

National
SCIENCE
Challenges

HIGH-VALUE
NUTRITION

Ko Ngā Kai
Whai Painga

High-Value Nutrition National Science Challenge

Annual report 2016/2017

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From the Chair



We are unique in the food and nutrition science sector. High-Value Nutrition has never been about “business as usual.” Traditional approaches have not brought the substantial lift in export revenue from high-value foods that New Zealand needs for a sustainable and prosperous future. We can only do that by harnessing research for sustained innovation.

However judicious investment in research is not enough. The reason High-Value Nutrition is unique is that we are driven by a mission to substantially lift export revenue from high-value foods by 2025. To do this, we need not only excellence science, but also, a clear pathway for the food sector to apply that research to the foods we export today and foods on the horizon.

Consumers in our major markets already value food from New Zealand. We have a well-deserved reputation as a producer of high-quality foods grown in a gentle environment, “surrounded by the Pacific Ocean, with the light of Spain and the climate of Bordeaux.” That is great, but it is not enough.

Consumers in our major markets rate health and wellbeing benefits in food products as important. For the right benefit, they will happily pay more. But those consumers do not automatically/naturally see New Zealand as a country that produces food with health benefits supported by scientific excellence, innovation and integrity. When compared for this quality against competitor countries, surveys see New Zealand routinely ranking halfway down the list.

So our job is to take New Zealand to the top of the list. To get there High-Value Nutrition is investing in the research and industry ecosystem New Zealand needs to encourage the development and delivery of innovative high-value foods that consumers choose to stay healthy and well.

The Challenge research institution partners bring the best research teams from multiple disciplines in the country together in pursuit of a shared mission. We put scientists and industry players together to spark the creative discussions to collaborate and share insight to uncover new opportunities that will lift our export returns from high-value foods. The very nature of the Challenge mission brings together the best teams from New Zealand Inc. to focus on a grand objective. I want to thank all those who share this mission with us. We will succeed by working together.

A handwritten signature in black ink, appearing to read 'Bob Major', with a long horizontal flourish underneath.

Bob Major

Chair High Value Nutrition National Science Challenge

Report from the Challenge Director and Chief Scientist



We like to think that High-Value Nutrition brings together the most diverse collection of disciplines in the country. Our priority and contestable research means experts in molecular biology, nutrition science and consumer behaviour, alongside scientists from many other disciplines, are working together on the Challenge mission. We have also built research partnerships with a wide range of successful companies in the food sector. These are businesses that already export unique foods from New Zealand and with the Challenge are focussed on the foods of future.

Gathering these people and companies together is no easy task but always rewarding because we are helping to build something new. On behalf of New Zealand Inc. our role is to build collaboration across divergent research disciplines and align research to be relevant for business and industry.

The complexity inherent in our role reflects the equally complex process that determines how we choose our food. The influences on what we eat come from a vast array of systems, from our individual genetic and biological heritage to our cultural upbringing and the physical and social environment we live in. The same food can mean different things to different cultures. Our food choices are a multi-faceted blend of what makes us human.

In order to succeed our approach to science must reflect this complexity. So this year we have worked to develop a series of great research projects into a unified programme that takes a whole-system approach. Our science looks at the impact of nutrition in the interplay of human cellular networks right through to the social and cultural environment. Our main focus continues to be on our priority research programmes. The metabolic, digestive and immune health platforms have made great progress this year. They have been joined by our infant health programme, underway since March, 2017. These four health-anchored research programmes sit alongside food systems and consumer research programmes to help guide New Zealand companies through the intricacies of regulatory regimes, patent landscapes and consumer behaviour.

Challenge Director Joanne Todd

Chief Scientist Professor Martin Kussmann

Snapshot of the year by the numbers

27

The number of words to describe what High-Value Nutrition does when your taxi-driver asks. We wanted to be able to let people know about the Challenge in one sentence. Though, of course, we do much more.

High-Value Nutrition 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.

120

The number of people who participated in the High-Value Nutrition inaugural industry forum in October, 2016. Their feedback said they liked how we bring industry and science together in the same room and joining the new networks we're developing.

30

The number of reports in our first series of *Scanning the Horizon* reports. If you want to know something about the markets, regulatory regimes and patent landscapes on a product in the Enhanced Immunity, Digestive Health and Metabolic Health food sectors, this is where you should look first. If you work for a business or research institution based in New Zealand you can sign up for The Knowledge, High-Value Nutrition's resource hub. We're adding to these reports and additional research all the time to bring together the key research for the "eco-system" supporting high-value foods from New Zealand.

805,000

The investment in dollars by industry in High-Value Nutrition research to date. Our goal is to reach \$1m in industry co-funding by the end of 2018.

10

The number of seconds it takes for a new test developed by the Cawthron Institute to tell if Greenshell™ mussels have the high-value bioactives that are good for our health. The old test took a week and had to be repeated many times. The new test works once and will enable Sanford Ltd, who co-funded the research with High-Value Nutrition to identify the mussels and their extracts that can be sold at a premium.

40

The number of obliging young women who agreed to take part in clinical trials to figure out whether A2™ milk could help people who have problems digesting traditional cows' milk. The women, who have all had acute digestive problems drinking milk, were given three different types of milk, lactose-free conventional milk, conventional milk and A2™ milk with a form of β-casein. The theory is that the A2™ milk with a different casein may be better for digestive wellbeing. The research has implications not only for the A2™ Milk Company, but the wider dairy sector. Our thanks go to the women for volunteering to help figure out what's behind symptoms of dairy and lactose intolerance.

1,750,000

The dollars invested by High-Value Nutrition to figure out how to find and nourish the good bacteria that helps babies stay healthy. The research team will identify the good probiotics in the digestive systems of healthy babies and work out how to incorporate the probiotics in weaning foods so all babies have the opportunity to develop better immune systems for childhood and later life. The investment launches our Infant Complementary Feeding platform, which completed our quartet of health-related priority research platforms. The other three are Enhanced Immunity, Digestive Health and Metabolic Health.

