Publications of the Academy of Finland 2/06

Food Sciences and Related Research in Finland 2000–2004

International Evaluation

Academy of Finland
Research funding and expertise

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International Evaluation

Members of Evaluation Panel
Professor G. Harvey Anderson (Chair)
Professor Dietrich Knorr
Professor Alice H. Lichtenstein
Associate Professor John Prescott
Dr. Catherine Stanton
Professor Willem M. de Vos

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Kuvailulehti

Julkaisija	Suomen Akatemia	Päivämäärä 16.2.2006
Tekijä(t)	Arviointipaneeli	
Julkaisun nimi	Food Sciences and Related Research in Finland 2000-2004. International Evaluation	
Tiivistelmä	Raportissa arvioidaan Suomessa tehtävää elintarviketutkimusta sekä siihen oleellisesti liittyvää ravitsemuksen ja kulutuksen tutkimusta. Arvioinnin kohteena oli alan tutkimusta harjoittavien organisaatioiden tai niiden relevanttien osien toiminta vuosina 2000-2004. Suomen Akatemian toimeksiannolla kutsuttiin kansainvälinen asiantuntijaryhmä arvioimaan kyseinen tieteenala kokonaisuudessaan. Arviointia varten ala määriteltiin väljästi. Arviointiin osallistui kaikkiaan 23 tutkimusyksikköä yhteensä 12:sta eri organisaatiosta. Tieteenalan laajuudesta ja monimuotoisuudesta johtuen arviointipaneeli päätti jakaa sen kolmeen osa-alueeseen: elintarvikkeiden bioprosessointi ja teknologia, elintarviketurvallisuus, -mikrobiologia ja -diagnostiikka, sekä ravitsemus- ja kuluttajatutkimus. Suurin sekä henkilöresurssien että rahoituksen suhteen on bioprosessoinnin ja teknologian osa-alue. Paneeli totesi tieteen tason kaiken kaikkiaan hyväksi. Kaikilla kolmella osa-alueella tehty tutkimus on saanut osakseen arvostusta sekä kansallisella tasolla että kansainvälisillä kentillä. Paneelin mukaan suomalaisten tulisi kokonaisuutta entisestään vahvistaakseen kiinnittää huomiota erityisesti kahteen asiaan. Ensinnäkin olisi tärkeää järjestää nykyistä pitempiaikaista rahoitusta tutkimuksille, joiden avulla selviää ruokavalion ja elämäntapojen yhteyksiä kroonisten sairauksien syntyyn. Toiseksi, jotta suomalaisten terveyden hyvä kehitys jatkuisi, olisi tärkeää kannustaa erityisesti sellaisia tutkimusasetelmia, joissa pyritään etsimään terveyden edistämisen kannalta laajoja yhteisratkaisuja yhdistämällä hedelmällisesti tutkimusalueita, kuten kansanterveystiede ja kliiniset tieteet, muiden merkittävien alueiden ja intressien kanssa, kuten kansallisen ravitsemuspolitiikan, kuluttajan käyttäytymisen sekä maatalous- ja elintarviketeollisuuden. Tutkimusalan yhtenä ongelmana paneeli näki pirstaleisuuden, mistä syystä kriittinen massa on usein vaikea saavuttaa. Tutkimusyhteisöihin toivottiin lisää niin kansainvälistä kuin kansallistakin tutkijaliikkuvuutta. Tohtoreiksi valmistutaan melko iäkkäinä, ja kansainvälistä postdoc-kokemusta lähtee hyvin harva hankkimaan. Nekin, jotka lähtevät, viipyvät pääsääntöisesti vain lyhyen aikaa ja palaavat samaan organisaatioon, josta tohtoreiksi valmistuivat. Erityismaininnan paneelilta sai maamme korkeatasoinen ravitsemustutkimus, joka on auttanut asiantuntijoita ravitsemussuositusten laatimisessa ympäri maailman, sekä elintarviketurvallisuutemme, jonka taso on poikkeuksellisen korkea.	
Asiasanat	Elintarviketutkimus, ravitsemustutkimus, kuluttajatutkimus, prosessointi, bioteknologia, mikrobiologia, ruokaturvallisuus, kansanravitsemus, tutkimusorganisaatio, rahoitus, arviointi,	
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Abstract

The report presents the evaluation of Finnish food sciences and related research. The evaluation covered the activities of the organizations or their relevant parts in the field during 2000-2004. Commissioned by the Academy of Finland, a panel of international experts was invited to evaluate the Finnish food sciences. For purposes of this evaluation the field was defined broadly. Altogether 23 research units from twelve different organizations were included in the evaluation.

Based on the extent and diversity of the field to be evaluated, the panel decided to group it into three subfields: food bioprocessing and technology; food safety, microbiology and diagnostics; and nutrition and consumer sciences. The subfield of bioprocessing and technology is the largest of these, both in terms of human resources and funding.

The panel found the overall standard of science good. Research carried out in all three subfields has received recognition both nationally and internationally. According to the panel, the Finns should focus on two issues in particular, in order to further strengthen the field. First, longer-term funding should be alloca-ted for studies in the area of nutrition, lifestyle modifications and chronic disease risk. Second, to secure the favourable health development of the Finnish population, it would be important to encourage research settings that seek to find out comprehensive solutions for health promotion by fruitfully combining research fields, such as national public health and clinical sciences, with other key areas and interests, such asnational nutrition policy, consumer behaviour and agricultural and food industry. The panel felt that one of the basic problems is the scatteredness of the research field, which leads to difficulties in gaining critical mass. Both international and national mobility of researchers should be en-couraged in research communities. Researchers complete their PhD at a relatively old age and only few go abroad to gain post doc experience. Even those who leave normally only stay for a short while and return to the same organization where they have completed their PhD.

The panel gave special recognition to Finnish high-level nutrition research that has benefited experts worldwide in their drafting of nutrition recommendations, as well as to Finnish food safety, the level of which is exceptionally high.

Key words	Food science, nutrition research, consumer research, processing, biotechnology, microbiology, food safety, public nutrition, research organization, funding, evaluation	
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Preface

Life is critically depending on a steady supply of healthy, safe and tasteful foods. These not only contribute to the quality of life but also add life to years in an aging population. It has also become increasingly clear that our diet can have a role in preventing disease while medicine can cure. As a consequence, there is a renaissance of the interest in Food Sciences, the collective disciplines that deal with foods and food components suitable for human nutrition and health. In addition, there are many scientific developments that are bringing this field to the forefront of science. These include developments based on the genome of human and its associated microbes, nano- and microtechnology for food processing as well as systems approaches for nutrition, food safety and food production.

Based on these scientific and social arguments, the Academy of Finland has selected Food Sciences as one of the target areas for further development within the domain of Biosciences. To support future strategic selections, the Finnish Food Sciences have been evaluated by a selected group of international experts and the results of their assessment are described here. We are grateful to each one of the members of the Evaluation Panel for their commitment before, during and after the compact series of site visits that were held in October 2005 and have led to this valuable report.

Tiina Mattila-Sandholm, Senior Vice President
Chair of the Research Council for Biosciences and Environment

Executive Summary of Panel Recommendation

The following are the recommendations of the Report of the Finnish Food Sciences Evaluation Panel. However, it is important to read the full text of the Report in order to put these recommendations in context.

The recommendations are made to accommodate not only the current state of Food Sciences but to prepare for the future health of the Finnish population. Food is more than just a source of essential nutrients and the Food Sciences are now not only engaged in, but leading in some of the most complex aspects of the biological, physical and social sciences.

Food Sciences is in a renaissance era, arising from the undisputed recognition of its role in the prevention of chronic disease as well as its importance to the economy of nations. Health economists attribute to the agri-food system a primary role in the advancement of economic health of nations and of the physical health of its population since the time of the Industrial Revolution. In comparison, the health care system has contributed much less, yet the research investment and the funding required for treatment is currently taking a disproportionate share of government resources in many countries.

Finland has been a pioneer in research describing the role of food in chronic disease and in developing approaches that harness the resources of the agri-food sector in the prevention of chronic diseases. Many of these are being emulated around the world. However, as in all fields of science, knowledge continues to develop and, as a result, the field of Food Sciences has new tools, challenges and unprecedented opportunities to advance both the economic and physical health of the Finnish population.

It is the opinion of the review panel that it is in national interest of Finland to provide additional support to the field as embraced by the recommendations that follow.

Recommendations

1. Strategic planning needs to be emphasized and enhanced by a thorough ongoing compilation of industry, academic and government research projects in the area of food science and nutrition, to ensure, that available resources are oriented toward the future, fill gaps, expand under-funded areas deemed of national importance and reward productive research units.

2. An advisory group, including international participants, should be created with the express purpose of creating a vision and providing continued oversight of the fields of Food Science and Nutrition.

3. Collaboration among units (within or among institutions) should be encouraged through formulation of research funding strategies that provide the required incentives.

4. Food technology research needs to be more focused on developing products to promote human health and prevent chronic diseases. New innovations need to be confirmed with high-quality, well-controlled human nutrition intervention studies.

5. A means to drive the innovation cycle in the area of Food Science and Nutrition (through university-institute-industry cooperation/partnerships) needs to be developed, through expanded funding mechanisms and a clearly articulated vision for the end result.

6. There is a need to critically assess national funding programs applied to food sciences, to determine if they can be made more effective by improving criteria for ongoing funding, by adding flexibility to the duration of funding, and by ensuring adequate representation of the field in the review panels.

7. Obvious areas of duplication need to be reconciled to avoid wasted resources and areas of exclusivity need to be expanded to avoid complacency and stagnation.

8. Areas identified as orphan would benefit from integration into larger units and this should be supported, at least initially, with start-up funding.

9. The Finnish Food Science policy in research and innovation should interact actively with the EU 7th Framework activities, notably those of the European Technology Platform (ETP) Food for Life.

10. Increased mobility of faculty/senior researchers between national and international units should be encouraged and efforts made to avoid inbreeding within units and in the selection of departmental chairs/chiefs.

11. A clear career research path for doctoral scientists should be developed.

12. The high food safety standards and traceability of Finnish produce was recognized as a tremendous strength of the Finnish Food Sector, and this should be exploited to add value to the Finnish produce.

13. Efforts to build and strengthen collaborations in Food Sciences between Nordic countries, Baltic States and Russia should be encouraged by qualifying such activities to receive funding from the recently established NordForsk.

By G. Harvey Anderson, Chair
On behalf of the Evaluation Panel

1. Background and purpose

The Board of the Academy of Finland established on 30 March 2005 an international team to evaluate the quality and status of Finnish Food Sciences and Related Research. The evaluation was executed in co-operation with other organizations providing funding for the field, including the Finnish Funding Agency for Technology and Innovation (Tekes), the Finnish National Fund for Research and Development (SITRA), the Ministry of Agriculture and Forestry (MAF), and the Finnish Food and Drink Industries' Federation (FFDIF).

The participating units conducted internal self-assessments. The international team conducted a field evaluation during the week of October 24–28, 2005. The schedule of the site visit week is enclosed as Appendix F.

2. Definition of the field to be evaluated

For the purpose of this evaluation, the field of Food Sciences was broadly defined to include areas encompassed by both Food and Nutritional Sciences, expressed as 'all research dealing with foods and food components as well as their effects on human nutrition and health'. The modern food chain is a continuum of complex considerations that range from field to fork and have impact on the health and well being of the consumer.

3. Execution of evaluation

The Board of the Academy of Finland approved the general agenda for the evaluation of the research field during 2005. The Board also appointed a Steering Group to lead and support the execution of the evaluation.

Evaluation panel was nominated by the President of the Academy of Finland. Details of the evaluation task were specified to the panel within a document approved by the Steering Group. The document, called Terms of Reference, is attached to this document as Appendix A. Members of the Evaluation Panel are introduced in Appendix B.

An Evaluation Team, based at the Academy of Finland, took care of the coordination of the evaluation process, prepared the Submission Form and the Instructions that went along with it, arranged the programme and timetable for the site visits, took care of practical issues, as well as communicated the upcoming ideas of the panel to the assessed units.

Members of the Steering Group as well as the Evaluation Team are listed in Appendix C.

The organizations and units within these organizations included in this evaluation, and key to the abbreviations used throughout the report are given in Table 1.

Table 1. Organizations and units of assessment (Abbreviation Key)

University of Helsinki	
Faculty of Agriculture and Forestry	Department of Applied Chemistry and Microbiology (HYSOV)
Faculty of Veterinary Medicine	Department of Basic Veterinary Sciences (HYVET)
Faculty of Biosciences	Department of Biological and Environmental Sciences (HYBIO)
Faculty of Agriculture and Forestry	Department of Economics and Management (HYEE)
Faculty of Veterinary Medicine	Department of Food and Environmental Hygiene (HYHYG)
Faculty of Agriculture and Forestry	Department of Food Technology (HYET)
Faculty of Medicine	Department of Public Health (HYKT)
University of Kuopio	
Faculty of Medicine	Department of Clinical Nutrition (UKUNUT)
	Food and Health Research Centre (UKUFUNC)
Faculty of Natural and Environmental Science	Institute of Applied Biotechnology (UKUIBIO)
	Research Institute of Public Health (UKUPUB)
University of Oulu	
Kajaani University Consortium	Sotkamo Laboratory of Biotechnology (OYSOLAB)
University of Turku	
Faculty of Mathematics and Natural Sciences	Department of Biochemistry and Food Chemistry (UTUBIO)
	Functional Foods Forum (UTUFFF)
	Research Centre of Applied and Preventive Cardiovascular Medicine (UTUCAR)
Helsinki University of Technology	
Department of Chemical Technology	Laboratory of Biochemistry and Microbiology (TKKBIMIC)
Department of Chemical Technology	Laboratory of Bioprocess Engineering (TKKBIOTEC)
Lappeenranta University of Technology	
Department of Chemical Technology	The LUT Centre for Separation Technology (LUTKEM)
Non-University Institutes	
Folkhälsan Research Centre	Institute for Preventive Medicine, Nutrition, and Cancer (FOLK)
MTT Agrifood Research Finland	(MTT)
National Consumer Research Centre	Food Research Group: Consumers in the Food Economy (NCRC)
National Public Health Institute	(KTL)
National Veterinary and Food Research Institute	(EELA)
VTT Technical Research Centre of Finland	(VTT)

4. Evaluation and evaluation criteria

The units evaluated by the Panel were either a department of a university or an independent research institute or relevant part of it, who actively responded to an invitation to participate from the Academy, and submitted the standardized assessment form (Appendix D). The units were mostly interdisciplinary research environments. Each unit was reviewed in order to gain information on the activity of the field in Finland, with the goal of developing a perspective on the scientific strengths and weaknesses of the research field as a whole.

Panel was asked to give:

1. A written statement of the quality of the research, achieved results, scientific contribution as well as doctoral training (Section 6.1)
2. A written statement of the quality and efficiency of the research environment and organization (Section 6.2)
3. Written feedback about the interaction between research and society, and the impact of it (Section 6.3) and
4. Recommendations for the future of the field (Section 6.4).

5. Objectives

The primary objective of the review was to determine the strengths and weaknesses of the discipline in Finland by evaluating the quality of the research activities of the units during 2000–2004, based on the written reports and site visits, and to provide recommendations on the research and organizational requirements needed to advance the impact of the field nationally and internationally.

