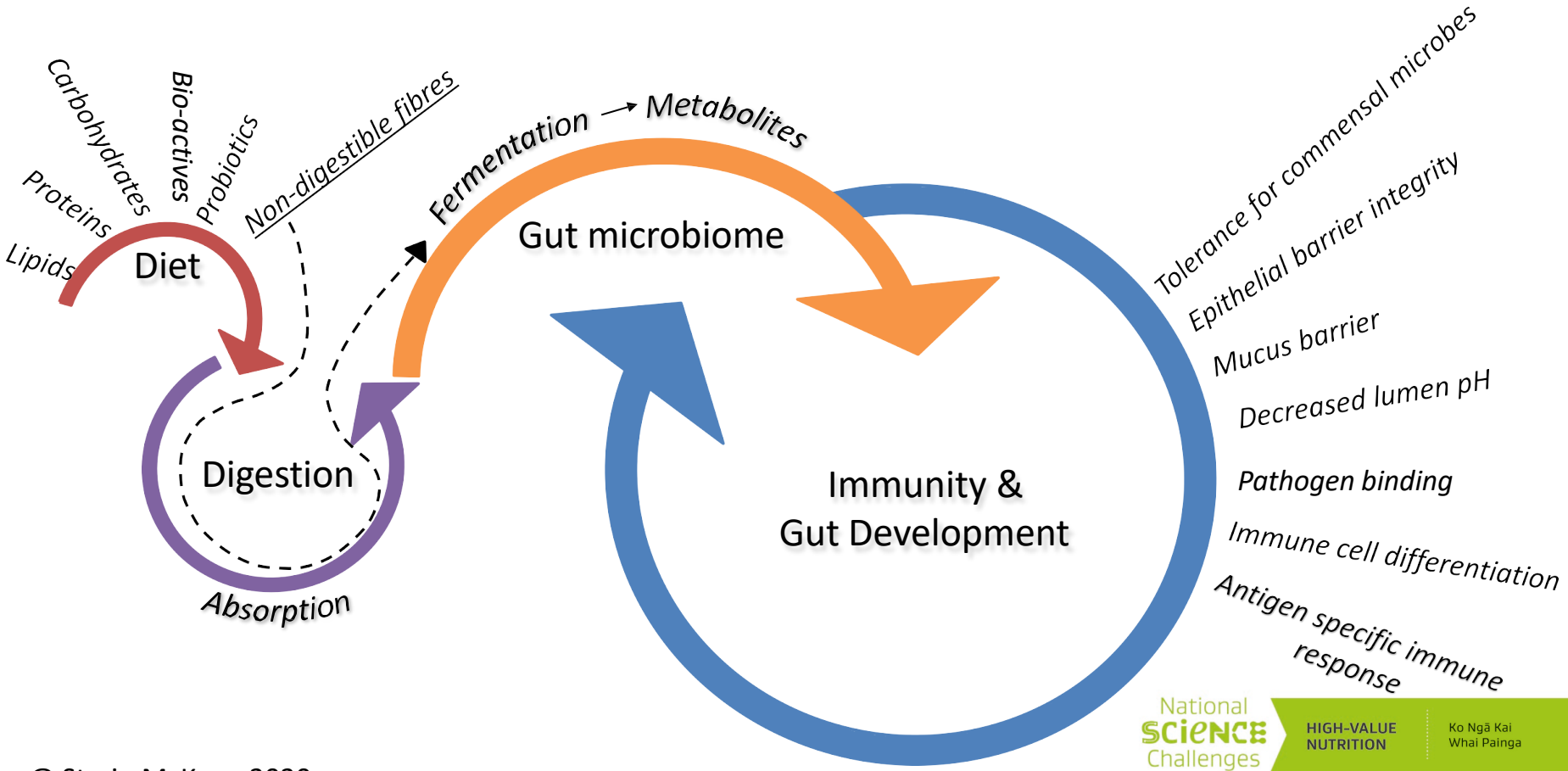
Changes in microbiota metabolic activity