26,000,000,000

The figure in dollars (\$26 billion) that the New Zealand economy made from high-value nutrition food exports in 2015. The number comes from a report published by High-Value Nutrition, *Measuring what counts: Export revenue of New Zealand's High-Value Foods*. The report sets out the methodology to establish the baseline from which New Zealand can lift export returns by investing in science to identify and market the health benefits in New Zealand foods. The report groups high-value foods into three categories, foods that have general health claims, food that have proven health claims and foods that are especially nutritious.

Challenge overview

High-Value Nutrition (HVN) is the National Science Challenge building the science excellence and knowledge New Zealand needs to create and deliver foods to the world that people choose to stay healthy and well. The HVN team has worked to clarify and enhance the high-value nutrition 'ecosystem' which brings together national and international partners, crown research institutes, universities and industry partners to share expertise, insight and the necessary focus to deliver scientifically validated foods that strengthen New Zealand's reputation as a trusted exporter of high-quality foods for health.

The High-Value Nutrition priority research programmes are progressing as planned. The priority research areas are Metabolic Health, Immune Health, Infant Health and Digestive Health. The Consumer insights and Bioactive Food Systems

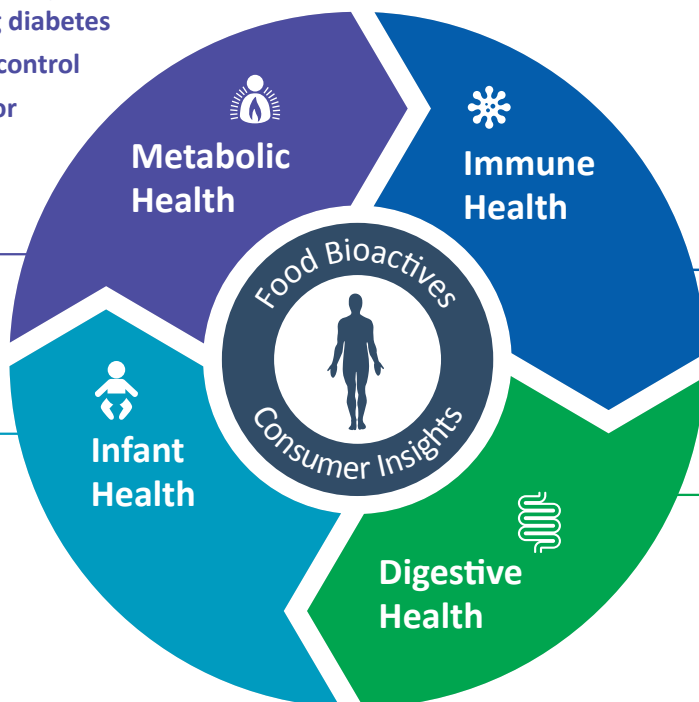
programmes not only guide research to meet the needs of consumers, but also make available the regulatory, patent, labelling and product design information businesses need to launch new products into key markets. Within each priority research area sit contestable research projects. Each has a strong industry partnership, is smaller in scale and has a shorter time frame. The goal is to have scientifically validated products ready for consumers in the near future.

HVN has earmarked research funding for its Vision Matāuranga strategy to build research capacity and awareness for Māori. A key initiative is our partnership with a network of Māori food businesses to model how research can support the development of foods that people choose to stay healthy and well.

High-Value Nutrition National Science Challenge research themes and projects

- TOFI: Thin on the outside, fat inside: preventing diabetes
- Kiwifruit for glucose control
- Combined proteins for lean body mass
- Grass-fed beef for cholesterol control

- Complementary feeding for immune protection
- Fibres for sustained energy release



- Building immune defence
- Natural milk for allergy management
- Greenshell™ mussels to manage inflamed joints

- Characterising irritable bowel syndrome
- A2™ Milk for gut comfort

Our whole systems approach to High-Value Nutrition science

Our biology
Organ networks
Cellular networks
Molecular networks
Genetic interaction