The specific objectives were to:

- form a general picture of the focus, scientific quality and contribution of Finnish Food Sciences and Related Research
- assess the organization, strengths, weaknesses, opportunities and threats of the research field and research units, and
- make suggestions and recommendations concerning the needs for development, focus and emphasis of the whole research field (strategy).

6. Evaluation of the field

The evaluation was based on assessment of the submitted written materials provided by the units, information supplied by the Academy, and by site visits and discussions with the units.

Based on the composition of the units, their size and research activities, the panel grouped the units into the following three subfields:

Subfield 1: Food Bioprocessing and Technology
Subfield 2: Food Safety, Microbiology and Diagnostics
Subfield 3: Nutrition and Consumer Sciences

The units were asked to divide their research portfolio in relation to the evaluated field among the three subfields in such a way that the sum of their involvement fractions made a total 100%, regardless of weather the unit also performed research not included in the area of evaluation. To avoid excess fragmentation, the minimum involvement fraction in order to become noticed within a subfield was set to 20%.

A tabulation of the research staff, funding and publications in the field is provided for the field as a whole as well as by the three subfields of food bioprocessing and technology, food safety and microbiology, and nutrition and consumer sciences in Appendix E. This tabulation is, at best, an approximate because of variability in data collection and the judgements that had to be made in the allocations to the subfields.

In 2004, 111 senior researchers and 453 research staff with funding (in euros) of 16 million core funding and 23 million external funding contributed to the field (Appendix E, Tables 5-6). This is broken down by subfield in Appendix E. Research funding in the subfields in 2000–2004 was highest for food bioprocessing and technology, followed by food safety and microbiology, and least for nutrition and consumer sciences. The distribution of total publications by the field during 2000–2004 was approximately 75% and 25% in international and national peer reviewed publications, respectively (Appendix E, Table 7).

Figure 1. Distribution of total research funding of the three subfields 2000–2004

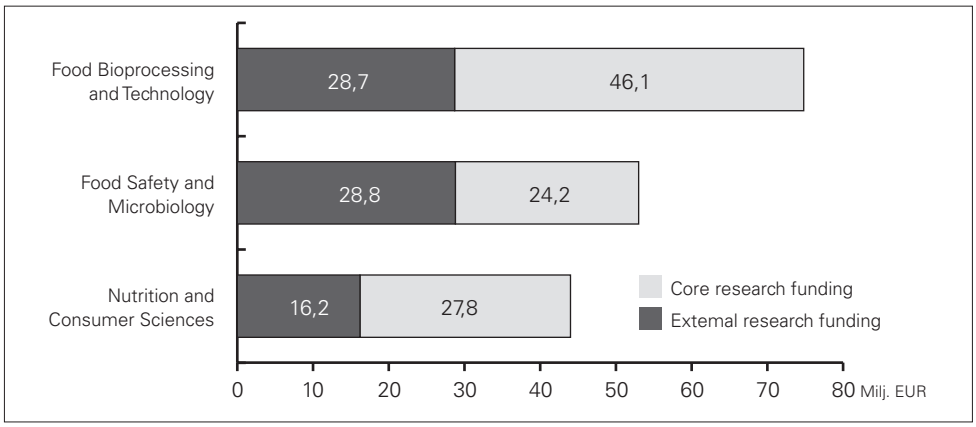


Figure 2. Development of total research funding (million euros) of the subfields 2000–2004

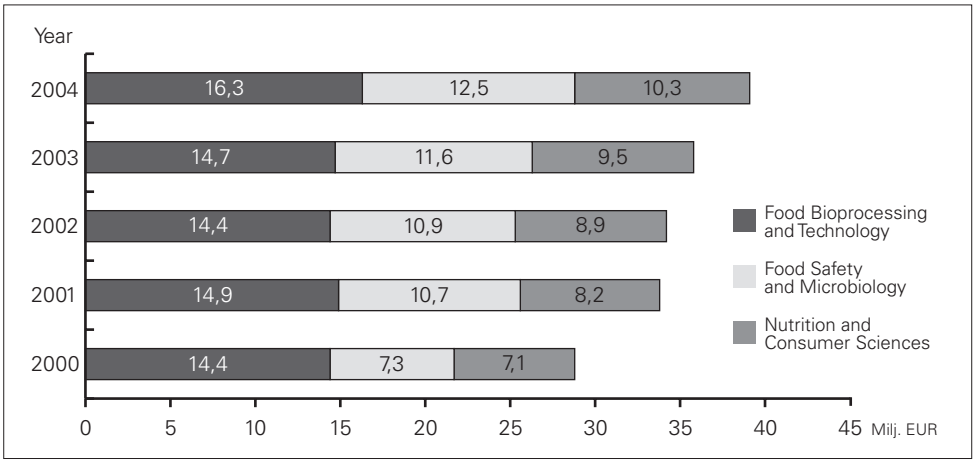


Figure 3. Development of core research funding (million euros) of the subfields 2000–2004

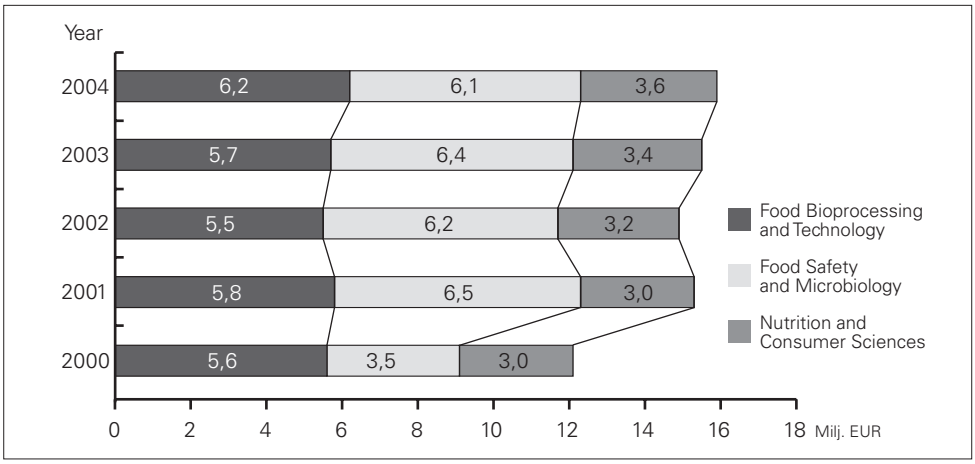
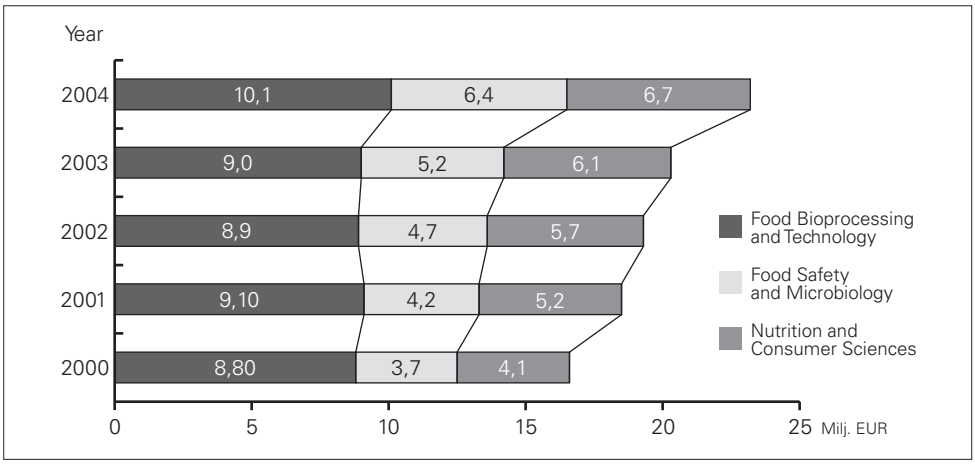


Figure 4. Development of external research funding (million euros) of the subfields 2000–2004



A brief review of each unit is provided in Appendix G.

Subfield 1: Food Bioprocessing and Technology

Understanding the behaviour and interaction of food components/materials at the fundamental level is a prerequisite to development of foods with desired functional properties. While some work is ongoing in this area, addressing the behaviour of various components in food systems, it was recognized that insufficient attention is currently given to basic studies in food research to address these issues. Exploitation of the food raw material, to develop processed foods and food constituents with optimal functional and sensory properties for downstream processing into high-quality food is a prerequisite. Hence, it has an important link with Subfield 2: Food Safety, Microbiology and Diagnostics. An important area is exploitation of existing technologies, and evaluation of novel technologies for maintenance and protection of the bioactivity of sensitive nutrients and functional food ingredients (e.g. antioxidants, plant and animal derived bioactive peptides, lipids, etc.) during food processing and storage.

This subfield includes disciplines such as physics, (bio)chemistry, microbiology and genetics, engineering, nutrition, veterinary, animal and plant sciences, and mathematics.

The common general themes of food chemistry, food technology, enzymatic modification, fermentation and separation technology, as well as biomaterial sciences, were considered for evaluation in the following units that include the entire portfolio of Helsinki University of Technology, Lab. of Biochemistry and Microbiology (TKKBIMIC), Helsinki University of Technology, Lab. of Bioprocess Engineering (TKKBIOTEC), Lappeenranta University of Technology, Dept. of Chemical Technology (LUTKEM) as well as University of Oulu, Sotkamo Lab. of Biotechnology

Table 2. Key activity areas of the assessed units in Subfield 1 – Food, Bioprocessing and Technology.

% of food research portfolio				Biomaterial sciences	Enzymatic modification	Food chemistry	Food technology	Fermentation	Product development	Separation technology
80	HYET	University of Helsinki	Dept. of Food Technology		•	•	•	•		•
45	HYSOV	University of Helsinki	Dept. of Applied Chemistry and Microbiology		•	•	•	•		•
30	UKUIBIO	University of Kuopio	Institute of Applied Biotechnology			•				
50	UTUBIO	University of Turku	Dept. of Biochemistry and Food Chemistry			•		•		•
20	UTUFFF	University of Turku	Functional Foods Forum	•		•			•	
100	TKKBIMIC	Helsinki Univ. of Technology	Lab. of Biochemistry and Microbiology	•			•	•	•	
100	TKKBIOTEC	Helsinki Univ. of Technology	Lab. of Bioprocess Engineering		•			•		•
100	LUTKEM	Lappeenranta Univ. of Tech.	Dept. of Chemical Technology					•		•
100	OYSOLAB	University of Oulu	Sotkamo Lab. of Biotechnology			•	•			
75	MTT		MTT Agrifood Research Finland	•		•	•	•	•	•
60	VTT		VTT Technical Research Centre of Finland	•	•	•	•	•	•	•

(OYSOLAB), the major parts of University of Helsinki, Dept. of Food Technology (HYET), MTT Agrifood Research Finland, VTT Technical Research Centre of Finland, University of Turku, Dept. of Biochemistry and Food Chemistry (UTUBIO), and University of Helsinki, Dept. of Applied Chemistry and Microbiology (HYSOV), and to a lesser extent University of Kuopio, Institute of Applied Biotechnology (UKUIBIO) and University of Turku, Functional Foods Forum (UTUFFF).

The key activity areas and units performing these are given in Table 2. In the 11 units, fermentation and separation biology are the themes represented in the majority, whereas biomaterial sciences and product development are theme areas in less than 30% of the units.

Subfield 2: Food Safety, Microbiology & Diagnostics

An important subfield within Food and Nutritional Sciences focuses on microorganisms and detection of their presence and/or activity. Considerable attention is given to their exploitation for the purpose of adding to the quality and conservation of raw materials, such as occurs in food fermentations. This subfield is intimately linked to Subfield 1 above. In addition, increased attention is being given to microbial diversity and activity in the human gastrointestinal tract and its modulation by probiotic microbes and prebiotic compounds. This has potential for an immediate impact on human health and clearly links to Subfield 3: Nutrition and Consumer Sciences. Elimination of food spoilage or pathogenic microbes is of crucial importance throughout the entire food chain and is increasing in relevance in view of consumer demands for minimally processed foods. Hence, food safety is of crucial importance notably for the Finnish food industry that has a tradition of high quality products either with low numbers or completely devoid of pathogens. Relevant to this and other subfields is

Table 3. Key activity areas of the assessed units in Subfield 2 - Food Safety, Microbiology and Diagnostics.

% of food research portfolio				Food fermentations	Microbial pathogens & food spoilage	Probiotics and intestinal microbiota	Detection systems
20	HYSOV	University of Helsinki	Dept. of Applied Chemistry and Microbiology				•
100	HYVET	University of Helsinki	Dept. of Basic Veterinary Sciences	•	•	•	•
100	HYBIO	University of Helsinki	Dept. of Biological and Environmental Sciences			•	
100	HYHYG	University of Helsinki	Dept. of Food and Environmental Hygiene		•		•
70	UKUIBIO	University of Kuopio	Institute of Applied Biotechnology		•	•	•
20	UKUNUTFUNC	University of Kuopio	Dept of Clinical Nutrition / Food & Health Res. Centre			•	
50	UTUBIO	University of Turku	Dept. of Biochemistry and Food Chemistry		•	•	•
40	UTUFFF	University of Turku	Functional Foods Forum			•	•
25	MTT[1]		MTT Agrifood Research Finland	•		•	•
100	EELA		National Veterinary and Food Research Institute		•		•
20	VTT		VTT Technical Research Centre of Finland	•	•	•	•

[1] MTT's fraction of 25% includes the given activity fractions in subfield 2 (15%) and subfield 3 (10%), which were below the set minimum of 20%.

the detection of the presence and activity of microbes. In this area of diagnostics as well as in the other areas, the rapid developments in microbial genomics have potential to drive further innovations as well as to advance the level and status of Food Sciences and Related Research.

This subfield includes disciplines such as food microbiology, molecular biology and genetics, general microbiology, virology, genomics and post-genomics, biochemistry, fermentation, toxicology, gastroenterology, nanotechnology, veterinary medicine, and human medicine.

The common general themes of food fermentations, microbial pathogens and food spoilage, probiotics and intestinal microbiota, as well as detection systems, were considered for evaluation in the following units that include the entire portfolio of University of Helsinki, Dept. of Veterinary Medicine (HYVET), University of Helsinki, Dept. of Biological and Environmental Sciences (HYBIO), University of Helsinki, Dept. of Environmental Hygiene (HYHYG) as well as National Veterinary and Food Research Institute (EELA), the major parts of, University of Kuopio, Institute of Applied Biotechnology (UKUIBIO), and University of Turku, Dept. of Biochemistry and Food Chemistry (UTUBIO), significant parts of University of Turku, Functional Foods Forum (UTUFFF), MTT Agrifood Research Finland, and to a lesser extent University of Helsinki, Dept. of Applied Chemistry and Microbiology (HYSOV), University of Kuopio, Dept. of Clinical Nutrition (UKUNUT), and VTT Technical Research Centre of Finland.

The key activity areas and units performing these are given in Table 3. In the 11 units, research in detection systems and probiotics and intestinal microbiota are themes of the majority with fewer units conducting research in food fermentations, microbial pathogens and spoilage organisms, and in toxic compounds formed during food processing.