Short Chain Fatty Acids

Tsukuda et al, ISME (2021); Nilsen et al, Genes (2020)

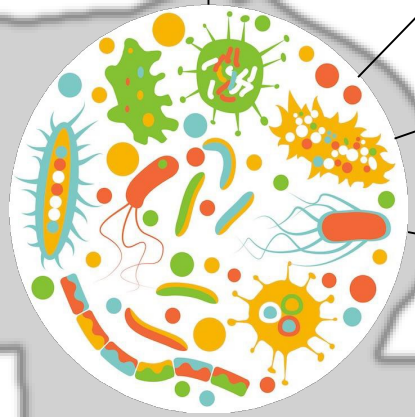
Aim- Evaluating the impact on infant health and immunity through prebiotic food sources which seed the microbiome.



Measuring the gut microbiome

What species are present?
TAXONOMIC COMPOSITION
Amplicon sequencing

What can those species do?
FUNCTIONAL PROFILING
Shotgun sequencing



What are those species doing?
TRANSCRIPTOMICS
RNA sequencing

What have those species done?
METABOLOMICS
ID suite of small molecules

agresearch
āta mātai, mātai whetū

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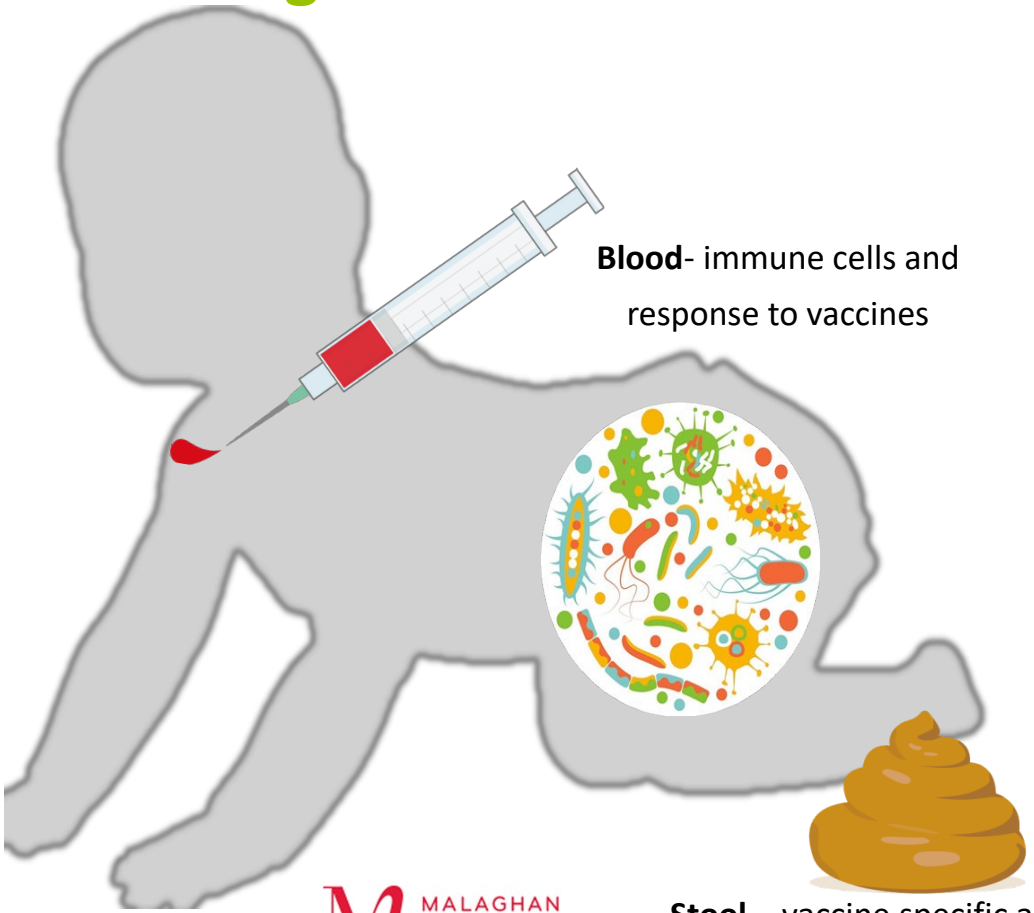
Measuring immune function and outcomes