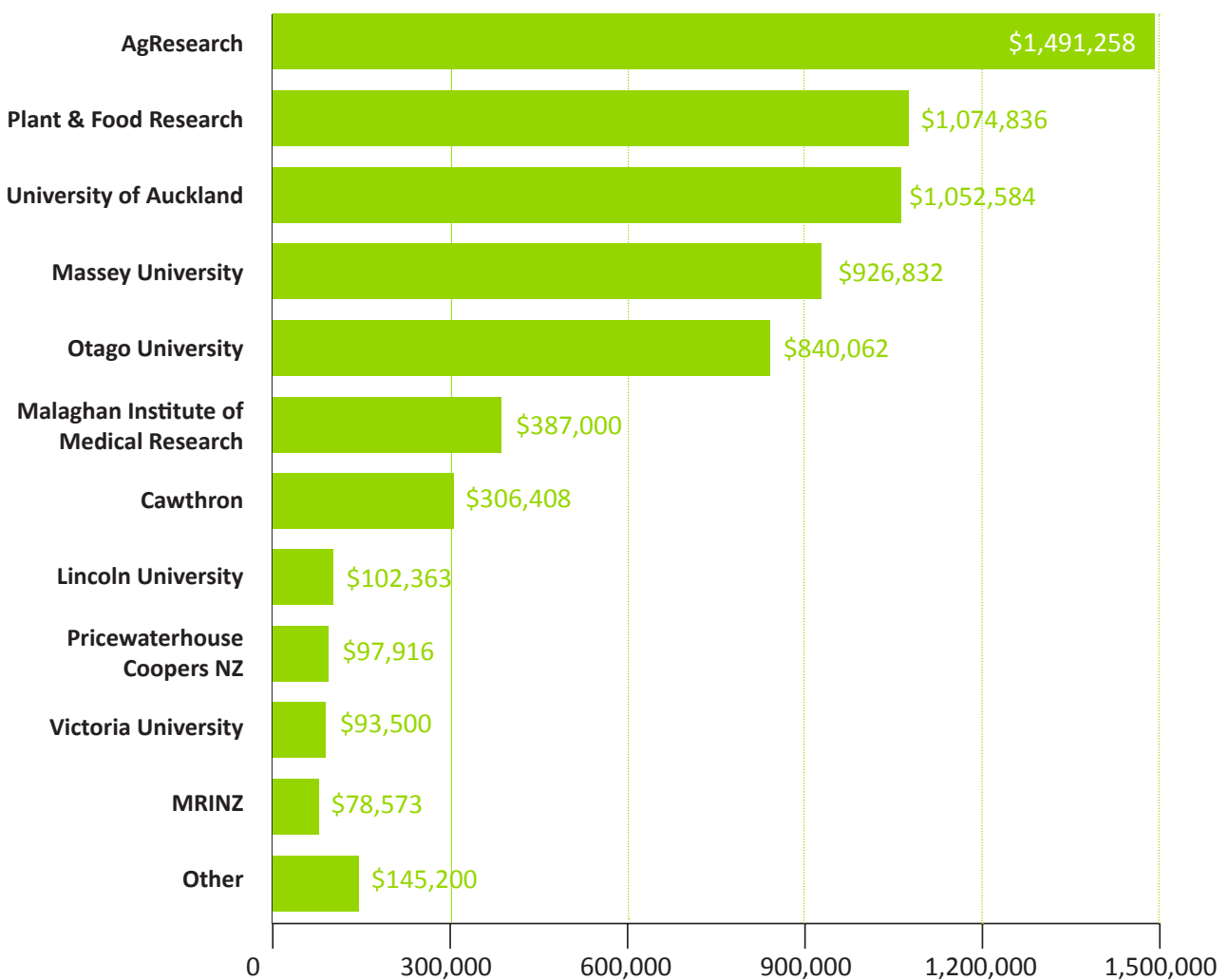
Our environment
Where we live
Cultural backgrounds
Social networks
Food choices

Our research focuses on understanding biological processes as complex integrated systems. Nutrition to keep us healthy and well requires an holistic approach.

Research funding

High-Value Nutrition is investing \$23.9M in research in the current funding period (actual investment and forecast to mid-2019). These investments fall under four major consumer health targets in metabolic, immune, digestive and infant health supported by food science and consumer insights platforms. The strategic framework is complemented by two special projects, focussed on establishing baseline measures and developing the methodology for measuring the impact of HVN on New Zealand export revenues and international reputation. The diagram below outlines the funding that the Challenge has invested with research teams throughout the country.

High-Value Nutrition National Science Challenge research funding 2016/2017



What people say about High-Value Nutrition

In 2016 High-Value Nutrition hosted its first industry forum in Auckland. Key voices from industry and science shared their knowledge and perspective on the Challenge mission and goals with 120 participants. This is some of the feedback we gathered about the forum and the Challenge.

“Meeting people that have only been names are now real. A key positive for me.”

“Thanks all at HVN for organising the Industry Forum. I believe we also need to invite and involve the producers, growers, farmers, and gatherers of food ingredients.”

“Good to meet the management team and see signs that commercialisation is the focus.”

“Any research portfolio needs a risk element in it and a mechanism for nurturing or fast-tracking SMEs or aligning them with dinosaurs could be worth consideration.”

“Great to have the opportunities to engage with industry – the war stories are very useful.”

“The companies that rolled out their experiences was very rewarding.”

“Tangible evidence of how science can add value to food products (and increase profits) would have been useful in gaining the sector buy-in. But I presume that such evidence will become available as the Challenge progresses.”

“Good to hear new Science and Challenge Managers speak. The interactive session with companies in the morning was very good.”

“Representing a healthy food product in the south I am keen to build some propositions/proposals. Keen to work alongside the High-Value Nutrition team whom I got to know. An idea of mission and the networking aspects were the most valuable parts for me.”



High-Value Nutrition 2.0 – From Projects to Programme

Since its launch in 2014, the High-Value Nutrition National Science Challenge has matured from a set of good projects into an integrated programme grouped under a common theme. Our big science picture sees us take a whole systems approach, to investigate and profile complex and common health issues. We can then identify New Zealand foods and food components that can help people here and overseas stay healthy and well. By doing this we build research excellence and capability, and support New Zealand's capability to lift the export revenue earned from the quality food we produce.

We are developing food prototypes, focusing on infant, metabolic, digestive and immune health. All of our projects relate to the scientific interface of immunity and metabolism, which together with the gut-brain connection, allows us to target the complex interactions that govern how we digest food and absorb and deliver nutrients to keep our body functioning well.

This health-focussed research sits alongside our food and consumer science programmes so we know that the food prototypes and research insights we develop and discover meet the needs of our current and future consumers and industry partners. It will be the role of industry to develop and deliver high-value New Zealand food products that people in our major markets, and specifically in Asia, choose to stay healthy and well.

Our science seeks to balance research with different timeframes and focuses on a unified programme. We have four health-related research programmes, the two enabling programmes of bioactive food systems and consumer science, to help industry identify commercial opportunities and seven contestable research projects that have shorter time frames. In the latter, we have partnered with key New Zealand food businesses to examine aspects of the benefits of existing foods, ranging from milk to Greenshell™ mussels. We are leveraging knowledge gained in each programme across all Challenge areas, and are seeing new biomarkers being utilised in the closer-to-market contestable projects.