Subfield 3: Nutrition and Consumer Sciences

This subfield includes research grounded in the physiological, biochemical, clinical and public health sciences aimed at enhancing health, and preventing and treating disease, as well as research based on the behavioural, social, psychological and economic sciences to address attitudes, perceptions, sensory responses and preferences of consumers. Nutritional epidemiology, nutrigenomics, functional foods, qualitative research, human medicine, life cycle nutrition, chronic disease, and consumer behaviour are major components of activity in this subfield.

The common general themes of human nutrition and health, clinical and therapeutic nutrition, public health nutrition, consumer studies, as well as sensory science, were considered for evaluation in the following units that include the entire portfolio of University of Helsinki, Dept. of Economics and Management (HYEE) and University of Helsinki, Dept. of Public Health (HYKT), University of Kuopio, Dept. of Public Health (UKUPUB), University of Turku, Research Centre of Applied and Preventive Medicine (UTUCAR), Folkhälsan Research Centre (FOLK), National Public Health Institute (KTL) as well as National Consumer Research Centre (NCRC), the major parts of University of Kuopio, Dept. of Clinical Nutrition (UKUNUT-FUNC), significant parts of University of Turku, Functional Foods Forum (UTUFFF) and University of Helsinki, Dept. of Applied Chemistry and Microbiology (HYSOV), and some parts of University of Helsinki,

Table 4. Key activity areas of the assessed units in Subfield 3 – Nutrition and Consumer Sciences.

% of food research portfolio				Human nutrition and health	Clinical and therapeutic nutrition	Public health	Consumer studies	Sensory science
35	HYSOV	University of Helsinki	Dept. of Applied Chemistry and Microbiology	•				
100	HYEE	University of Helsinki	Dept. of Economics and Management				•	
20	HYET	University of Helsinki	Dept. of Food Technology				•	•
100	HYKT	University of Helsinki	Dept. of Public Health	•	•	•	•	
80	UKUNUTFUNC	University of Kuopio	Dept. of Clinical Nutr. / Food & Health Res. Centre	•	•		•	
100	UKUPUB	University of Kuopio	Research Institute of Public Health	•		•		
100	UTUCAR	University of Turku	Res. Centre of Appl. & Prev. Cardiovascular Med.	•	•			
40	UTUFFF	University of Turku	Functional Foods Forum	•	•		•	•
100	FOLK	Folkhälsan Res. Center	Inst. of Preventive Medicine, Nutrition & Cancer	•	•			
100	KTL		National Public Health Institute	•	•	•	•	
100	NCRC		National Consumer Research Centre				•	
20	VTT		VTT Technical Research Centre of Finland	•			•	•

Dept. of Food Technology (HYET) and VTT Technical Research Centre of Finland, as well as minor parts (< 20%) of University of Turku, Dept. of Biochemistry and Food Chemistry (UTUBIO), University of Kuopio, and MTT Agrifood Research Finland (chemistry section).

The key activity areas and units performing these are given in Table 4. Of the 12 units, the majority have research in the broad themes of human nutrition and health and in consumer studies. Clinical and therapeutic nutrition research is a theme for six units. Public health nutrition is a research focus in three units, as is sensory science.

6.1 Scientific quality of the research

Overall, the scientific quality of the research is sound, and in some areas it has resulted in landmark studies that have been embraced by the international community, which is a remarkable achievement for a relatively small country and small number of investigators. Based on the bibliometric comparisons of a recent review by the Academy of Finland[1], Finnish agricultural sciences, part of which includes the field now being evaluated, are doing very well with great improvement during 1988-2002 as measured by publishing activity and citation indices.

The research has achieved national and international recognition in all three subfields. However, to enhance the overall portfolio, Finnish Food Science research needs to put more effort in two areas. First, it should consider providing more long-term support for productive studies that demonstrate the effects of diet and lifestyle on chronic disease. Second, to continue to improve the health

[1] *Scientific Research in Finland. A Review of Its Quality and Impact in the Early 2000s (2003). Timo Oksanen, Annamaija Lehvo & Anu Nuutinen (Eds.). Publications of the Academy of Finland 10/03.*

of the population, research should be encouraged toward addressing questions that integrate the domains of public health sciences, basic sciences, clinical sciences, health policy, consumer behaviour and the agri-food industry. In each country the factors that determine health are guided by policies that are often developed in isolation.

In the subfield of Food Bioprocessing and Technology, overall the scientific quality is mixed, with most of the Food Sciences work in this area being scientifically relevant. In some areas such as Functional Foods, the research is well established and innovative, with such initiatives as the Functional Foods Forum (UTUFFF) being created. In most cases the units are fragmented, which limits achievement of critical mass, core competency and impact. Some of the work does not make the grade at a national level, is very applied and may be too oriented towards product development and commodity technology. The numbers of post-graduate students pursuing Ph.D. degrees, post-doctoral scientists and high-quality peer reviewed research papers in this area are relatively low. Furthermore, emphasis on protection of intellectual property (e.g. patents), technology transfer, innovations and new technologies is low, and sufficient food engineering competence is lacking.

In the subfield of Food Safety, Microbiology & Diagnostics, overall the scientific quality is high and clearly competitive on an international level, with many examples of good to high impact publications in the area. Some of the work has real promise, even though links to current Finnish social needs are longer term. For example, exploitation of recent ~omics developments, bacterial genome mining and research on microbe-host interactions has put this aspect of Finnish Food Science at the pinnacle. Specific examples of these include HYVET, HYHYG, and EELA. Moreover, this enhances possibilities for national and international collaborations, particularly at EU level, as has been realized in the EU PROEUHEALTH project (including UTUBIO, UKUIBIO and VTT). In many cases, good quality research is realized, but this could benefit from an improved focus and organization at the Department level, such as at HYSOV. Finally, the synergy between relevant aspects of this subfield and that of the subfield of Food Bioprocessing and Technology, notably in the area of food safety and preservation should be developed and exploited. The same holds true for interaction with the subfield of Nutrition and Consumer Sciences in the area of gastrointestinal health.

In the subfield of Nutrition and Consumer Sciences, overall the scientific quality is high and highly competitive on an international level, with Finnish research having made major contributions to the international knowledge base. The genetic homogeneity and isolation of the population, and meticulously maintained databases on birth records and health of the population have led to unique contributions to the understanding of the role of food sciences as a determinant of health. Longitudinal studies of the relationship between food, nutrition, lifestyle and behaviour have been pioneered in Finland, examples of which include ATBC, STRIP and DIPP and DPS. The results of these studies have been used to set dietary guidelines worldwide and formulate intervention programs for chronic disease risk reduction. Finland has been a leader in developing and conducting experimental studies to provide hard evidence of the health benefits of functional foods and food components, and has played a primary role in stimulating health claims on

foods, both nationally and internationally. Likewise, analytical methodologies, for example for isoflavones, are used worldwide to assess chronic disease patterns and develop national food databases. In some cases, for example DPS, these efforts involve multiple units within Finland. Within this subfield, the area of Consumer Sciences is much less developed than Nutrition research. Alone among countries in Scandinavia, Finland has had in recent years an emerging presence in sensory research related to foods through HYET. This has been the only source of basic studies of sensory determinants of food acceptability. This evaluation identified beginnings of interesting basic sensory research activity related to health/appetite (UKUNUT) and to functional foods (UTUFFF), and to an understanding of genetics and brain mechanisms associated with food preferences (EU Diogenes project involving HYET, UKUNUT, HYKT and international partners). Some emphasis on, and competency in, applied sensory studies to assess sensory qualities and determine consumer acceptability was apparent in two units (VTT, UKUFUNC).

6.2 Research environment and organization

Food Science research in Finland is conducted in departments located at various universities, i.e. University of Helsinki, University of Turku, University of Kuopio, Lappeenranta University of Technology, Helsinki University of Technology, and University of Oulu, in public research centres, namely National Veterinary and Food Research Institute (EELA), MTT Agrifood Research Finland, VTT Technical Research Centre of Finland and National Consumer Research Centre, as well as in the diversely financed Folkhälsan Research Centre, and in addition through collaborative networks, an example of which is the Functional Foods Forum. The "Functional Foods Forum" represents a relatively new concept in Food Science research in Finland, whereby the expertise of a number of strong teams working in the areas of food nutrition and health at the University of Turku now work together as a special research unit of the university. The origin of the Functional Foods Forum sprang from the realization that expertise at the university across Food, Medical and Dental Departments working on food and health would benefit from closer interaction. The establishment and provision of laboratories was followed by the selection of three strong teams to constitute network now known as the Functional Foods Forum. These were the NAMI team (representing Nutrition, Allergy, Mucosal immunology and Intestinal microbiota), the Lignans and Phytoestrogens team, as well the Probiotics and Prebiotics team. These groups were the first to be incorporated into the UTUFFF facilities, which now include a range of other related disciplines. Although the full merits of the formation of this network has yet to be shown, this kind of collaboration may be a model for Finnish Food Science that needs to combine focus and mass.

Overall, research space and equipment available for research was impressive and this was not identified as a limitation by any of the units evaluated. However, limitations were identified in the infrastructure supporting the research. Support of research, even for the major well-designed and long-term longitudinal studies that have put Finland on the international map is short-term with the majority of national sources being of only three years duration (maximum). There is limited circulation of

graduate students and of postgraduates to international centres of expertise. Indeed, the duration of programs for PhD completion and the failure of graduates to move away from their training units were identified as not meeting international standards. The mostly low mobility and international/industrial experience of senior personnel is a limitation. Many units complained about the shortage of core funded positions and some had sizable research programs with no core funded senior position. Others drew attention to the overhead on research grants and the charges applied to support the facilities. The fragmentation of units into small groups and the limited interactions among groups are limiting the potential of the research environment.

6.3 Interaction between research and society

The outreach/dissemination programs provided by the research entities range from limited to excellent. Many of the research projects are relevant to Finnish society or to current Finnish research strategies. In some cases the needs of the Finnish food industry as well as research topics specific to the Nordic region and related R&D opportunities are not clearly identified or used to the fullest extent.

Dissemination of research results was seen by many units as the primary means of influencing various end-users in society. Forms of dissemination ranged from teaching and publishing peer-reviewed articles to actual provision of research reports to members of the general public, depending on the mandate of the unit. Many groups have been highly successful in producing research papers in prestige journals, which will ensure that they reach a wider audience. In other cases, projects for industry produced output that was communicated only to that industry. Thus, the consumers of the research outcomes depended very much on the nature of the unit and its perceived mission. Dissemination of research directly to SMEs is highly variable (and often with university groups and not with the non-university institutes as to be expected) and was not apparent in many cases, but is more common in regional units.

Some groups had an emphasis in the past on producing reports in Finnish for local consumption, although this seems to be changing, as the importance of international recognition, typically through peer-reviewed journal articles gained acceptance. In at least one case, that of the NCRC, the perceived requirement for immediate public dissemination of research may be inhibiting outcomes in terms of peer-reviewed publications. Consistent with their institutional role, many research groups are active in providing articles in the popular press, as well as radio and TV interviews. The extent to which these activities increase the public knowledge or understanding of research outcomes, and thus are an appropriate focus of activity, is unclear.

In general, units did not see their role as assessing the impact of their research on society overall. In many cases it is not clear how the researchers would accomplish this. Many units stated that they interacted with industry to determine industry needs, in some cases there was the belief that the industry would automatically be aware of consumer needs. In cases where the research focus was related to public health through diet, assessment of outcomes may take some years, although again there was little evidence of units being actively involved in such assessments. The same point can be made with respect to

groups reporting to government, whose work may eventually lead to shifts in policy. It is clear that research groups considered evaluating the ultimate impact of their research to be outside their mission, and perhaps outside of their expertise. It appeared that consideration of the ultimate impact of research on the Finnish public was not given a high priority, in particular when framing research questions. One consequence of this may be that groups remain focused on relatively narrow issues that arise out of their own discipline base, which in effect discourages collaboration with complementary groups to address questions of "public good". An alternate reason is that researchers with expertise in the more basic sciences are not trained to address issues related to "public good". They would benefit from help in this area. The extent to which funding agencies ask different research groups to frame questions together to take account of public good is not known, but perhaps should be considered. On the other hand, those in the nutrition area provided a long list of involvement in international and national advisory, policy and professional associations, attesting to their high status in the field and contribution to society.

7. Recommendations

1. Strategic planning needs to be emphasized and enhanced by a thorough ongoing compilation of industry, academic and government research projects in the area of food science and nutrition, to ensure that available resources are oriented toward the future, fill gaps, expand under-funded areas deemed of national importance and reward productive research units.

Finland is a relatively small country that is highly productive in the area of Food Sciences and Related Research. Faced with limited resources to support these activities, it would benefit from a clear picture of what current activities are ongoing, the areas in which it can make unique contributions, and those that are of national importance from both economic and health perspectives. It is difficult to adequately assess the state of the field without a comprehensive assessment of ongoing activities.

To build on the results of the present evaluation, continuous assessment of Food Sciences and Related Research activities in Finland is required (conducted on a regular, e.g. every two years, basis). To accomplish this goal, it might be useful to subdivide the disciplines and enumerate activities within the subcategories of, for example, new product development, food and agriculture, economics and nutrition interventions. This would have the benefit of identifying units that are engaged in complementary activities. It would also allow for an assessment of under-recognized opportunities.

2. An advisory group, including international participants, should be created with the express purpose of creating a vision and providing continued oversight of the fields of Food Science and Nutrition.

An internationally selected steering group that is repopulated on a rotating basis would be an important resource to provide a frequent and informed analysis of research activities and make recommendations on directing funds to strategic areas important to the health and welfare of the Finnish population. This group should be balanced with experts who are familiar with the current activities within Finland.

3. Collaboration among units (within or among institutions) should be encouraged through formulation of research funding strategies that provide the required incentives.

Collaboration within and among units or subunits can increase the scope and depth of a research project. It can likewise reduce the need to develop duplicate activities and promote increased quality of the work. Creating artificial barriers to collaboration should be avoided. For example, it may be beneficial to encourage collaborative efforts within larger units to take advantage of proximity and shared resources. In other cases, it may be beneficial to encourage collaborative efforts among smaller or specialized units in order to expand the depth and scope of a project. The goals and assessment of the collaboration should be based on a synergistic outcome, not artificial divisions. For example, consideration should be given to provision of seed money to create a focused Finnish Food Sciences Centre involving Universities of Helsinki, Turku and Kuopio as key research organizations.

4. Food technology research needs to be more focused on developing products to promote human health and prevent chronic diseases. New innovations need to be confirmed with high-quality, well-controlled human nutrition intervention studies.

In some cases, the research priority appears to be aimed at identifying novel bioactive materials in food, especially foodstuffs unique or particularly abundant in Finland, to promote Finnish products. This may be too broad an objective. Food technology research should be focused on specific health issues pertinent to the Finnish population and development of food products that will mitigate these factors and are compatible with the current food intake patterns, for example, low sodium products or more acceptable salt substitutes, a wider range of low allergenic dairy or grain products. Projects should emanate from the epidemiological data and the observational studies completed in Finland to date. The efficacy of products with specific claims on health benefits should be confirmed with high-quality, well-control nutrition intervention studies. Funding of projects that tie new product development and assessment in humans should be considered. Likewise, monitoring of the impact of new products after introduction into the Finnish foods supply should be provided for.