Blood- immune cells and response to vaccines

Breast Milk – Immune markers

Infections - Health Records

Stool - vaccine specific antibody titres

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Infant Health

Questions

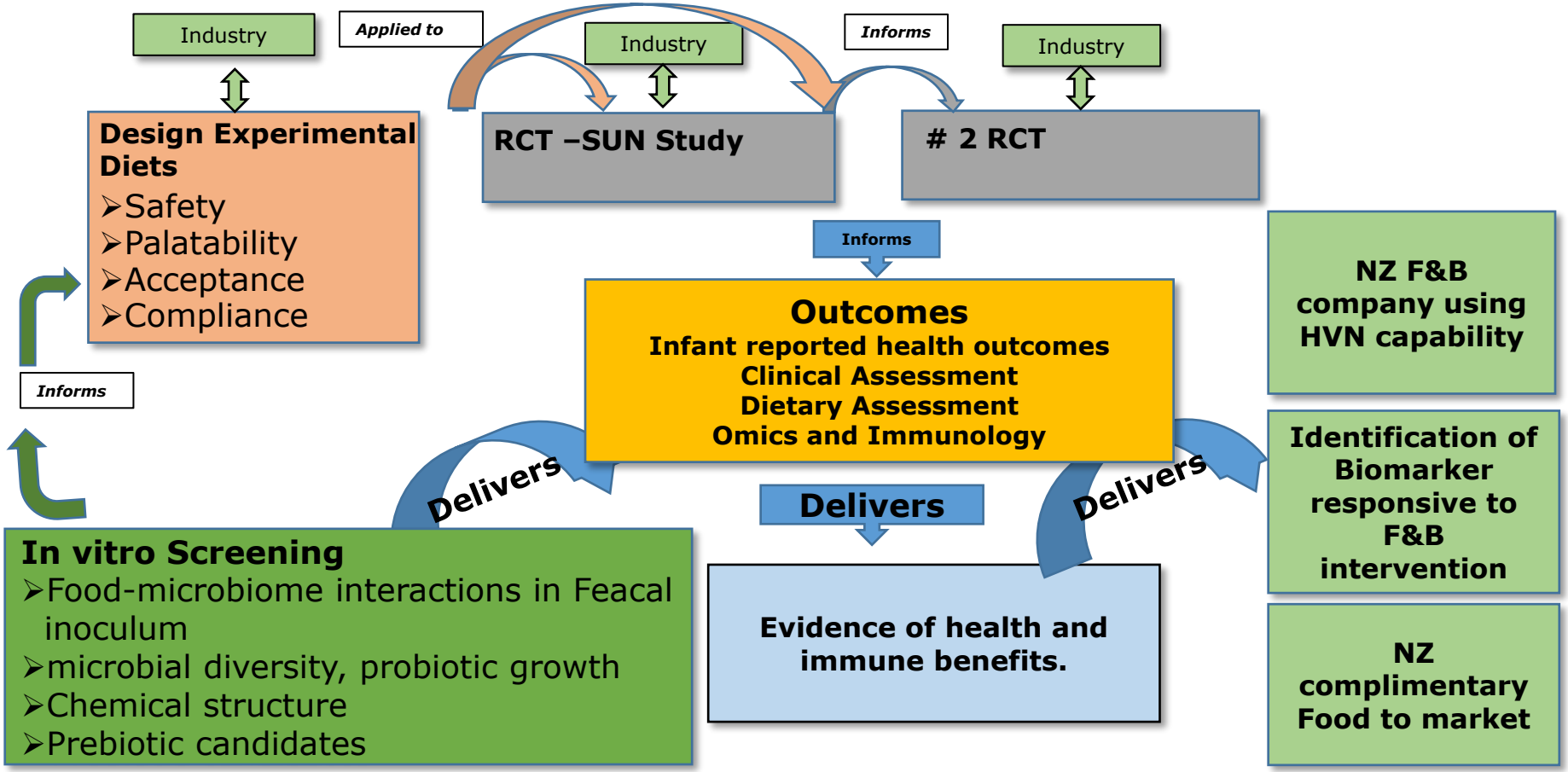
1. What are some key NZ food products to include in an infant's diet to promote immune health?