At High-Value Nutrition our research not only bridges gaps in New Zealand science and builds local expertise, it also connects international science

expertise to innovation. We are bringing a common whole-system scientific approach to a diverse range of disciplines. By doing this we promote “additionality”, where the total impact and outcomes of the research is greater than the sum of the individual projects.

Science summaries

Priority research programmes

+ Consumer Insights

Consumer insights are needed to help guide and prioritise opportunities for the High-Value Nutrition National Science Challenge, and to provide information for businesses to assess market opportunities. The first phase of consumer research has been completed and focused on infant complementary feeding. The project involved New Zealand researchers interviewing new parents in their homes in Shanghai, China about their choices of foods for their babies. This was to understand their beliefs, attitudes and perceptions regarding the introduction of the first solid foods to babies. Researchers also conducted an online survey of 1500 parents in Hong Kong, Guangzhou and Shanghai. This research confirmed that the High-Value Nutrition Infant Health programme focus on foods that boost immunity in babies aligns strongly with consumer needs. This is relevant to New Zealand companies developing foods that help protect infants from illness. The first report on Chinese parental attitudes to feeding their infants has been completed and is available on the High-Value Nutrition resource hub, **The Knowledge**.

+ Digestive Health

In New Zealand's large and growing target food export markets in Asia we know digestive health is a common and rising topic of concern and discussion, with interest from many consumers including lifestyle and technology consumers. A healthy gut is critical to physical health, mental health and well-being. Several characteristics describe a healthy gut, such as: efficient digestion, optimal laxation, and limited discomfort (bloating, pain, flatulence). However,

the mechanisms underpinning these health parameters are poorly defined. Up to 60% of the population reports symptoms of suboptimal gut function and comfort. Approximately 30% of the population has at least one of the functional gut disorders (functional constipation, functional diarrhea and Irritable Bowel Syndrome, or IBS) where “everything looks normal” and there is no detectable disease, but there is abnormal gut transit and gut hypersensitivity. Our research programme, led by AgResearch in collaboration with the University of Otago, Plant and Food Research and Malaghan Institute of Medical Research, focuses on food and beverage products for improving gut function and comfort. We have recruited a cohort of participants, including healthy “controls” and people with functional gut disorders. This cohort, named COMFORT, will allow the creation of a database of information to shed light on the demographic, psychological and biological influences on gut function and comfort. The database will include information about the metabolites present in biological samples (e.g. blood, breath, etc.) and the makeup and function of the gut microbiome, the colonies of bacteria that influence digestive function and are markers of gut health status. It will also include a novel, validated questionnaire to record participants’ gut symptoms. This whole-systems database will help researchers identify the characteristics of people who have suboptimal gut function and comfort, which in turn will help industry to tailor food and beverage products to meet the needs of consumers in our major Asian markets, to improve their gut function and comfort.

+ Food Bioactives

Many health benefits of foods can be attributed to the bioactives they contain. These are substances that have a biological impact on our health and wellbeing. Once identified, this programme ensures they are delivered intact to produce real benefits to consumers. The first step has been to review existing technologies used in the food and pharmaceutical industries. This has led the researchers at Massey University to formulate an approach to developing several systems to encapsulate or “coat” healthy bioactives to preserve their health benefits. They can then track and trace the encapsulated bioactives within a formulated food throughout the many steps foods taken to reach a consumer, right through storage, delivery, consumption and digestion. The research findings and technology

have potentially wide applications throughout the country’s food sector.

+ Immune Health

Led by a team at the Malaghan Institute, this research will build our understanding of the relationship between foods and our immune system. By filling in key gaps in our knowledge, the research will support the development of food and beverage products that can help consumers, largely in key Asian markets, to bolster their immunity to health conditions related to the respiratory system, especially those related to exposure to pollution. The initial work to collect faecal and blood samples from people who received the seasonal influenza vaccine has been completed. The large amount of data produced is being analysed to see what links may exist between our immune response and the microbiome in our digestive system. The researchers have developed a series of successful pre-clinical models. These will test how foods can:

- help the microbiome enhance the effectiveness of vaccination
- assess how specific foods can reduce respiratory inflammation triggered by polluted air.
- determine the magnitude and duration of the immune response in our lungs from diesel exhaust particles and urban dust (relevant to research on allergies)

+ Infant Health

This programme commenced in the second quarter of 2017, and aims to support the development of high-value foods that can be fed to infants to help reduce infectious illnesses. Led by the University of Auckland, in collaboration with COSBI (Centre for Computational and Systems Biology at the University of Trento, Italy) the first stage is underway to search public domain information for insights into the optimal gut microbiome profile in an infant which can confer immune health benefits. This will lead to the identification of potential foods to be evaluated in a clinical trial in 2018.

+ Metabolic Health

The Peak Nutrition for Metabolic Health programme (PANaMAH) focuses on understanding what may be unique risk factors

for the development of diabetes among Asian populations. The research is prompted by the rising rate of obesity and subsequent rise in diabetes in Asia. The cause may lie in the storage of body fat within 'unsafe' stores, including within and around vital organs. This is known as the TOFI profile 'thin on the outside fat on the inside'. The TOFI_Asia study has recruited a cohort of ~400 Asian Chinese and Caucasian adults into a clinical study to investigate the causes of this increased susceptibility. Participants have undergone a series of investigations into metabolites/biomarkers of increased risk, with a sub-group having whole body scans to measure body composition plus an MRI (magnetic resonance imaging) scan to measure fat within organs. Analysis is underway on whether the risk profile differs between Chinese and Caucasians. Identifying early predictive markers of type 2 diabetes may lead to new opportunities for food and beverage approaches for prevention and management of early-onset diabetes which will be investigated through clinical trials in 2018.