5. A means to drive the innovation cycle in the area of Food Science and Nutrition (through university-institute-industry cooperation/partnerships) need to be developed, through expanded funding mechanisms and a clearly articulated vision for the end result.

In some cases, there are clear advantages to university-institute-industry collaborations where specific capacities/areas of expertise are distinct. For example, industry has the capacity to develop

a novel product and produce it, whereas research institutions have the capacity to test it via clinical investigation. Alternatively, a research institution may identify the need for products with specific nutritional characteristics and industry may apply their expertise in the area of development. A third research centre can then assess efficacy. The emphasis should be on combining two complementary areas of expertise rather than mandating narrow partnerships.

The position of the technology institutes (VTT/MTT) in the Finnish innovation process should be clearly articulated and instruments should be set in place to monitor/safeguard this position in between the university and industrial research.

6. There is a need to critically assess national funding applied to food sciences, to determine if they can be made more effective by improving criteria for ongoing funding, by adding flexibility to the duration of funding and by ensuring adequate representation of the field in the review panels.

There are a number of landmark studies that are ongoing or have been completed in the area of chronic disease risk, nutrition and lifestyle modification. It is anticipated that much of the data have yet to be analysed and additional data can be generated from these studies. These efforts appear to be hampered by the unstable funding for these projects. For one or two unique projects, long-term (10-year) financial commitments on a competitive basis should be initiated. International standards and expertise should be used in evaluating research proposals and ongoing projects, but application and review for renewal of longitudinal projects every three years is not a good use of resources. Consideration should be given to providing more stable funding of large scale observational and intervention health-related studies that have made major contributions on an international level to provide for long-term archiving of samples and data.

7. Obvious areas of duplication need to be identified and reconciled to avoid wasted resources and areas of exclusivity need to be expanded to avoid complacency and stagnation.

Consideration should be given to reorganizing efforts to minimize excessive duplication with the intent of maximizing use of personnel and economic resources. Likewise, limited activities and options in certain areas can breed complacency and stagnation. Research is stimulated by healthy competition. The aim should be to balance healthy competition with the intent of encouraging innovation and progress.

8. Areas identified as orphan would benefit from integration into larger units and this should be supported, at least initially with start-up funding.

Some units are very small and suffer from limited opportunities to share equipment, intellectual know-how, cross-fertilization of ideas and efficiency of scale. In some cases, unique expertise could be lost with removal of the units, but integration would be a solution to this problem.

Careful consideration should be given to the critical mass of research entities, prior to funding, to ensure that the area to be funded has the critical mass to undertake the project.

9. The Finnish Food Science policy in research and innovation should interact actively with the EU 7th Frame-

work activities, notably those of the European Technology Platform (ETP) Food for Life.

The European Commission is facilitating the development of European Technology Platforms (ETPs) to promote innovation in Europe. ETPs will bring together stakeholders in key economic sectors so as to develop a long-term vision of the sector, create a strategy for delivery, and put in place the management to ensure maximum impact.

The challenging opportunities for improving welfare and well-being in Europe through research and innovation in the European agro-food industry, together with the size, nature and regional importance of this industry, broadly justify the inclusion of a food ETP amongst the some 25 existing ETPs at various stages of development.

10. Increased mobility of faculty/ senior researchers between national and international units should be encouraged and efforts made to avoid inbreeding within units and in the selection of departmental chairs/ chiefs.

It was noted that in many cases, new faculty appointments or promotions seem to be limited or favoured to come from within the institution/university. There may be advantages to considering a wider range of individuals to fill these positions. Funding to encourage broader searches and/or relocation costs should be considered and seen as an opportunity to bring in new research direction and expertise. It became apparent that the academic culture in Finnish institutions is for personnel trained at an institution to remain there after the formal training period is completed, with or without a short postdoctoral training period abroad. This system risks fostering intellectual inbreeding and stagnation rather than cross-fertilization and innovation. Alternate models of training and career development from other countries are abundant. This change will require a shift in expectations among graduate research institutions within Finland. Funding mechanisms to encourage this transition should be established.

Furthermore, the method for selection of Department Chairs should be readdressed and a more effective system of team leader identification installed, as a problem associated with leadership of "rotating Chairs" was recognized as a weakness of the system currently in place.

11. A clear career research path for doctoral scientists should be developed.

In some cases, students enter doctoral training programs relatively late in life and once the training is completed their professional activities are little altered, both in terms of institution and responsibilities. A reassessment of the criteria used to start a Ph.D. program should be made prior to the initiation for a formal training program. There are many models throughout the world in this area that could be considered.

12. The high food safety standards and traceability of Finnish produce was recognized as a tremendous strength of the Finnish Food Sector, and this should be exploited to add value to the Finnish produce.

Various foods are highly sensitive to deterioration. This notably holds for animal produce and in this sector Finland has developed extremely high safety standards by an integrated chain approach involving well-trained veterinar-

ians, operators and other staff. As a consequence, there are opportunities to e.g. increase production, and export of Finnish products such as eggs and meat.

13. Efforts to build and strengthen collaborations in Food Sciences between Nordic countries, Baltic States and Russia should be encouraged by qualifying such activities to receive funding from the recently established NordForsk.

Finland and other Scandinavian countries know a history of strong collaborations that was structured into specific Nordic collaborations until the mid-nineties. However, upon entering the EU, these funding structures for these collaborations have been somewhat diminished. With the presently expanded EU dimensions, these Nordic structures for the food sciences need to be reconsidered, possibly by also involving the Baltic States and Russia.

Appendix A: Terms of Reference for the Panel

Terms of Reference for the Panel

This document sets out the standard Terms of Reference applicable for the Panel. The contents of this document are relevant to the Panel members as well as to the units of assessment. This document should be read in conjunction with the Instructions to Submission Form, which will be used by the units of assessment (hereafter referred to as the unit) in preparing their evaluation documents. The unit refers to the department, institute, or research station, which are involved in the evaluation.

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1. Background and purpose

The Board of the Academy of Finland decided on 30 March 2005 that the quality and status of Finnish food-related research will be evaluated with respect to the international level. The field of Finnish food sciences has not been comprehensively evaluated before, so it was considered highly relevant and justified. It is estimated that a few hundred researchers will be involved in the evaluation.

Present evaluation combines an external assessment by an international Evaluation Panel with an internal self-assessment exercise. The purpose of the evaluation is to support the development of this research field in the future. The main objectives of the external evaluation are: to examine the quality of the research of the units during 2000–2004, and to provide recommendations on how to develop the research and the contribution of the whole field in the future.

2. Definition of the field to be evaluated

In the field of food sciences, materials suitable for human consumption as well as their processing and use as nutrition are studied. The practical context includes food products and their processing technology, nutritional value, safety and quality. In defining the research field, the suitability of materials for human consumption and nutrition is fundamental. The field is highly interdisciplinary, in the center of which is the deep understanding of materials commonly used as nutrition. The center is supplied with the basic and applied knowledge as well as the novel findings of biotechnology, chemistry, microbiology, food hygiene and toxicology, nutritional sciences, processing technology as well as consumer and behavioural sciences. Regardless of which discipline the research is anchored into, it is here considered food science, if it deals with materials suitable for nutrition, and targets, in the long run at least, in enabling the use of such materials for human consumption.

The field to be evaluated is very broad and heterogeneous. All scientific research related to food and nutrition as well as materials currently used and suitable for using as such is to be assessed regardless of the focus, which may be e.g. the basic characteristics or the processing of materials, their sensory quality or safety, their nutritional value or specific metabolic response, or their status and significance in our culture, attitudes and consumptional habits.

With the definition "Food and nutrition", the majority of scientific research dealing with agriculture and animal production is excluded. If the object of the research on its way to become food cannot or usually is not used for nutrition as such, e.g. a spike of rye from the field, a cow from the barn or a fish from the pool, the research does not belong to the field now being evaluated. However, it should be kept in mind, that the modern food chain is a stepless continuum of complex causality from field to fork. Therefore, if e.g. the chemical compounds in different parts of rye kernel are studied, or the composition of colostrum, or the structure and function of muscles of meat-producing animals, which all affect the ultimate quality as well as technological, economical and nutritional value of the food-to-become, we are definitely within the field of the evaluation.

In the multidisciplinary field of contemporary biotechnology, potentially health promoting compounds are studied and extracted from various materials. This sort of basic research often independently preceeds the research aiming towards ultimate food applications. In this case, automatically included in this evaluation are studies, which look at fractions and specific compounds within materials already considered food as such, e.g. egg, milk, or fish oil.

On the other end of the food chain, are the fork users in the surrounding culture with their habits, state of knowledge, opinions, preferences, consumption patterns, and last, but not least, free will in relation to food, eating and nutrition.

3. Organisation

The Board of the Academy of Finland approved the general agenda for the evaluation of the research field during 2005. The Board also appointed a Steering Group to lead and support the execution of the evaluation.

The evaluation is executed in co-operation with other organizations providing funding for the field. Involved are the National Technology Agency of Finland (Tekes), the Finnish National Fund for Research and Development (Sitra), the Ministry of Agriculture and Forestry (MAF) as well as the Finnish Food and Drink Industries' Federation (FFDIF).

The members of the Steering Group are
Tiina Mattila-Sandholm, Chair of the Research Council for Biosciences and Environment, Academy of Finland, Chair of the group
Anu Harkki, Program Director, Sitra
Matti Heikkilä, Professor, Research Council for Culture and Society
Seppo Heiskanen, Director, FFDIF
Marja-Liisa Hänninen, Professor, Research Council for Health
Markku Järvenpää, Secretary General, MAF
Riitta Keiski, Professor, Research Council for Natural Sciences and Engineering
Pasi Puttonen, Professor, Research Council for Biosciences and Environment
Liisa Rosi, Senior Technology Advisor, Tekes
Kalervo Väänänen, Professor, Research Council for Health, Vice Chair of the group

The list of invited Panel members, the list of evaluation documents to be submitted, and the Terms of Reference have been reviewed and approved by the Steering Group.

4. International Evaluation Panel

The external evaluation will be carried out by an international Panel of independent high-level experts. All departments, independent research institutes and research stations will be evaluated by the Evaluation Panel.

The Academy of Finland has invited six renowned scientists as Evaluators:
G. Harvey Anderson, Professor (Department of Nutritional Sciences, University of Toronto, Canada), Chair of the Panel
Dietrich Knorr, Professor (Department of Food Biotechnology and Food Process Engineering, Berlin University of Technology, Germany)
Alice Lichtenstein, Professor (Jean Mayer USDA Human Nutrition Research Center on Aging, Tufts University, Boston, USA)
John Prescott, Professor (School of Psychology, James Cook University, Smithfield, Australia)
Catherine Stanton, Principal Investigator (Dairy Products Research Centre, Teagasc Moorepark, Cork, Ireland)
Willem de Vos, Professor (Laboratory of Microbiology, Wageningen University, and Wageningen Center for Food Sciences, the Netherlands).

5. Objectives of the evaluation

The purpose of this exercise is to evaluate Finnish food sciences as well as nutrition and consumption closely related to it. The evaluation period is 2000–2004, on which the future recommendations to be provided will be based.

The evaluation has objectives as follows:
- To form a general picture of the focus, scientific quality and contribution of Finnish food-related research
- To assess the organisation, strengths, weaknesses, opportunities and threats of the research field and research units
- To make suggestions and recommendations concerning the needs for development, focus and emphasis of the whole research field (strategy).

6. Evaluation criteria

The basic unit to be evaluated by the Panel is a department of a university or an independent research institute or relevant part of it (Appendix 1). The units are mostly interdisciplinary research environments. Each unit will be evaluated as such, but the focus is on the research field as a whole.

Panel is asked to give:
- A written statement of the quality of the research, achieved results, scientific contribution as well as doctoral training (Section 6.1),
- A written statement of the quality and efficiency of the research environment and organisation (Section 6.2),
- A written feedback about the interaction between research and society, and the impact of it (Section 6.3), as well as Recommendations for the future of the field (Section 6.4).

The main emphasis is on scientific evaluation. The panel should ensure that the evaluation takes into account all of the relevant material available.

6.1 Scientific quality of the research

The Panel's main role is to evaluate the quality of research. The quality statement is based on evaluation documents submitted by the Units. Panel members will have the opportunity to complete this information during the site visits. All research, whether basic or applied, should be given equal weight.

The quality statement must reflect the work of all of the research staff listed in a unit.

Important issues to be considered:
- What is the international quality and status of the unit's research?
- How innovative and challenging are the research programmes and research lines?

- *Case: Scientific publications in Finnish and Swedish. Panel will need to consider that in some cases it is not feasible to publish the results of research in languages other than Finnish or Swedish, which are the official languages of Finland. These publications may still provide evidence of international excellence if they can be compared favourably with similar studies in other countries.*

6.2 Research environment and organization

Evaluation deals with research environments, prevailing research practices and collaborative networks.

Important issues to be considered:
- What kind of research environment facilitates the research in terms of funding, infrastructure and mobility (strengths, weaknesses, needs for improvement)?
- What is characteristic to the activity, leadership and administration in the field?
- Are the national and international networks sufficient (universities, research centres, enterprises)?
- How does the research of the unit interrelate to the strategies of the accommodating organization?
- What is the role of interdisciplinarity in the units as well as the whole field?

6.3 Interaction between research and society

The Panel is asked to write feedback about the interaction between research and society. The feedback is to be based on all evaluation documents as well as interviews. The Panel should especially consider other activities such as expert tasks, popularized works, patenting, technology transfer and cooperation with other sectors of society.

Concerning that we are assessing research dealing with food, nutrition and consumption, the Panel should pay special attention to the societal contribution of each unit as well as the relevance of the research on the national as well as international level. The questions to be asked are "How actively and efficiently does the unit communicate its points and findings to various stakeholders and the rest of society?" and "In what way has the research of the unit as well as its co-operation with other actors of the society contributed to the success of these actors?". The Panel should consider this from the point of view of e.g. food industry, small and medium-sized enterprises, development, production and use of novel food stuffs, development, production and use of healthy food stuffs, improvement of food safety, establishment of new regulations and norms, common understanding on food quality etc. The Panel is asked to discuss the interaction between the unit's research and society from the relevant aspects.

Important issues:
- How fruitful is the co-operation between the unit and the communities ultimately applying the results of the research, and what kinds of results have been achieved?
- In case of innovations, how promptly and efficiently is the intellectual property protected to enable rapid technology transfer to parties capable of developing new products for the market?
- Is sufficient and systematic effort made to find suitable collaborators for commercialising the innovations?
- Is the research of the field relevantly focused with respect to the future scenarios of the national as well as international development?
- What is the academic and non-academic (business R&D, administration) need of research doctorates in the field, and how well is it met with the current intensity of doctoral training?

6.4 Panel's recommendations for the future

The Panel is asked to provide recommendations for the future development of the research field. The Panel will need to consider that the recommendations are focused mainly on the field, not on a unit, research group or single researchers.

Key issues to be addressed are:
- What strengths and weaknesses does the field have in Finland?
- What opportunities and challenges does the field have?
- How should the field improve its performance in carrying out its research?
- What kind of means could be recommended in order to improve and strengthen research performance at various levels?