3. Through what mechanisms do these foods improve immune health?

4. What biomarkers can confirm clinical immune health outcomes?

5. What are dynamic changes in dietary intake and how do these impact on microbiota and the metabolome in early life.

Infant Health – Research Programme Overview



Pilot – Feasibility Study

Samples for

Prebiotic Food Development
→ Acceptance
→ Palatability
→ Compliance
→ Resistance Starch

Trial
- 40 infants
  30 kumara
  10 Probiotic Control
- Intervention 6 months
- 3 clinic visits
- Sample collection
- Health records
- Food records

Omics and Cell Biology
- Metabolomics
- Microbiomics
- Immunology

Clinical Assessment

Delivered

Development of RCT

Lovell *et al.* "Nourish to Flourish": complementary feeding for a healthy infant gut microbiome—a non-randomised pilot feasibility study. *Pilot Feasibility Stud* 8, 103 (2022)

Outcomes

INFANTS

19 (47%)

34 (85%) exclusively breastfed
6 (15%) combination fed

5.5 months average age at introduction to solid foods.

88% participants completed the study.

WHAT WE LEARNT

Stool sample

Easier to collect once the infant had started solids.

Urine sample

Contamination with stool.

Good consent to the blood sample. Difficult to get enough volume of blood.

Breastmilk sample

Easy to collect.

Saliva sample

Difficult to collect as infants got older.

Food records

Difficult obtaining information if infant attended day care.

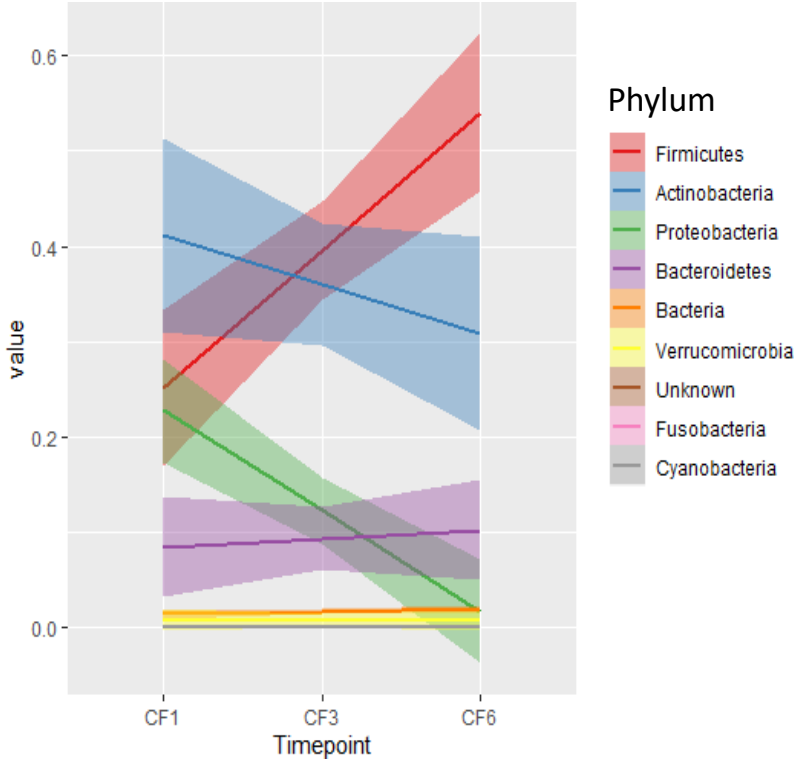
Illness records

Parents accurately reported **75%** of all illnesses ~ to GP records. Accurate reporting decreased from **75%** when infants were 9 months of age to **25%** when infants were 12 months of age.