Contestable research

✳ A good night's sleep

When infants wake in the night they are often simply hungry. This may be because their digestive system has dealt with all the easily digested carbohydrates in food that provide their energy needs. New weaning foods with optimal amounts of dietary fibre to give sustained digestion and energy release by gut bacteria may provide an answer to this common problem. The team, led by the University of Otago, has recreated the mix of bacteria that does the work of fermenting fibres during digestion under laboratory conditions. They can now test how different combinations of dietary fibre may influence the biological markers that give an indication of sustained energy release and therefore a good night's sleep for the baby and its parents.

✳ A2 milk™ for gut health

There is emerging evidence that milk containing only the A2 form of β -casein aids digestive wellbeing through mechanisms unrelated to lactose intolerance or protein allergy. This may benefit people who experience unpleasant symptoms after consuming cows' milk. This research is investigating the hypothesis that A2 β -casein dairy products help digestion

by preventing intestinal inflammation. If successfully completed, the research will provide a strong platform for market diversification in current and new markets with the potential to significantly grow demand and revenue for the NZ dairy sector. A team from AgResearch and the University of Auckland, have completed a clinical trial that investigated the acute responses of 40 young women to drinking three different milks at random, over the course of several weeks, (A1 beta-casein-free milk (a2 Milk™), conventional milk (containing a mix of A1 and A2 beta-casein), and lactose-free conventional milk (also containing a mix of A1 and A2 beta-casein). Measurement techniques included subjective questionnaires as well as analysis of breath markers of digestion and MRI scans. The participants were classified into three different groups: dairy-tolerant, lactose-intolerant, or dairy-intolerant. The research team are now analysing the data.

✳ Complex lipids for metabolic health

This project features a collaboration led by AgResearch with Firstlight Foods to provide robust scientific evidence that by consuming complex lipids from New Zealand grass-fed Wagyu beef, health conscious consumers can reduce their cholesterol levels. The team has identified the effects of grass and grain-feeding on the levels of fatty acids and complex lipids in a range of meat cuts. They have found that the levels of healthy fatty acids, such as omega-3 fatty acids, are higher in grass-fed Wagyu compared to grain-fed Wagyu. Human clinical studies will research the benefits to cardiovascular health from eating grass-fed Wagyu.

✳ Kiwi fruity and friendly

This project aims to evaluate whether kiwifruit can favourably modulate blood glucose responses within a healthy diet. Led by Plant and Food Research in partnership with Zespri, the initial trial on the effects of kiwifruit in a typical Asian meal context has been completed. Results from blood glucose analyses confirm that kiwifruit consumed 30 minutes before eating a rice based meal leads to the suppression of the post-meal blood glucose peak as well as reduction of the insulin response. A second trial is underway to investigate the longer term metabolic effects of kiwifruit eaten before breakfast among Asian consumers.

MultiProMo

Many countries, including New Zealand, have ageing populations. With ageing comes the loss of muscle mass and muscle function. Massey University researchers working with industry partner Goodman Fielder are developing high-protein foods to combat age-related muscle weakening. Laboratory experiments have shown that the type of protein is the key to delivering the protein in a way that is optimally digested. The next step is a human clinical trial to examine how the body responds to high-protein foods that are digested at different rates, and what this means for the muscle health of seniors.

Musseling up – high value Greenshell™ mussel foods

This project has initially focused on developing faster and better ways to identify the goodness in New Zealand's iconic Greenshell™ mussels, in particular anti-inflammatory benefits to support people to maintain good joint and bone health and physical mobility. The team at the Cawthron Institute has developed a rapid test method for measuring the high-value components of Greenshell™ mussels that promote human health. The test takes 10 seconds and only needs to be done once, compared to the previous method which took a week and required multiple tests. We now also understand the natural variation that occurs in the levels of selected high-value bioactives in Greenshell™ mussels. This data set will enable identification of Greenshell™ mussels that can form the basis of a premium class of food products for health conscious consumers. Greenshell™ mussels and extracts derived from them are being tested in laboratory, animal and human models to determine the way they work and how well they work to support joint and bone health. New food concepts are being designed with industry partner Sanford Ltd.

Natural protection of milk

Studies suggest there may be an association between the consumption of raw, unprocessed farm milk and the reduced incidence of allergy. However, consumption of raw milk is not always safe and to date no 'safe' milk product has been available to fill this market need. The Māori-owned dairy processing and exporting company Miraka, in partnership with AgResearch, is developing a

product that is safe to consume and has the natural traits of unprocessed milk to deliver added health benefits. Researchers have identified an animal model that can be used to demonstrate the reduced risk of allergy development in early life after milk feeding. A pre-clinical gastrointestinal model to compare allergy responses after consumption of either unprocessed or processed milks has been developed, and will continue to evaluate prototype products.

Special projects

Measuring what counts: Export revenue of New Zealand's High-Value Foods

In the first half of 2017, we published the first of an ongoing series of reports that assess the value to New Zealand of high-value food exports. A team at PwC have developed a way to estimate the value of these exports that were previously not measured easily. The report enables High-Value Nutrition to establish a baseline of 2014 to 2016 data, from the launch of the Challenge. Initial results show exports of functional foods with science backed health claims have increased substantially in the Challenge period.

Producing the goods: New Zealand's international reputation for high-value foods backed by science

High-Value Nutrition has commissioned a report from the Agribusiness and Economic Research Unit at Lincoln University to assess New Zealand's international reputation as a producer of high quality foods with scientifically validated health benefits and how this can be enhanced in the future. The first survey of 400 participants in each of Australia, Japan and China, as well as a survey of key informants with experience of consumer behaviours and trends, and key customers and product gatekeepers in different markets, has been completed. The report will be released shortly, and shows there is still room to grow New Zealand's reputation in this space. Surveys will be repeated at three-yearly intervals.