The Panel should provide recommendations on
- research representing single-, multi- as well as interdisciplinarity
- development of research: personnel, environment and infrastructure
- strengthening the impact and effectiveness of the research on the society
- other issues

7. Tasks, responsibilities and working arrangements of the Panel

In conducting the expert evaluation the Panel members will base their examination on desk research at home as well as the background information to be provided concerning the Finnish innovation system, and ultimately supplement their view during the site visits in Finland.

Panel members will set responsibilities within the group and together with the Evaluation Secretary. All evaluation documents are provided by the Evaluation Office. For the full description of the research active staff and the evaluation documents please see the Instructions to Submission Form, which will be used by the units of assessment in preparing their evaluation documents.

7.1 Desk research

Desk research will be carried out before the site visit. The material includes facts of the research staff and funding
- list of publications
- lists of best publications of senior staff collection of the best publications
- list of doctoral theses
- lists of visits and collaborations self-assessment exercise of the unit.

7.2 Site visits and interviews

A sample of researchers will be interviewed during the site visit e.g.:
- Heads of Units (research)
- Senior staff, professors, post-doctoral researchers, visiting foreign scholars.

The specific timetable and instructions will be provided by the Evaluation Office in due time.

7.3 Confidentiality

Panel members undertake not to make use of and not to divulge to third parties any non-public facts, information, knowledge, documents or other matters communicated to them or brought to their attention in the performance of the evaluation. The evaluation and the ratings are only for official use and confidential until the final summary evaluation report is published.

7.4 Evaluation report and publicity

The evaluation report including the main recommendations is based on the evaluation criteria defined by the Academy of Finland.

The evaluation report will be written and edited by the Panel members with the assistance of the Evaluation Secretary.

Prior to final editing and publishing, the units of assessment get to review the report to correct any factual errors.

The evaluation report is confidential and only for official use until publication.

Evaluation reports will be published in the Publications of the Academy of Finland in both printed and electronic form (www.aka.fi).

8. Timetable of evaluation process

Jan-Feb 2005	Definition of the field (food-related research, actors)
Feb 2005	Appointment of the Executive Group
Mar 2005	Appointment of the Evaluation Secretary
Apr 2005	Appointment of the Evaluation Panel
Feb-Apr 2005	Definition of evaluation criteria
Jan-Dec 2005	Communication to the field
Apr 27, 2005	The onset seminar
May-Aug 2005	Preparation and delivery of evaluation documents
Oct 24-28, 2005	Site visits to the units of assessment
Nov-Dec 2005	Preparation of report
Jan-Feb 2006	Publishing and releasing the report
2006	Informing and communicating the results
2006-	Following up the implementation of the provided recommendations

9. Coordination of Evaluation

The evaluation process is operationally coordinated by the Evaluation Team mainly at the Academy of Finland. Director Arja Kallio, Senior Science Advisor Timo Kolu,

Science Advisor Sanna-Maija Miettinen and Project Secretary Marjo Hirvonen from the Evaluation Team together with Evaluation Secretary Dr. Kaisa Immonen from Asiaset Ltd. The Evaluation Secretary will assist the Panel on site visits and in preparing and editing the evaluation report. The duties of the Project Secretary are to compile the evaluation documents, organize the practical details of the site visits and provide administrative support.

10. Funds

The evaluation is funded by the Academy of Finland and the other funding bodies involved in the Steering Group of the evaluation. The Academy of Finland will pay an expert fee to the Panel Members. All travel expenses related to the Panel's visits and accommodation in Finland will be covered or reimbursed by the Academy of Finland.

Helsinki, 3 June 2005

Tiina Mattila-Sandholm
Chair of the Steering Group
Academy of Finland

Appendix B: Members of the Evaluation Panel Brief Introduction

G. HARVEY ANDERSON
Professor, Chairman of the Panel
Department of Nutritional Sciences
University of Toronto, Canada

Dr. G. Harvey Anderson received his B.Sc and M.Sc from the University of Alberta, Canada and Ph.D. (Nutritional Sciences) from the University of Illinois (1969). After postdoctoral experience at the Massachusetts Institute of Technology, he joined the University of Toronto. He has held a full professorship since 1977, and served the University in various leading positions over the years. He is presently Director of the University-Industry Program in Food Safety, Nutrition and Regulatory Affairs. Dr. Anderson's research on protein and amino acid metabolism, food selection and intake regulation, diet and behaviour, infant nutrition, total parenteral nutrition, and diet and chronic disease (with emphasis on sugars and proteins), has led to over 250 publications and the training of more than 60 M.Sc. and Ph.D. students and postdoctoral fellows. His research has received continuous peer-reviewed grant support since 1970. Dr. Anderson has received many awards including the Borden Award (research) and the McHenry Award (leadership) from the Canadian Society for Nutritional Sciences. He has also served on several editorial boards and research grant committees and as a consultant to governments, universities and members of the food and pharmaceutical industries.

DIETRICH KNORR
Professor
Department of Food Biotechnology and Food Process Engineering
Berlin University of Technology, Germany

Dietrich Knorr received his PhD (Food and Fermentation Technology) in 1974 at the University of Agriculture, Vienna, Austria (cum laude). He spent nearly ten years at the University of Delaware, Newark, USA, holding a full professorship in Food Processing and Biotechnology during 1984–1989. Since 1987, Dr. Knorr has been the Professor of Food Technology and Food Biotechnology and Head of Department at Berlin University of Technology. He also holds Adjunct and Research professorships at Cornell University and University of Delaware, USA, respectively. Over 35 students have received PhD's and approx. 150 MS degrees under his supervision. Dr. Knorr's main interests are in food process engineering especially emerging technologies (e.g. high pressure, pulsed electric field, ultrasound) food biotechnology, especially plant cell cultures, probiotics, prebiotics, secondary metabolites, antimicrobial polymers and sustainable food systems, and his research has led to over 300 peer-reviewed

papers in international journals. He has received several awards, among which are EFFoST Outstanding Research Scientist Award as well as IFT Marcel Loncin Research Prize, both in 2004, and IFTs Nicholas Appert Award in 2003. Since 2000, he has been the editor of Innovative Food Science and Emerging Technologies, and participates in the editorial work of many other journals. Dr. Knorr is a member in various societies, carries numerous expert tasks as an international and national reviewer and evaluator for universities, granting agencies and research institutes. So far he has been coordinator of four large EU-sponsored international research projects.

ALICE H. LICHTENSTEIN
Stanley N. Gershoff Professor of Nutrition Science and Policy
Director and Senior Scientist
Jean Mayer USDA Human Nutrition Research Center on Aging Tufts University, Boston, USA

Alice H. Lichtenstein received her D.Sc. (Nutritional Biochemistry) from Harvard University, Boston, MA, USA (1979). After postdoctoral training at the Cardiovascular Institute, Boston University School of Medicine, she joined Tufts University, Boston, MA, USA. Dr. Lichtenstein's research focuses on the interplay between diet, lifestyle and predictors of heart disease risk, work funded by the National Institutes of Health. She has published over 150 papers and 20 book chapters. Dr. Lichtenstein currently chairs the Nutrition Committee of the American Heart Association, is Associate Editor of the Journal of Lipid Research, and is on the Editorial Advisory Board of Tufts Health and Nutrition Letter and Editorial Board of Atherosclerosis. She served on the 2000 Dietary Guidelines Advisory Committee and Dietary Reference Intake Macronutrient Panel of the National Academy of Sciences, Institute of Medicine. Dr. Lichtenstein has received many honours and awards, including an honorary doctorate from the Faculty of Medicine at University of Kuopio, Finland (2005) and the Robert H. Herman Memorial Award from the American Society of Clinical Nutrition (2006).

JOHN PRESCOTT
Associate Professor
School of Psychology
James Cook University, Cairns, Australia

John Prescott received his PhD (Psychology) in 1986 at the University of New South Wales, Sydney, Australia. After a period at Australia's National Drug and Alcohol Research Centre, he was appointed as joint director of the Sensory Research Centre in the Division of Food Science and Technology at CSIRO, the Australian government science organisation. Here he managed a large-scale project investigating the food perceptions and preferences of consumers in Asia, as well as conducting studies into human perception of tastes, flavours and oral irritants. In 1996, he established the Sensory Science Research Centre at The University of Otago (New Zealand) where he continued a program of cross-cultural sensory research, as well as undertaking

studies on genetic variations in taste sensitivity, taste and odour learning and the determinants of food and flavour preferences. In 2003, he joined James Cook University where he is head of the School of Psychology. His research has led to more than 60 papers in refereed journals and numerous book chapters. He has served as Secretary and President, and is currently Vice-President, of the Australasian Association for Chemosensory Science. He is editor of the journal Food Quality and Preference and on the editorial board of Journal of Sensory Studies.

CATHERINE STANTON
Principal Investigator
Moorepark Food Research Center
Teagasc Moorepark, Fermoy, Co. Cork, Ireland

Catherine Stanton received her Ph.D (Biochemistry) in 1988 at Bournemouth University, UK. Her first position was Senior Research Scientist at Johnson & Johnson, UK. After that, during 1990–1994 she conducted research at Wake Forest University Medical Center, USA, first as a Postdoctoral Fellow and the last two years as Research Associate. Since 1994, Dr. Stanton has been based at Teagasc Moorepark, Ireland. From 2002 onwards, her position has been Principal Research Officer. Dr. Stanton's research interests include biological production and health benefits of CLA, nutritional and technological aspects of probiotic cultures, nutritional aspects of dairy/functional foods, cell factories for production of nutritionals, post-translational modifications and proteolytic processing as well as biotechnology for protein/peptide product development. Her research has led to 90 peer-reviewed publications in international journals. Dr. Stanton has been actively involved in several government committees, and served as the reporting member in FAO/WHO expert workshops on probiotics in Argentina (2001) and Canada (2002). She has memberships in many academic societies and in the American Society for Biochemistry and Molecular Biology (ASBMB) since 1994.

WILLEM MEINDERT DE VOS
Professor
Laboratory of Microbiology
Wageningen University, and
Wageningen Center for Food Sciences, the Netherlands

Willem M. de Vos (1954) received a cum laude (top 3%) PhD degree at the University of Groningen, NL, in the area of Molecular Genetics, partly done at the Max Planck Institute in Berlin, was a post-doc at the NIRD (now IFR) in the UK, and became Group Leader and later Research Manager at NIZO serving the NL dairy industry. While continuing with industrial R&D, he became (at the age of 32) the first Professor of Bacterial Genetics and later Chair of Microbiology at Wageningen University. He served as Director of the Department of Biomolecular Sciences, stopped his NIZO appointment in 2000 to become Programme Director Microbial Functionality and Safety at the Wageningen Centre for Food Sciences, a Dutch Technology Top

Institute. Dr. de Vos has supervised over 50 PhD students, published more than 300 peer-reviewed papers, as well as been involved in the filing of over 20 patents. He has received several international awards, including FEBS, EMBO and CEC fellowships, and the Rhone Poulenc Dairy Science Award. Dr. de Vos is co-chairing the Faculty of 1000 on Food and Industrial Biotech, and is among the ISI highly cited authors (h factor > 50). Furthermore, he serves in several international advisory boards within the area of genomics and food sciences.

Appendix C: Execution of Evaluation Steering Group and Evaluation Team

Members of the Steering Group were

Tiina Mattila-Sandholm, Chair of the Research Council for Bioscience and Environment, Academy of Finland, Senior Vice President, Research and Development, Valio Ltd., Chair of the Steering Group
Anu Harkki, Programme Director, SITRA
Matti Heikkilä, Professor, Research Council for Culture and Society
Seppo Heiskanen, Director, FFDIF
Marja-Liisa Hänninen, Professor, Research Council for Health
Markku Järvenpää, Secretary General, MAF
Riitta Keiski, Professor, Chair of the Research Council for Natural Sciences and Engineering
Pasi Puttonen, Professor, Research Council for Biosciences and Environment
Liisa Rosi, Senior Technology Advisor, Tekes
Kalervo Väänänen, Professor, Chair of the Research Council for Health, Vice Chair of the group

Evaluation Team

Dr. Kaisa Immonen, Evaluation Secretary, Asiaset Ltd, kaisa@asiaset.fi
Dr. Arja Kallio, Director, Biosciences and Environment Research Unit, Academy of Finland, arja.kallio@aka.fi
Mr. Timo Kolu, Senior Science Advisor, Academy of Finland, timo.kolu@aka.fi
Dr. Sanna-Maija Miettinen, Science Advisor, Academy of Finland, sanna-maija.miettinen@aka.fi
Ms. Marjo Hirvonen, Project Secretary, Academy of Finland, marjo.hirvonen@aka.fi
Ms. Sirpa Halmela, Project Secretary, Academy of Finland, sirpa.halmela@aka.fi

Evaluation Office

Academy of Finland
Biosciences and Environment Research Unit
P.O. Box 99 (Vilhonvuorenkatu 6)
FI-00501 Helsinki, Finland

Appendix D: Submission Form (D1) and Instructions (D2)

D1 – Submission Form (See Instructions)

GENERAL INFORMATION

Organisation	
Department or equivalent	
Address	
Phone	
Internet home page	
Head of the Department	
Phone	
Email	
Contact person for the Evaluation	
Phone	
Email	

Submission form shall be submitted by August 31, 2005 in ten (10) paper copies as well as one copy in electronic format (rtf) to the following address:
Projektisihteeri Marjo Hirvonen
Suomen Akatemia
PL 99, 00501 Helsinki
Email: marjo.hirvonen@aka.fi

1. Staff

1.1 Staff in 2000–2004 (FTE)

Task	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
Senior researchers						
Post doc researchers						
Doctoral students						
Other research staff						
Visiting researchers and visiting research students						
Total number of research active staff						
Technical personnel						
Administrative personnel						
Other personnel						

1.2 Research active staff 2000–2004[2]

Name	Task	Academic degree	Period (year-year)	FTE

[2]. Staff includes persons receiving salaries and grants

2. Scientific publishing

2.1a Unit's research profile in the context of the evaluation (in relation to staff)

Research field	**(%)**
Biotechnology	
Food chemistry and - biochemistry	
Food microbiology	
Food hygiene Food toxicology	
Food safety	
Nutrition	
Food processing technology	
Consumer and behavioural research	
Other (spesify):	
Total	**100**
Comments:	

2.1b Description of the Unit's research profile (max. 4 pages)

2.2a List of publications and other output 2000–2004 (Appendix 1)

2.2b Number of scientific publications and other outputs 2000–2004

Type of output	**Number**
1. Articles in refereed international journals	
2. Articles in refereed international edited volumes and conference proceedings	
3. Articles in refereed Finnish scientific journals	
4. Articles in refereed Finnish edited volumes and conference proceedings	
5. Scientific monographs published abroad	
6. Scientific monographs published in Finland	
7. Other scientific publications	
8. Patents	
9. Computer programs and algorithms	
10. Visiting/invited international lectures	
11. Radio and television programmes and journals popularising science	
12. Other output	

2.3 Lists of senior researchers' key publications (See 1.2) (Appendix 2)

2.4 Copies of the Unit's key publications
(append copies of publications, maximum number of publications = number of senior researchers but a minimum of five publications) (Appendix 3)

3. Doctoral training

3.1 List of doctoral dissertations 2000–2004

Name (family name, given name)	Year of birth	Gender	Topic of dissertation

3.2 Completed doctoral degrees (in order of completion, per year)

Name (family name, given name)	Year of birth	Gender	Year of completing the degree/organisation

3.3 Employment of PhDs

Name	Year of disputation	Present employment (job description, organisation)

4. The Unit's collaboration contacts

4.1 Visits abroad (minimum duration of visit: one month)

Name	Target organisation	Country	Topic of the visit	Duration (in months)

4.2 Visits to the Unit (minimum duration of visit: one month)

Name of visitor	Home organisation	Country	Topic of the visit	Duration (in months)

4.3 Short but particularly important visits

Name of visitor	Home organisation	Country	Topic of the visit

4.4 Most important national and international collaborators (max. 10)

Name	Organisation	Country

4.5 Describe the most important outcomes of the visits and collaboration contacts (max. 1 page)

5. Other scientific and societal activities

5.1 Invited presentations in international scientific conferences

Name	Name and time of the conference

5.2 Memberships on editorial boards of international scientific journals

Name	Journal	Period

5.3 Prizes awarded to researchers, honours and scientific positions of trust

Name	Prize, position etc.