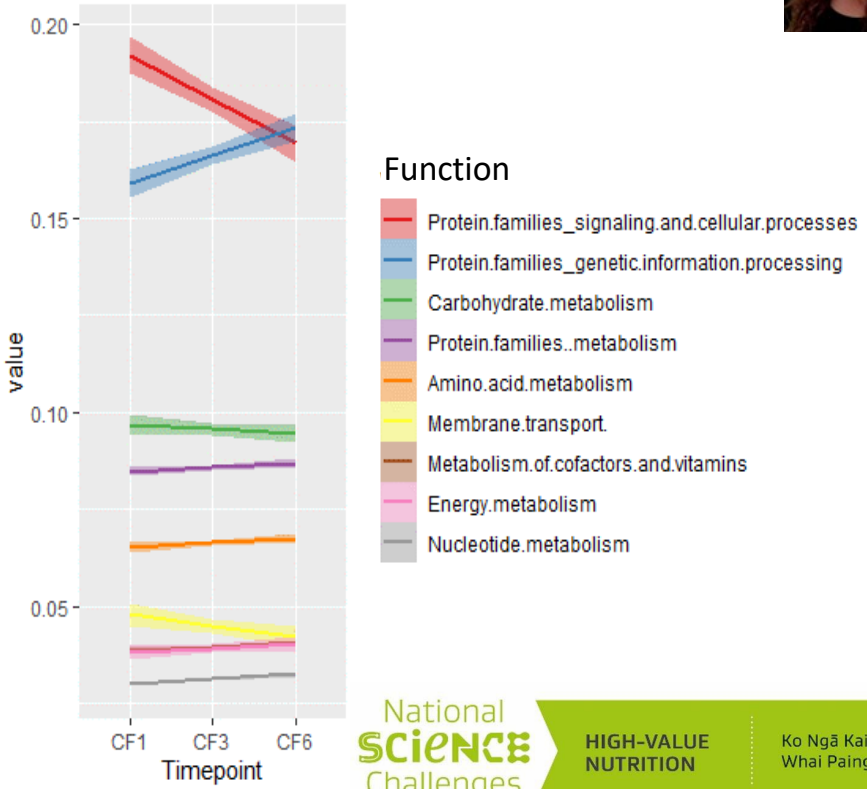
Lovell *et al.* "Nourish to Flourish": complementary feeding for a healthy infant gut microbiome—a non-randomised pilot feasibility study. *Pilot Feasibility Stud* **8**, 103 (2022)

Broad trends over time

Phylum composition



Functional composition



McKeen S, et al. (2022) Adaptation of the infant gut microbiome during the complementary feeding transition. PLOS ONE 17(7): e0270213.

Seeding throUgh FeediNg: nourishing the infant microbiome to support immune health 'The SUN' randomised controlled trial

Double-blind, randomised controlled trial, 300 infants who have not yet started solids and their mothers.

- Kūmara,
- Kūmara + resistant starch from bananas
- Control

Kai Rotorua

Primary outcome [1]

Difference in GP-confirmed respiratory infections at 10 months.

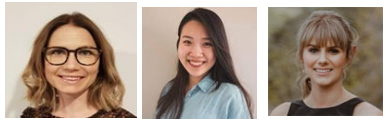
Secondary outcome [1]

Difference in infant health assessed using daily records of illness, verified using medical records.

Other Secondary outcomes

Difference in immune and omic markers – blood samples, faecal samples

Sleep……..



RECRUITMENT

RANDOMISATION

Monthly phone call
Questionnaires/App

Time (months)

0

4

actigraph

Baseline (prior to introduction of solids)
(clinic visit)
Questionnaires, anthropometry,
faecal sample, breast milk sample
Blood Sample

Month 2
(clinic visit)
Questionnaires, dietary intake,
anthropometry, faecal sample,
Breast milk sample

Month 4
(clinic visit)
Questionnaires, dietary intake,
anthropometry, faecal sample
Breast milk sample,
Blood Sample

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