Our performance

High-Value Nutrition is one of 11 National Science Challenges (NSCs) funded by the Ministry of Business, Innovation and Employment. The ministry has developed a performance framework to measure progress towards the specific mission each Challenge has and against the science policy goals for NSCs generally. The 'Delivery of Challenge' objective has eight specific key performance indicators (KPIs) customised to High-Value Nutrition. Our reporting also includes four key KPIs that apply to all NSCs. The table summarises Challenge KPIs.

Delivery of Challenge Objective

The High-Value Nutrition Challenge objective as approved by Cabinet is:

“To develop high-value foods with validated health benefits to drive economic growth.”

Delivering on the High-Value Nutrition mission Specific key performance indicators	What the Challenge has done 2016/17
<p>Industry validation of research plans</p> <p>Proportion of priority research investments (programmes and projects) made with good evidence of target consumer’s need and demand in export markets coupled with clear F&B businesses endorsement. (With a sub measure relating to engagement with Māori-owned businesses).</p> <ul style="list-style-type: none">• 50% (score) at initiation (assessed individually and collectively)• 100% at the 24 month review	<p>Research plans are validated through a robust process with industry stakeholders.</p> <p>The process details consumer needs and anticipated demand in export markets. The Board and the Challenge Industry Advisory Panel endorse investment for all research plans and projects.</p> <p>The final major investment for a priority health area was approved in February 2017 and awarded to the University of Auckland for the Infant Complementary Feeding priority research. The proposal process started with a combined industry/science workshop which resulted in the validation of the scope of the science objectives.</p> <p>To support the Challenge objectives the following initiatives are underway:</p> <ul style="list-style-type: none">• The Consumer Insights programme is combining use of in-depth interviews and an external provider was used to conduct a large quantitative survey across three Asian cities• Adding infant complementary feeding as a theme to Scanning the Horizon reporting, with the first report due in December 2017

Businesses using HVN capabilities

- **Number of F&B businesses using HVN capabilities to develop and or support products as part of the process of validation of health benefits for target consumers. (With a sub measure relating to engagement with Maori owned businesses)**
- **>10 in total from HVN funded research with >2 per priority research programme by 2018**

32 New Zealand businesses requested access to The Knowledge, the Challenge online resource and research hub.

22 companies access Challenge capability as a member of an Industry Reference Group or through direct involvement in product development through co-funding one of the seven contestable research projects.

Representatives from 63 businesses, from SMEs to multinationals participated in the Challenge Industry symposium in October 2016

Investment performance to plan

% HVN funded research project and programme research objective end points (results) met on time to specification.

- **60% as budgeted**
- **80% as reforecast**

67% of priority, contestable and special project research met their objectives as budgeted/contracted.

91% of objectives based on reforecast due dates due to known delays were met.

Two contestable projects had objectives that were delayed by two months due to supplier delays. One was completed in this reporting period, the other is forecast to be completed in the first quarter of next year.

One contestable project did not meet one of its objectives based on June 2017 reporting, Investigation into any potential wider impact is underway.

The priority research programmes continue to track well towards their deliverables, which will further inform future product developments.

The outputs of the special projects have been completed as required and feedback from industry stakeholders show positive support for the New Zealand Inc. initiative, with specific value for smaller businesses exporting or looking to export to Asia.

Biomarkers

- **Number of 'biomarkers' responsive to nutrition that address consumer health targets identified that underpin applications submitted to FSANZ under standard 1.2.7 or self-substantiated general level claims notified with supporting scientific evidence of the food health relationship.**
- **>3 in total from the funded research with >1 in each priority health target by 2018**

Two contestable research projects are preparing to apply to Food Standards Australia and New Zealand (FSANZ) for a food health claim. These relate to two of the four priority health areas and include use of identified biomarkers.

Products in development

- Number of discrete F&B projects in development with significant export potential supported by “evidence dossiers” involving HVN research demonstrating health benefits for target consumers. (With a sub measure relating to projects, involving Māori owned businesses)
- >3 in total from funded research (with >1 per priority health target areas by 2018 with 5 year sales projects of >\$50m each)

One contestable research project has made excellent progress in developing an F&B product that would be new to market. Reporting indicates an intent to export and to compile an evidence dossier to support the health benefit.

Four of the contestable research projects are developing the evidence to demonstrate a new health benefit using an existing product already on the market.

Another contestable research project is using an existing F&B project however; they are considering alternative formats for consuming the product. The strength of the research suggests evidence dossiers could be produced to demonstrate health benefit.

Industry co-investment

- Value of R and D investment by F&B businesses in “HVN capabilities” to support development and marketing of F&B products with health benefits. (With a sub measure relating to investment by Māori owned businesses).
- >\$1M in aggregate from funded research by year end 2018

To date, committed Industry investment in HVN research is \$805,000.

This excludes in kind investment such as providing product or support from subject matter experts. In kind investment has been excluded to ensure R&D investment is accurately recorded.

Evidence dossiers

- Number of evidence dossiers (derived from HVN research or teams) submitted to FSANZ (or notified buy businesses under the FSANZ model) in support of approved food health claims.
- >2 in total from funded research by 2018

No evidence dossiers were submitted to FSANZ in support of an approved health claim from Challenge-funded research.

However at least two funded research projects are liaising with the Ministry of Primary Industries regarding preparing information for an evidence dossier.

Revenues

- Value of export revenues from discrete food and beverage products supported by evidence based HVN research demonstrating health benefits for target consumers. (With a sub measure relating to revenues of Māori owned businesses.)
- >\$10M additional F&B revenues from funded research in CY 2019

The stretch target for the KPI is >\$10M additional F&B export revenues from aligned and related research in CY 2016. The Challenge-commissioned report *Measuring What Counts: Export Revenue of NZ's High-Value Foods* notes that kiwifruit remains the scientifically-validated functional food export from New Zealand with a proven health claim, Kiwifruit contributed about \$1B in export value in 2015 with High-Value Nutrition research now used in communications.