5.4 Memberships on committees and on scientific advisory boards of business companies or other similar tasks of no primarily academic nature

Name	Tasks	Period

6. The Unit's self-assessment

6.1a SWOT – evaluation of the Unit's scientific strengths, weaknesses, opportunities and threats (expertise, funding, facilities, organisation; max. 2 pages).

6.1b Benchmarking, evaluate the Unit in relation to other research groups in the field (compare resources and results, opportunities/restrictions to those three relevant research groups; max. 2 pages).

6.2 The Unit's research strategy 2006–2008 (relation to the parent organisation's strategy, priority areas in research, development measures; max 1 page).

6.3 The societal impact of the Unit's activities (max. 1 page).

6.4 Assess the academic and societal need for doctoral training within the Unit's research fields and the Unit's role in doctoral training (max. 1 page).

7. Funding

7.1 The Unit's core and external funding received from the parent organisation.

Source of funding		2000	2001	2002	2003	2004	Total
Core funding	Budget funding						
	Other						
External funding	Academy of Finland[3]						
	Tekes						
	Ministry of Agriculture and Forestry						
	Other public source						
	Industry						
	Private foundations						
	EU						
	Other foreign organisations						
Total							

[3] *See instructions*
Notes (if applicable)

7.2 The role of the Academy of Finland in promoting the scientific and societal impact of research (max. 1 page)

7.3 The role of funding awarded by different funding organisations in promoting the scientific and societal impacts of research, excluding funding from the Academy of Finland (max. 1 page)

D2 - Instructions to Submission Form

1. Staff

1.1 Indicate information on the staff in full-time equivalents (FTE). Full-time equivalent refers to annual full-time work including paid holidays and other statutory days off. Other holidays, leaves of absence etc. shall be deducted from the calculatory working time.

One person-workday is 8 hours 15 minutes and one person workweek 41 hours 15 minutes effective working time (lunch hours included, 1 hour/day). If the person's working time is less than the norms of normal office hours, the amount of person-work is calculated using the working time norm as divider.

Research active staff includes persons who plan, produce and publish new knowledge, theories and methods as well as products and processes based on them and lead research projects. Technical personnel refer to persons working under the supervision of research active staff to carry out projects but who are not involved in the theoretical planning, publishing or other related activities. Administrative personnel refer to persons who take care of administrative tasks related to the research, such as financial and personnel administration or other office duties but who are not normally involved with the technical implementation of the projects.

Persons under the following titles will always be listed in the research active staff:
- Academy Professor (in Finnish: akatemiaprofessori)
- Academy Research Fellow (akatemiatutkija)
- Assistant (assistentti)
- Chief Research Scientist (johtava tutkija)
- Clinical Teacher (kliininen opettaja, apulaisopettaja)
- Doctoral Assistant (tohtoriassistentti)
- Group Leader (ryhmänjohtaja)
- Head of Research (tutkimuspäällikkö)
- Laboratory Director (laboratorionjohtaja)
- Postdoctoral Research Fellow (tutkijatohtori)
- Professor (professori)
- Research Professor (tutkimusprofessori)
- Research Director (tutkimusjohtaja)
- Research Lecturer (tutkijalehtori)
- Senior Curators (yli-intendentti)
- Senior Researcher (vanhempi tutkija)
- Specialist Researcher (erikoistutkija)
- University Lecturer (yliopistonlehtori)

Moreover, the following persons should always be included in the research active staff:
a) Postdoctoral researchers
b) Doctoral students (category: Doctoral students) belonging to either of the following groups:
- Persons with at least an MA or MSc (or equivalent) degree who have been employed by the university as full-time researchers or assistant researchers to do doctoral studies for a period of no less than six months.
- Persons with at least an MA or MSc (or equivalent) degree who, for a period of no less than six months, have fulfilled the following two criteria: they a) have been affiliated with the Unit as full-time researchers or assistant researchers to do doctoral studies and b) have been receiving research funding from some other source than another university or research institute.

These groups include, e.g. doctoral students employed by graduate schools.

Doctoral students who do not fulfil either of the above criteria, i.e. who have not been employed by the university and have not been receiving other funding, can also be included in the research active staff for the period they are not holding a post in another university or research institute. The Unit can decide case by case whether to include these doctoral students. It is worth observing that it is not necessarily advisable to include doctoral students who do not have substantial publications from the period 2000–2004.

According to its choice, the Unit can also include other members of the staff in the research active staff, e.g. departmental amanuenses (amanuenssi).

1.2 In case persons duties have changed during the period under review (e.g. from technical personnel to research active staff), indicate the person's both tasks and period according to the format.

2. Scientific publishing

2.1a Estimate of the Unit's research orientation according to fields of science related to this evaluation.

2.1b This question surveys how the research carried out in the Unit has impacted research in its own field(s). Describe the orientation of scientific publishing, most important research results and the role of multidisciplinarity or interdisciplinarity etc. In case the research carried out in the Unit is clearly specialized in the different fields of food sciences, describe each field separately (see also Question 6.3).

2.2a List of publications and other outcomes in the order indicated in the summary table, by type of outcome. Regarding each outcome, indicate the name of the author/authors and the outcome.

2.2b In the summary table, calculate the number of each type of outcome in the list during the period under review.

2.3 Each senior researcher shall list five of his/her key publications during the period under review, indicated in the order of quality. Unlike other information, the list may also include manuscripts published in 2005 or manuscripts approved for publication but still unpublished. A copy of the manuscript approved for publication shall be submitted with the other information.

At the end of the publication data, give the impact factor in bold (use only one year). Researchers may if they so wish also give the citation index of their publications. Indicate this citation index as the last information by using the abbreviation CI = number of citations.

References to books should give the names of any editors, place of publication, editor, and year.

Example:
Von Wright A, Bruce A. Genetically modified micro-organisms and their potential effects on human health and nutrition. Trends in Food Science & Technology 2003; 14: 264-276; IF=1.8; CI=2

2.4 For ensuring easy readability do not make the font size smaller when copying publications. The copies of publications shall be two-sided.

3. Doctoral training

3.1 If at least half of the doctoral dissertation has been supervised and done at a research institute, the research institute can also list the doctoral dissertation as its own outcome. In this case indicate also the university where the doctoral dissertation has been presented for approval.

3.2 Indicate only degree-awarding organizations.

3.3 In addition to the name of the organization, indicate the type of organization (university, business company, research institute, state, municipality or other).

4. The Unit's collaboration contacts

4.1–4.3 List the visits per year. List the visits of each year by country in the alphabetical order. In Field 1, give other information in accordance with the title except the duration of the visit that is to be indicated in Field 2. The minimum duration of a visit to be indicated is one month. In item Topic of the visit indicate clearly the objective of the visit, for example regarding a post doc period describe what were the content objectives related to the visit.

4.4 Collaborator refers to a person or a research team with whom the cooperation has either generated or is expected to generate within the next three (3) years one of the outcomes indicated in Item 2.2.

4.5. Describe here e.g. key joint publications, researcher training, adoption and use of new technologies or new approaches.

6. The Unit's self-assessment

Self-assessment is an important part of the evaluation. Please answer carefully.

6.1 and 6.2. In addition to strengths and weaknesses it is also important to assess what the present strengths or developable strengths enable in the future and what kinds of threats are related to the weaknesses.

6.3 Describe the Unit's research programme for the next few years, the key research objectives and means to achieve these objectives. What is the role of basic and applied research? Is there need for new knowledge, facilities, is the present level of funding sufficient for attaining the objectives laid down? Do the strategies of the parent organization and the Unit support each other?

6.4 Describe here how the Unit's research activities and cooperation with other actors in society have promoted the activities of other societal actors. Describe e.g. how the activities have promoted food-processing industry, the activities of SMEs, production and use of new food products, production and use of functional food products, drafting of new regulations and norms, general knowledge of the quality of food products etc.

7. Funding

7.1 Core funding applies to the Unit's budget funding and possible other funding for research awarded by the parent organization. The funding covers both the salary costs with social charges of the staff and the operational costs which include consumption costs and investment costs for research activities.

7.2 Use of research funding received from external sources, indicated per year. Academy of Finland fellowships should also be involved and counted. Salaries should be counted as 1.33* gross salary.

7.3 Describe how the funding awarded by the Academy has promoted the scientific and societal impact of the Unit's activities. Scientific impact refers to the contribution of the research carried out by the Unit to the development of the field. Societal impact refers to the ability of the research activities to promote values that are considered as important in society.

7.4 Describe the contribution of the funding awarded by different funding organizations to the scientific and societal impacts.

Appendix E: Summary of Research Resources by Subfield – Tables 1-7

Table 1. Total staff by subfield and unit 2000–2004 (ftes*)

Food Bioprocessing and Technology			Total staff					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	45%	23,0	27,0	29,3	27,9	26,6	134
University of Helsinki	Food Technology	80%	20,0	20,8	19,2	16,0	16,0	92
University of Kuopio	Inst. of Applied Biotechnology	30%	1,7	2,0	4,1	3,8	3,8	15
University of Turku	Biochemistry and Food Chemistry	50%	16,8	15,5	16,6	18,2	17,2	84
University of Turku	Functional Foods Forum	20%	0,0	1,0	3,8	6,4	7,1	18
Helsinki Univ. of Tech.	Lab. of Biochem. and Microbiol.	100%	16,5	15,5	16,0	17,0	18,0	83
Helsinki Univ. of Tech.	Lab. of Bioprocess Engineering	100%	25,0	26,0	25,0	23,0	27,0	126
Lappeenranta Univ. of Tech.	Chemical Technology	100%	9,2	9,2	9,2	9,2	9,2	46
University of Oulu	Sotkamo Lab. of Biotechnology	100%	9,7	13,9	13,6	8,7	8,6	55
MTT Agrifood Res. Finland		75%	68,9	81,3	57,6	60,7	64,7	333
VTT Tech. Res. Centre		60%	99,5	99,7	98,1	89,8	85,3	472
Subfield 1 - total			**290**	**312**	**292**	**281**	**283**	**1458**

* 1 fte = 1 person-year's work

Food safety and microbiology			Total staff					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	20%	10,2	12,0	13,0	12,4	11,8	59
University of Helsinki	Basic Veterinary Sciences	100%	9,5	15,5	16,5	16,5	16,5	75
University of Helsinki	Biological and Environmental Sci.	100%	4,8	4,8	3,8	5,0	6,0	24
University of Helsinki	Food and Environmental Hygiene	100%	31,2	33,4	38,8	41,8	44,7	190
University of Kuopio	Inst. of Applied Biotechnology	70%	3,9	4,6	9,5	8,8	8,8	35
University of Kuopio	Clinical Nutrition	20%	5,0	4,4	5,6	8,0	9,4	32
University of Turku	Biochemistry and Food Chemistry	50%	16,8	15,5	16,6	18,2	17,2	84
University of Turku	Functional Foods Forum	40%	0,0	2,0	7,6	12,8	14,1	37
MTT Agrifood Res. Finland		25%	23,0	27,1	19,2	20,2	21,6	111
Nat. Vet. & Food Res. Inst.		100%	22,0	29,0	29,0	33,0	34,0	147
VTT Tech. Res. Centre		20%	33,2	33,2	32,7	29,9	28,4	157
Subfield 2 - total			**159**	**181**	**192**	**207**	**212**	**952**

Nutrition and consumer sciences			Total staff					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	35%	17,9	21,0	22,8	21,7	20,7	104
University of Helsinki	Economics and Management	100%	4,8	6,8	6,9	6,0	6,0	31
University of Helsinki	Food Technology	20%	5,0	5,2	4,8	4,0	4,0	23
University of Helsinki	Public Health	100%	7,0	8,0	8,0	8,0	9,0	40
University of Kuopio	Clinical Nutrition	80%	20,0	17,6	22,4	32,0	37,6	130
University of Kuopio	Res. Inst. of Public Health	100%	7,0	8,0	10,0	11,0	10,0	46
University of Turku	Res.CentreAppl.&Prev.Cardiov Med.	100%	15,7	18,3	15,5	15,8	15,5	81
University of Turku	Functional Foods Forum	40%	0,0	2,0	7,6	12,8	14,1	37
Folkhälsan Res. Center	Inst. Prev. Med. Nutr. Canc.	100%	18,0	16,0	20,0	14,0	14,0	82
Nat. Public Health Inst.		100%	61,7	64,6	66,0	67,0	71,0	330
Nat. Consumer Res. Centre		100%	5,0	6,0	4,8	5,3	4,9	26
VTT Tech. Res. Centre		20%	33,2	33,2	32,7	29,9	28,4	157
Subfield 3 - total			**195**	**207**	**221**	**228**	**235**	**1086**
TOTAL			**645**	**700**	**706**	**715**	**731**	**3496**

Table 2. Total research active staff by subfield and unit 2000–2004 (ftes)

Food Bioprocessing and Technology			**Total research active staff**					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	45%	12,6	14,4	18,0	18,0	18,0	81
University of Helsinki	Food Technology	80%	13,8	15,1	13,3	10,8	13,0	66
University of Kuopio	Inst. of Applied Biotechnology	30%	0,8	1,1	2,6	2,3	2,3	9
University of Turku	Biochemistry and Food Chemistry	50%	10,7	10,6	13,0	12,7	13,4	60
University of Turku	Functional Foods Forum	20%	0,0	0,7	3,0	5,3	5,7	15
Helsinki Univ. of Tech.	Lab. of Biochem. and Microbiol.	100%	13,5	13,5	13,5	14,5	15,5	71
Helsinki Univ. of Tech.	Lab. of Bioprocess Engineering	100%	19,0	19,0	18,0	16,0	21,0	93
Lappeenranta Univ. of Tech.	Chemical Technology	100%	7,2	7,2	7,2	7,2	7,2	36
University of Oulu	Sotkamo Lab. of Biotechnology	100%	7,7	11,9	11,6	6,7	6,6	45
MTT Agrifood Res. Finland		75%	25,4	28,6	23,0	25,1	24,6	127
VTT Tech. Res. Centre		60%	55,8	57,1	57,2	50,5	46,0	267
Subfield 1 - total			**166**	**179**	**180**	**169**	**173**	**868**

Food safety and microbiology			**Total research active staff**					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	20%	5,6	6,4	8,0	8,0	8,0	36
University of Helsinki	Basic Veterinary Sciences	100%	6,0	12,0	13,0	13,0	13,0	57
University of Helsinki	Biological and Environmental Sci.	100%	4,8	4,8	3,8	5,0	6,0	24
University of Helsinki	Food and Environmental Hygiene	100%	17,1	18,9	20,5	23,5	21,5	102
University of Kuopio	Inst. of Applied Biotechnology	70%	1,8	2,5	6,0	5,3	5,3	21
University of Kuopio	Clinical Nutrition	20%	3,6	3,2	4,2	6,2	7,0	24
University of Turku	Biochemistry and Food Chemistry	50%	10,7	10,6	13,0	12,7	13,4	60
University of Turku	Functional Foods Forum	40%	0,0	1,4	6,0	10,6	11,4	29
MTT Agrifood Res. Finland		25%	8,5	9,5	7,7	8,4	8,2	42
Nat. Vet. & Food Res. Inst.		100%	9,7	15,5	17,0	19,9	22,4	85
VTT Tech. Res. Centre		20%	18,6	19,0	19,1	16,8	15,3	89
Subfield 2 - total			**86**	**104**	**118**	**129**	**131**	**569**

Nutrition and consumer sciences			**Total research active staff**					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	35%	9,8	11,2	14,0	14,0	14,0	63
University of Helsinki	Economics and Management	100%	3,2	5,4	5,8	4,6	4,6	24
University of Helsinki	Food Technology	20%	3,4	3,8	3,3	2,7	3,3	17
University of Helsinki	Public Health	100%	0,0	0,0	0,0	0,0	0,0	28
University of Kuopio	Clinical Nutrition	80%	14,4	12,8	16,8	24,8	28,0	97
University of Kuopio	Res. Inst. of Public Health	100%	7,0	8,0	10,0	11,0	10,0	46
University of Turku	Res.CentreAppl.&Prev.Cardiov.Med.	100%	8,2	10,8	8,9	7,1	7,3	42
University of Turku	Functional Foods Forum	40%	0,0	1,4	6,0	10,6	11,4	29
Folkhälsan Res. Center	Inst. Prev. Med. Nutr. Canc.	100%	11,0	9,0	13,0	7,0	7,0	47
Nat. Public Health Inst.		100%	34,8	36,5	37,3	39,0	43,2	191
Nat. Consumer Res. Centre		100%	4,5	5,4	3,8	4,3	4,4	22
VTT Tech. Res. Centre		20%	18,6	19,0	19,1	16,8	15,3	89
Subfield 3 - total			**115**	**123**	**138**	**142**	**149**	**695**
TOTAL			**367**	**406**	**436**	**440**	**453**	**2132**

Table 3. Senior researchers by subfield and unit 2000–2004 (ftes)

Food Bioprocessing and Technology			Senior researchers					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	45%	2,3	2,7	4,1	4,5	5,9	19
University of Helsinki	Food Technology	80%	2,6	2,2	2,5	2,5	3,0	13
University of Kuopio	Inst. of Applied Biotechnology	30%	0,2	0,2	0,5	0,5	0,2	1
University of Turku	Biochemistry and Food Chemistry	50%	3,2	3,2	3,9	4,1	4,4	19
University of Turku	Functional Foods Forum	20%	0,0	0,4	0,8	1,2	1,7	4
Helsinki Univ. of Tech.	Lab. of Biochem. and Microbiol.	100%	3,0	3,0	3,0	3,0	3,0	15
Helsinki Univ. of Tech.	Lab. of Bioprocess Engineering	100%	3,0	4,0	3,0	4,0	5,0	19
Lappeenranta Univ. of Tech.	Chemical Technology	100%	1,1	1,1	1,1	1,1	1,1	5
University of Oulu	Sotkamo Lab. of Biotechnology	100%	3,0	3,0	2,6	1,2	1,3	11
MTT Agrifood Res. Finland		75%	5,8	5,8	5,0	5,0	5,9	27
VTT Tech. Res. Centre		60%	13,5	13,4	13,6	14,2	13,3	68
Subfield 1 - total			**37**	**39**	**40**	**41**	**45**	**202**

Food safety and microbiology			Senior researchers					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	20%	1,0	1,2	1,8	2,0	2,6	9
University of Helsinki	Basic Veterinary Sciences	100%	1,0	2,0	2,0	2,0	4,0	11
University of Helsinki	Biological and Environmental Sci.	100%	0,6	0,6	0,6	0,6	0,6	3
University of Helsinki	Food and Environmental Hygiene	100%	1,9	1,9	1,7	1,8	2,3	10
University of Kuopio	Inst. of Applied Biotechnology	70%	0,4	0,4	1,1	1,1	0,4	3
University of Kuopio	Clinical Nutrition	20%	0,8	0,6	0,8	1,6	1,6	5
University of Turku	Biochemistry and Food Chemistry	50%	3,2	3,2	3,9	4,1	4,4	19
University of Turku	Functional Foods Forum	40%	0,0	0,8	1,6	2,4	3,3	8
MTT Agrifood Res. Finland		25%	1,9	1,9	1,7	1,7	2,0	9
Nat. Vet. & Food Res. Inst.		100%	3,7	6,4	7,3	7,6	7,9	33
VTT Tech. Res. Centre		20%	4,5	4,5	4,5	4,7	4,4	23
Subfield 2 - total			**19**	**23**	**27**	**30**	**33**	**132**

Nutrition and consumer sciences			Senior researchers					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	35%	1,8	2,1	3,2	3,5	4,6	15
University of Helsinki	Economics and Management	100%	1,3	1,5	1,3	1,5	1,5	7
University of Helsinki	Food Technology	20%	0,6	0,5	0,6	0,6	0,7	3
University of Helsinki	Public Health	100%	0,0	0,0	0,0	0,0	0,0	14
University of Kuopio	Clinical Nutrition	80%	3,2	2,4	3,2	6,4	6,4	22
University of Kuopio	Res. Inst. of Public Health	100%	0,0	1,0	1,0	2,0	3,0	7
University of Turku	Res.CentreAppl.&Prev.Cardiov.Med.	100%	0,3	0,4	0,5	0,5	0,4	2
University of Turku	Functional Foods Forum	40%	0,0	0,8	1,6	2,4	3,3	8
Folkhälsan Res. Center	Inst. Prev. Med. Nutr. Canc.	100%	1,5	1,5	1,0	1,0	1,0	6
Nat. Public Health Inst.		100%	9,2	9,2	8,2	9,5	10,3	46
Nat. Consumer Res. Centre		100%	1,9	1,4	0,6	1,3	1,4	7
VTT Tech. Res. Centre		20%	4,5	4,5	4,5	4,7	4,4	23
Subfield 3 - total			**24**	**25**	**26**	**33**	**37**	**160**
TOTAL			**81**	**88**	**92**	**104**	**115**	**494**

Table 4. Research funding by subfield and unit 2000–2004 (thousands of euros)

Food Bioprocessing and Technology			**Research funding**					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	45%	996	1,245	1,282	1,146	1,344	6,012
University of Helsinki	Food Technology	80%	1,077	780	710	858	869	4,293
University of Kuopio	Inst. of Applied Biotechnology	30%	82	150	220	215	221	887
University of Turku	Biochemistry and Food Chemistry	50%	649	665	758	781	735	3,588
University of Turku	Functional Foods Forum	20%	18	70	125	164	252	629
Helsinki Univ. of Tech.	Lab. of Biochem. and Microbiol.	100%	770	838	949	1,056	1,196	4,809
Helsinki Univ. of Tech.	Lab. of Bioprocess Engineering	100%	1,177	1,206	1,170	1,120	1,660	6,333
Lappeenranta Univ. of Tech.	Chemical Technology	100%	855	992	903	788	805	4,344
University of Oulu	Sotkamo Lab. of Biotechnology	100%	380	275	172	196	192	1,215
MTT Agrifood Res. Finland		75%	3,344	3,389	2,571	2,995	3,045	15,345
VTT Tech. Res. Centre		60%	5,025	5,328	5,569	5,378	6,018	27,317
Subfield 1 - total			**14,372**	**14,938**	**14,429**	**14,696**	**16,337**	**74,772**

Food safety and microbiology			**Research funding**					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	20%	443	553	570	509	597	2,672
University of Helsinki	Basic Veterinary Sciences	100%	373	486	618	714	916	3,107
University of Helsinki	Biological and Environmental Sci.	100%	65	94	104	104	89	456
University of Helsinki	Food and Environmental Hygiene	100%	1,329	1,238	1,334	1,786	2,259	7,946
University of Kuopio	Inst. of Applied Biotechnology	70%	190	349	512	502	515	2,069
University of Kuopio	Clinical Nutrition	20%	204	246	266	440	478	1,634
University of Turku	Biochemistry and Food Chemistry	50%	649	665	758	781	735	3,588
University of Turku	Functional Foods Forum	40%	36	140	251	328	503	1,258
MTT Agrifood Res. Finland		25%	1,115	1,130	857	998	1,015	5,115
Nat. Vet. & Food Res. Inst.		100%	1,203	4,047	3,780	3,656	3,384	16,070
VTT Tech. Res. Centre		20%	1,675	1,776	1,856	1,793	2,006	9,106
Subfield 2 - total			**7,281**	**10,725**	**10,906**	**11,610**	**12,498**	**53,020**

Nutrition and consumer sciences			**Research funding**					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	35%	775	968	997	891	1,045	4,676
University of Helsinki	Economics and Management	100%	181	269	237	201	183	1,071
University of Helsinki	Food Technology	20%	269	195	178	215	217	1,073
University of Helsinki	Public Health	100%	238	291	303	335	337	1,503
University of Kuopio	Clinical Nutrition	80%	814	986	1,064	1,761	1,910	6,535
University of Kuopio	Res. Inst. of Public Health	100%	50	212	277	385	277	1,201
University of Turku	Res.CentreAppl.&Prev.Cardiov.Med.	100%	331	227	416	284	315	1,573
University of Turku	Functional Foods Forum	40%	36	140	251	328	503	1,258
Folkhälsan Res. Center	Inst. Prev. Med. Nutr. Canc.	100%	317	425	517	456	380	2,096
Nat. Public Health Inst.		100%	2,091	2,291	2,489	2,421	2,678	11,970
Nat. Consumer Res. Centre		100%	303	379	362	443	440	1,926
VTT Tech. Res. Centre		20%	1,675	1,776	1,856	1,793	2,006	9,106
Subfield 3 - total			**7,080**	**8,158**	**8,947**	**9,511**	**10,293**	**43,989**
TOTAL			**28,734**	**3,3821**	**34,283**	**35,817**	**39,128**	**171,781**

Table 5. Core research funding by subfield and unit 2000–2004 (thousands of euros)

Food Bioprocessing and Technology			Core research funding					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	45%	327	361	384	515	442	2,029
University of Helsinki	Food Technology	80%	246	224	234	220	210	1,134
University of Kuopio	Inst. of Applied Biotechnology	30%	77	46	57	64	68	312
University of Turku	Biochemistry and Food Chemistry	50%	193	214	236	243	238	1,124
University of Turku	Functional Foods Forum	20%	0	0	27	20	25	72
Helsinki Univ. of Tech.	Lab. of Biochem. and Microbiol.	100%	560	480	530	490	620	2,680
Helsinki Univ. of Tech.	Lab. of Bioprocess Engineering	100%	464	455	469	517	546	2,450
Lappeenranta Univ. of Tech.	Chemical Technology	100%	175	187	36	31	37	466
University of Oulu	Sotkamo Lab. of Biotechnology	100%	16	21	13	10	13	72
MTT Agrifood Res. Finland		75%	1,895	1,998	1,674	1,927	1,978	9,473
VTT Tech. Res. Centre		60%	1,601	1,804	1,852	1,627	2,019	8,903
Subfield 1 - total			**5,554**	**5,790**	**5,512**	**5,662**	**6,196**	**28,714**

Food safety and microbiology			Core research funding					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	20%	145	161	171	229	197	902
University of Helsinki	Basic Veterinary Sciences	100%	115	123	142	145	150	675
University of Helsinki	Biological and Environmental Sci.	100%	30	30	40	40	40	180
University of Helsinki	Food and Environmental Hygiene	100%	973	925	1,003	1,334	1,673	5,908
University of Kuopio	Inst. of Applied Biotechnology	70%	180	108	132	149	159	728
University of Kuopio	Clinical Nutrition	20%	101	94	104	120	117	536
University of Turku	Biochemistry and Food Chemistry	50%	193	214	236	243	238	1,124
University of Turku	Functional Foods Forum	40%	0	0	54	40	51	144
MTT Agrifood Res. Finland		25%	632	666	558	642	659	3,158
Nat. Vet. & Food Res. Inst.		100%	636	3,600	3,181	2,938	2,130	12,485
VTT Tech. Res. Centre		20%	534	601	617	542	673	2,968
Subfield 2 - total			**3,539**	**6,522**	**6,238**	**6,423**	**6,086**	**28,807**

Nutrition and consumer sciences			Core research funding					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	35%	254	281	298	401	344	1,578
University of Helsinki	Economics and Management	100%	108	111	114	112	109	553
University of Helsinki	Food Technology	20%	61	56	59	55	52	283
University of Helsinki	Public Health	100%	157	163	165	166	162	814
University of Kuopio	Clinical Nutrition	80%	406	375	416	482	466	2,145
University of Kuopio	Res. Inst. of Public Health	100%	0	0	0	0	0	0
University of Turku	Res.CentreAppl.&Prev.Cardiov.Med.	100%	2	2	2	2	2	10
University of Turku	Functional Foods Forum	40%	0	0	54	40	51	144
Folkhälsan Res. Center	Inst. Prev. Med. Nutr. Canc.	100%	184	208	246	220	241	1,099
Nat. Public Health Inst.		100%	1,077	955	1,039	1,060	1,221	5,352
Nat. Consumer Res. Centre		100%	188	251	217	294	304	1,255
VTT Tech. Res. Centre		20%	534	601	617	542	673	2,968
Subfield 3 - total			**2,972**	**3,003**	**3,227**	**3,373**	**3,626**	**16,201**
TOTAL			**12,065**	**15,315**	**14,977**	**15,458**	**15,907**	**73,723**

Table 6. External research funding by subfield and unit 2000–2004 (thousands of euros)

Food Bioprocessing and Technology			External research funding					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	45%	669	884	898	631	902	3,983
University of Helsinki	Food Technology	80%	831	556	476	638	659	3,159
University of Kuopio	Inst. of Applied Biotechnology	30%	5	104	163	151	153	575
University of Turku	Biochemistry and Food Chemistry	50%	456	451	522	538	498	2,464
University of Turku	Functional Foods Forum	20%	18	70	99	144	226	557
Helsinki Univ. of Tech.	Lab. of Biochem. and Microbiol.	100%	210	358	419	566	576	2,129
Helsinki Univ. of Tech.	Lab. of Bioprocess Engineering	100%	714	751	701	603	1,115	3,883
Lappeenranta Univ. of Tech.	Chemical Technology	100%	680	805	868	757	769	3,878
University of Oulu	Sotkamo Lab. of Biotechnology	100%	363	254	159	187	179	1,143
MTT Agrifood Res. Finland		75%	1,449	1,392	897	1,068	1,067	5,873
VTT Tech. Res. Centre		60%	3,424	3,524	3,716	3,751	3,999	18,415
Subfield 1 - total			**8,818**	**9,148**	**8,917**	**9,033**	**10,142**	**46,059**