International reputation

New Zealand's international reputation as a food producer of high quality and scientifically validated food health benefits is enhanced.

- Three yearly survey in 2016/2019/2022 and 2025 (of target international consumers, regulators, importers and other relevant stakeholders) showing positive ongoing increases in "positive" reputation.

The first three-yearly survey was completed in 2016. The survey captured international consumers, regulators, importers and other relevant stakeholder opinions on NZ's reputation as a food producer of high-value foods. The survey will be available on the HVN website, and serves as the baseline for future surveys.

Key Performance indicators for all National Science Challenges

Science quality and Best Research team collaboration

- Mean citation scores for journals in which the Challenge has published.
- Field weighted citation index of Challenge publications.
- Number of publications in journals within the top quartile (field-weighted) of peer reviewed scientific per \$5M invested.
- New Zealand's international reputation in the science of food health relationships is enhanced.
- % Publications by collaboration type (i.e. with co-authors from multiple research organisations and/or with international co-authors) on a 12 month rolling average.
- % Publications by collaboration type (i.e. with co-authors from multiple research organisations and/or with international co-authors) on a 12 month rolling average.
- % Publications by collaboration type (i.e. with co-authors from multiple research organisations and/or with international co-authors) on a 12 month rolling average.
- Effectiveness of research team re science leadership, skills mix, etc.

What the Challenge has done 2016/2017

Nineteen abstracts were submitted in a peer review process for presentation at international and national conferences.

Five journal articles have been published, with a further two submitted and awaiting acceptance.

Five key reports have been published as part of the science output and are available on the Challenge resource hub, The Knowledge.

These science outputs are a key part of the work to raise the profile of High-Value Nutrition within international science fora. Challenge research team makeup has been stable, resulting in continued focus and a wide range of outputs this reporting year. All priority research projects have international collaborators and input from multiple research institutions nationally.

Stakeholder Engagement and Public Participation

- Satisfaction among stakeholders with research priority setting
- Satisfaction among stakeholders with knowledge exchange and technology development

The High-Value Nutrition management team has carried out a range of initiatives to build stakeholder engagement and public participation.

- Industry Forum in October 2016, with 120 attendees and very positive post-event feedback
- Increased online presence including a refresh of the Challenge website home page
- Soft launching 'The Knowledge' the Challenge's online resource hub in April 2017. In the year to June 2017, there were 66 requests for access.
- Updated social media presence: with a content plan for Facebook, Twitter and Linked in
- Regular engagement by the Chief Scientist with contestable research leaders to update on priority research progress and planning
- Increased frequency of meetings with Science Leadership Team
- Increasing engagement with Business Managers network
- Enhanced media relations activity which included articles in National Business Review and the Otago Daily Times

MBIE facilitates a stakeholder engagement survey for each of the 11 National Science Challenges. Overall results for High Value Nutrition have improved since 2016, with the exception of results around Māori engagement. The survey results need to be read in the context of a low response rate. 20% of 132 candidates provided by High-Value Nutrition responded and so findings cannot always be tested for statistical significance. This was common across all NSCs. Key findings include:

Engagement with High Value Nutrition

Engagement has improved since 2016 from 60% being highly or somewhat engaged to 81% in 2017.

The findings below are based on those who provided responses rather than "Too early to tell" or "Don't know."

Satisfaction among stakeholders with research priority setting

32% (9 out of 28) are very satisfied or satisfied with the way the Challenge has set its research priorities. This is lower than the average for All NSCs (51%), but due to the low sample size cannot be tested for statistical significance.

65% of stakeholders feel they are able to effectively contribute to the research priorities of the Challenge, however only 27% feel they've been given the opportunity to influence the research priorities of the Challenge. As the research priorities were set several years ago this may reflect historical concerns.

Effectiveness of research team

64% (16 out of 25) are very confident or confident in the research team leading the Challenge. This is in line with the finding for 2016 and All NSCs.

Satisfaction among stakeholders with knowledge exchange and technology development

At this relatively early stage in the lifecycle of the NSC, 29% of High Value Nutrition stakeholders feel it is too early to comment on their satisfaction with outputs from the Challenge, or don't know how to answer. Those who feel able to comment, 32% are very satisfied or satisfied with the knowledge exchange and technology development of the Challenge. This is in line with the average for All NSCs.

Satisfaction among Māori stakeholders with their influence on, engagement with, and value received from the Challenge

It is not possible to report the views of Māori stakeholders on High Value Nutrition due to the low number of Māori respondents.

However 31% (9 out of 29) are very confident or confident that the Challenge will deliver outputs of practical use to the Māori audience.

Māori Involvement and Mātauranga

- **Satisfaction among Māori stakeholders with their influence on, engagement with, and value received from the Challenge**
- **\$ value of investment by HVN in research and related activities that 1) specifically target Māori needs and aspirations and 2) employ Mātauranga Māori**

The Challenge has allocated through its contestable funding process \$1m to projects with strong Māori business links. A Māori post-doctorate student has joined the Digestive Health research team.

The management team, fully in place since March, 2017, has focussed on key consultation to determine how best to implement the Challenge Vision Mātauranga strategy.

Key actions include:

- Presentation and discussion at the Board with Pat Snedden, Chair of A Better Start NSC and a respected and experienced adviser for iwi.
- Meetings with fellow NSCs on ways to implement Vision Mātauranga
- Challenge Director and Chief Scientist have engaged closely with the Callaghan Innovation Nuku ki te Puku Māori food business cluster, and other business leaders

Financial statements

HVN received \$8.7M from MBIE in the 2016/2017 financial year. Total expenditure was \$7.66 M. The surplus will be carried forward to the 2017/18 financial year. The only revenue source this year was from MBIE, this was due to the industry symposium that was held in October 2016 being complimentary to attend. It is the intent of the HVN management team that large scale events need to be as close to self-funding as possible in the future, to ensure operational costs can be used to further promote HVN or redistributed to research investments.

People costs increased compared to the prior year reflecting the structural changes made while

moving from Establishment Phase to Operational Phase. Operating expenses were lower in 2016/2017 due to the workshops held around the country the previous year and the Science symposium. One HVN event was held in the 2016/2017 financial year. Research expenditure increased as all research was contracted in the reporting period, including the final priority health area Infant Complementary Feeding.

The financial statement below has been prepared by the University of Auckland Financial Unit and is subject to the standard audit procedures and financial policies of the University.

	2015 Jan 15 – Jun 15 Actuals	2016 Jul 15 – Jun 16 Actuals	2017 Jul 16- Jun 17 Actuals	Challenge Total Jan 15 – Jun 19 Actuals + Forecast
Revenue				
MBIE Revenue	\$393,000	\$5,900,000	\$8,700,000	\$29,993,000
Other Revenue	\$0	\$18,552	\$0	\$48,552
Total Revenue	\$393,000	\$5,918,552	\$8,700,000	\$30,041,552
Expenditure				
People costs	\$352,058	\$861,857	\$885,046	\$4,118,642
Operating expenses	\$5,442	\$511,881	\$288,655	\$1,893,370
Research				
Priority research	\$0	\$2,252,784	\$3,869,999	\$14,915,000
Special projects	\$0	\$729,250	\$455,750	\$1,500,000
Open contestable funding	\$0	\$1,068,248	\$2,162,208	\$6,964,807
Contingency funds	\$0	\$0		\$570,195
Total Research Expenditure	\$0	\$4,050,282	\$6,487,957	\$23,950,002
Total Project Expenditure	\$357,500	\$5,424,020	\$7,661,658	\$29,962,014
Revenue – expenditure	\$35,500	\$494,532	\$1,038,342	\$79,538

Members and associates 2016/17

Board Members

Bob Major (Chair)
Independent Director

Dr Jocelyn Eason
Plant & Food Research appointee

Professor Jim Metson
University of Auckland appointee

Rodney Wong
Massey University appointee

Professor Warren McNabb
AgResearch appointee until 1 Sept 2016

Dr Jolon Dyer
AgResearch appointee from 1 Sept 2016

Professor Christine Winterbourn
University of Otago appointee until 31 Dec 2016

Professor Richard Blaikie
University of Otago appointee from 1 Jan 2017

Paul Morgan
Independent Director

Dr Andrew Kelly
Independent Director

Jane Lancaster MNZM CMINstD
Independent Director

International Science Advisory Panel

Emeritus Professor Sean Strain (Chair)
Emeritus Professor of Human Nutrition & Director,
Northern Ireland Centre for Food and Health
(NICHE), Ulster University, Ireland

Distinguished Professor Connie Weaver
Distinguished Professor and Department Head,
Director, Women's Global Health Institute,
Purdue University, USA

Professor Bruce German
Director, Foods for Health Institute, Department
of Food Science & Technology, University of
California, USA

Professor Philip Calder

Professor of Nutritional Immunology, Human
Development & Health, Academic Unit, Faculty of
Medicine, University of Southampton, UK

Professor Yang Yuexin

President Chinese Nutrition Society, Director,
Department Food Nutrition and Assessment,
National Institute of Nutrition and Food Safety, China

Science Leadership Team

Professor Martin Kussmann (Chair)
University of Auckland, Infant Complementary
Feeding

Associate Professor Nicole Roy
AgResearch, Digestive Health

Dr Elizabeth Forbes Blom
Malaghan Institute of Medical Research,
Immune Health until 31 Jan 2017

Dr Olivier Gasser
Malaghan Institute of Medical Research,
Immune Health from Feb 2017

Professor Sally Poppitt
University of Auckland, Peak Nutrition
for Metabolic Health

Distinguished Professor Harjinder Singh
Massey University, Bioactive Food Systems

Dr Roger Harker
Plant & Food Research, Consumer Insights

Associate Professor Clare Wall
University of Auckland, Infant Complementary
Feeding

Industry Advisory Panel

Dr Kevin Marshall (Chair)
Director, cDNAk

Vicky Taylor
General Manager, SmartFoods (until April, 2017)

Richard Te Hurinui Jones
(Ngāti Maniapoto, Te Arawa)
Chief Ideas Officer, Poutama Trust

Dr Jeremy Hill
Chief Science & Technology Officer, Fonterra

Gerard Hickey
Managing Director, Firstlight Foods

Ronnie Butt
Manager, New Business Development,
Comvita from Sept 2016

Craig Armstrong
Director, New Zealand Trade and Enterprise

Sarita Males
Chief Technical Officer, Douglas Nutrition
from June, 2017

HVN Management Team

Joanne Todd
Challenge Director

Professor Martin Kussmann
Chief Scientist

Robyn Nesbitt
Research Operations Manager

Gilbert Wong
Senior Advisor Marketing and Communications

Eleanor Surtida
Research Operations Administrator

Contestable Research and Special Projects Principal Investigators

Professor Gerald Tannock
University of Otago, A good night's sleep

Dr Matthew Barnett
AgResearch, a2 Milk™ for gut comfort

Dr Emma Bermingham
AgResearch, Complex lipids for enhanced
metabolic health

Dr Alison Hodgkinson
AgResearch, Natural protection of milk

Dr Matthew Miller
Cawthron Institute, Musseling-up: high-value
Greenshell™ musselfoods

Dr Simon Loveday
Massey University, MultiProMo

Dr John Monro
Plant & Food Research, Kiwi, fruity and friendly

Bill Kaye-Blake
PwC

Caroline Saunders
Lincoln University

Contact

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