Food safety and microbiology			External research funding					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	20%	297	393	399	280	401	1,770
University of Helsinki	Basic Veterinary Sciences	100%	257	363	476	569	766	2,431
University of Helsinki	Biological and Environmental Sci.	100%	35	64	64	64	49	276
University of Helsinki	Food and Environmental Hygiene	100%	356	313	331	452	586	2,038
University of Kuopio	Inst. of Applied Biotechnology	70%	11	242	380	353	356	1,341
University of Kuopio	Clinical Nutrition	20%	102	153	162	320	361	1,098
University of Turku	Biochemistry and Food Chemistry	50%	456	451	522	538	498	2,464
University of Turku	Functional Foods Forum	40%	36	140	197	288	452	1,113
MTT Agrifood Res. Finland		25%	483	464	299	356	356	1,958
Nat. Vet. & Food Res. Inst.		100%	567	447	599	718	1,254	3,585
VTT Tech. Res. Centre		20%	1,141	1,175	1,239	1,250	1,333	6,138
Subfield 2 - total			**3,742**	**4,203**	**4,668**	**5,188**	**6,412**	**24,212**

Nutrition and consumer sciences			External research funding					
Organization	**Unit (Dept.)**	**Share %**	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
University of Helsinki	Applied Chem. and Microbiol.	35%	520	687	698	491	701	3,098
University of Helsinki	Economics and Management	100%	73	158	123	89	74	518
University of Helsinki	Food Technology	20%	208	139	119	159	165	790
University of Helsinki	Public Health	100%	80	128	138	169	175	690
University of Kuopio	Clinical Nutrition	80%	408	611	648	1,279	1,444	4,390
University of Kuopio	Res. Inst. of Public Health	100%	50	212	277	385	277	1,201
University of Turku	Res.CentreAppl.&Prev.Cardiov.Med.	100%	329	225	414	282	313	1,563
University of Turku	Functional Foods Forum	40%	36	140	197	288	452	1,113
Folkhälsan Res. Center	Inst. Prev. Med. Nutr. Canc.	100%	133	217	272	236	139	997
Nat. Public Health Inst.		100%	1,014	1,336	1,450	1,361	1,457	6,618
Nat. Consumer Res. Centre		100%	115	127	145	148	136	672
VTT Tech. Res. Centre		20%	1,141	1,175	1,239	1,250	1,333	6,138
Subfield 3 - total			**4,109**	**5,155**	**5,720**	**6,137**	**6,667**	**27,788**
TOTAL			**16,669**	**18,507**	**19,305**	**20,358**	**23,221**	**98,059**

Table 7. Number of refereed publications in each unit during 2000–2004

		International		National		
Organization	**Unit (Dept.)**	journals	ed.vol & conf. proc	journals	ed.vol & conf. proc	
University of Helsinki	Applied Chemistry and Microbiology	210	46	6	4	266
University of Helsinki	Basic Veterinary Sciences	31	0	0	0	31
University of Helsinki	Biological and Environmental Sciences	34	2	0	0	36
University of Helsinki	Economics and Management	10	23	0	18	51
University of Helsinki	Food and Environmental Hygiene	113	46	0	19	178
University of Helsinki	Food Technology	108	9	1	1	119
University of Helsinki	Public Health	70	0	10	0	80
University of Kuopio	Inst. of Applied Biotechnology	19	2	0	0	21
University of Kuopio	Clinical Nutrition	171	24	15	12	222
University of Kuopio	Research Institute of Public Health	50	0	1	0	51
University of Turku	Res.Centre Appl.& Prev.Cardiov.Med.	46	20	18	0	84
University of Turku	Functional Foods Forum	184	50	5	2	241
University of Turku	Biochemistry and Food Chemistry	213	71	2	0	286
Helsinki Univ. of Tech.	Lab. of Biochem. & Microbiol.	45	5	0	1	51
Helsinki Univ. of Tech.	Lab. of Bioprocess Engineering	62	39	4	18	123
Lappeenranta Univ. of Tech.	Chemical Technology	24	20	0	1	45
University of Oulu	Sotkamo Lab. of Biotechnology	15	0	0	0	15
Folkhälsan Res. Center	Inst. Prev. Med. Nutr. Canc.	98	12	0	0	110
MTT Agrifood Res. Finland	Food Research	76	37	6	4	123
Nat. Consumer Res. Centre		3	4	2	2	11
Nat. Public Health Inst.		503	30	56	13	602
Nat.Vet. & Food Res. Inst.		103	12	6	8	129
VTT Tech. Res. Centre		208	93	11	36	348
Total		**2,396**	**545**	**143**	**139**	**3,223**

Appendix F: Programme - Evaluation week 43, 2005

Programme of the site visit week

Date	Location	Units	Time, min	Time, hour
Sun 23	Helsinki			17:00-19:30
Mon 24	Jokioinen & Turku	MTT Agrifood Research Finland	90	8:50-10:20
		Dept. of Biochemistry and Food Chemistry	90	11:20-12:50
		Functional Foods Forum	60	13:35-14:35
Tue 25	Helsinki Metropolitan	National Consumer Research Center	60	8:50-9:50
		Lab. of Biochemistry and Microbiology	70	10:35-11:45
		Lab. of Bioprocess Engineering	70	12:50-14:00
		The LUT Centre for Separation Technology	40	14:20-15:00
		VTT Technical Research Center of Finland	120	15:00-17:00
Wed 26	Helsinki Metropolitan	National Veterinary and Food Research Institute	90	8:10-9:40
		Dept. of Food Technology	120	10:00-12:00
		Dept. of Economics and Management	40	12:50-13:30
		Dept. of Applied Chemistry and Microbiology	120	13:30-15:30
		Res. Center of Appl. & Prev. Cardiovasc. Med.	60	15:50-16:50
Thu 27	Kuopio & Oulu	Dept. of Clinical Nutrition	90	8:35-10:05
		Food and Health Research Center	60	10:05-11:05
		Sotkamo Lab. of Biotechnology	90	9:30-11:00
		Research Institute of Public Health	50	11:15-12:05
		Institute of Applied Biotechnology	65	13:10-14:15
Fri 28	Helsinki Metropolitan	Dept. of Food and Environmental Hygiene	120	8:00-10:00
		Dept. of Basic Veterinary Sciences	40	10:00-10:40
		Dept. of Biological and Environmental Sciences	45	10:40-11:25
		National Public Health Institute	120	12:45-14:45
		Dept. of Public Health	45	15:05-15:50
		Inst. for Prev. Medicine, Nutrition, and Cancer	75	16:20-17:35
Sat 29	Helsinki			AM.

Appendix G:
Panelist reviews of Assessed Units

UNIVERSITY OF HELSINKI
Faculty of Agriculture and Forestry
Department of Applied Chemistry and Microbiology (HYSOV)

Overview and mission
The unit has approx 40 fte, including 11 professors, and approx. 25 post docs. The main research activities are food chemistry (development of new analytical procedures, interaction reactions and bioactivities of food components), microbiology (microbes that affect food safety, quality and health benefits, toxin production) and nutrition (dietary surveys on food patterns and association with dietary habits and chronic diseases, and intervention studies, including bone health as well as animal and cell culture experiments). The Microbiology section is part of the National Centre of Excellence (CoE).

Scientific quality, impact and viability
The output of >200 publications related to food chemistry, nutrition and biomedical sciences is high in number, with medium impact and seven patents. The number of doctoral theses was 24 for the reporting period. There is a good range of expertise at the unit, which could be further enhanced by integration with the Food Technology Dept. at the University.

Research environment and organization
This is a large unit, located at different sites with good range of expertise, and good facilities, although there appears to be low integration between the divisions, and problems with interdepartmental relations. The unit has good international contacts.

Interaction between research and society
This unit has a variety of national and international collaborations, including various EU-funded projects and to a lesser extent, the Finnish food industry.

UNIVERSITY OF HELSINKI
Faculty of Veterinary Medicine
Department of Basic Veterinary Medicine (HYVET)

Overview and mission
This subunit includes about 25 fte, including a senior scientist from EELA, and has been developed in the evaluation period following the appointment of Prof. Airi Palva who came from MTT in 1998 and heads Division of Microbiology and Epidemiology. Apart from Division's groups (including that of Prof. Olli Vapaalahti MD) working on animal viruses and food safety that are not included here and comprise

another 10 fte, the main activities are focusing on intestinal host-microbe interactions and microbial diversity in health and disease. Stress response, diagnostic tools and S-layers of lactic acid and other intestinal bacteria have been developed as models and new ~omics and nanobiotechnology approaches have been incorporated.

Scientific quality, impact and viability
The unit has a good output of 31 publications with good to high impact and the portfolio of PhD theses is developing (1 defended recently and about 2–3/year in the coming years) while four PhD theses have been supervised at Turku University in the reporting period. This unit has benefited from the new directions originating since the appointment of the new head and has excellent perspective to contribute more significantly to the food science area, notably in view of the strong outside funding. The University funds are very low in view of the strong external funding, but it would seem to be in the best interest of the University to reward this unit with more core funding.

Research environment and organization
The unit recently moved to the Viikki campus, has excellent molecular facilities and has initiated a number of strong collaborations, including one on Food and Environmental Hygiene. Their submission of a Centre of Excellence on Food Safety was evaluated with highest scores but not funded and may benefit from a further focus on microbial interactions and incorporating relevant collaborations.

Interaction between research and society
This unit has started a variety of collaborations within and outside the Viikki Centre (such as VTT, EELA) and the Finnish food science industry and high tech SMEs, among others supported by Tekes funding. This forms the basis for further developing their interaction with society in areas of food and medical importance.

UNIVERSITY OF HELSINKI
Faculty of Biosciences
Department of Biological and Environmental Sciences (HYBIO)

Overview and mission
This group headed by Prof. Timo Korhonen and Prof. Benita Westerlund-Wikström is actually forming a subunit including about 4–6 fte with a common focus on Lactobacillus-host interactions. It is part of a larger unit that is studying the molecular pathogenesis of human infections and this is an element that provides synergy.

Scientific quality, impact and viability
There is an impressive output of 34 papers in high impact journals with one particlarly outstanding paper (Nature Biotechnology). A total of five PhD theses were defended in the reporting period. While the (sub)unit is small, its viability is ensured by being part of a larger unit and the area of microbe-host interactions is an important one for both offensive and defensive aspects of food science and bridges the food and pharma interests at a molecular level. These aspects could form the basis for stronger collaborations.

Research environment and organization
The (sub)unit is part of the Department of Biological and Environmental Sciences of the Faculty of Biosciences at the University of Helsinki. The unit is located at the Viikki Centre with excellent facilities. It has collaborations with the Department of Basic Veterinary Medicine and has past and present contacts with the Finnish food industry.

Interaction between research and society
This unit has a basic research position in a relevant research area that offers the possibility to develop further interactions with the food industry with Tekes funding.

UNIVERSITY OF HELSINKI
Faculty of Agriculture and Forestry
Department of Economics and Management (HYEE)

Overview and mission
This group undertakes food-related research (30% Consumer and behavioural research; 70% Other: economics and management applied to food industry; food marketing) in the areas of Agricultural Economics (agricultural policy, including food processing and consumption issues; production economics and farm management), Consumer Economics (food consumption and advertising, especially studied over time), and Food Economics (business economics and management applied to the food sector in industry, trade and services). It also undertakes food marketing research.

The staff complement is (in 2004) 1.5 senior researchers, 2.8 other researchers, typically a small number of doctoral students and no post-doctoral researchers to date.

Scientific quality, impact and viability
The scientific output is low for the assessment period, with ten refereed publications from 2000–2004 (spread across all research staff). The bulk of these are consumer studies, for example related to effects of price knowledge and other influences on consumption. Conference proceeding titles increase the range of topics covered. Refereed publications are exceeded in each case by articles in edited volumes conference proceedings (both Finnish and international) and Finnish monographs. This is explicitly recognised in the submission and a goal for the 2006–2008 research strategy is to increase non-Finnish refereed publications.

Research environment and organization
The group has a number of collaborations, mostly in Finland. There is, as yet, limited obvious output in terms of refereed publications from some of these collaborations. There are no longer-term visits of staff to overseas institutions, nor longer visits to the department by visiting academics. Such visits (in both directions) might be an effective way of increasing the output of collaborations. The funding for the group is largely from the university, with additional funds from the Academy, the Ministry of Agriculture and Forestry, and Tekes. Industry funding is relatively low, and shows little growth during the assessment period.

Interaction between research and society
As a university department, the group has a teaching role and produces doctoral graduates. The main means of transmitting research outcomes by this group is via teaching (both internal and to external groups in the food industry). Links with the food industry are not otherwise obvious, and this may be an area for increased activity. Contributions via interactions with government and the EU are also noted. The senior staff also writes popular articles.

UNIVERSITY OF HELSINKI
Faculty of Veterinary Medicine
Department of Food and Environmental Hygiene (HYHYG)

Overview and mission
This is a large unit with about 25 fte staff including 4 professors each heading a specific group, viz. food pathogen diagnostics (Prof. Korkeala), psychrotophic lactic acid bacteria and systematics (Prof. Björkroth), environmental hygiene (Prof. Hänninen) and environmental and food toxicology (Prof. Pohjanvirta). They focus on the microbial and toxicological risks and the Finnish food and environmental hygiene control strategies at the EU, central, regional and municipal levels.

Scientific quality, impact and viability
The output of 113 publications of medium to good (some excellent) impact is high and impressive. A total of nine PhD theses were defended in the reporting period. At various levels, use is made of recent ~omics developments, and the unit was involved in completing the first bacterial genomic sequence in Finland. Further integrating the (molecular) activities of the different groups would strengthen the core activities of this unit and provide stronger possibilities for collaborations within Viikki and outside, notably at the EU level.

Research environment and organization
This is a dynamic research group, with relatively few post-doctoral scientists. There is good interaction among researchers based on subject area of research, and the research outcomes are strong. Good competitiveness of research, with all professors received funding from the Academy, and external funds and staff at the unit have been steadily increasing, with good national & international collaborations. A very structured college environment was found at the unit.

The unit recently moved to the Viikki campus and has excellent facilities and offers a variety of collaborations, including EELA and the Department of Basic Veterinary Medicine. There are many (33) PhD students but a low number of post-docs. There is educational exchange with the Department of Food Technology but less on the research side because of the unit's focus is on food safety. The toxicology research is embedded into the Centre of Excellence (CoE) of the Academy of Finland for Environmental Health Risk Assessment, and a submission for a CoE in Microbial Food Safety Research was evaluated with highest scores (top 5% of the international scientific groups in its own field) but not funded.

Interaction between research and society
This unit is the only one in Finland in the field of veterinary food and environmental hygiene. As such it serves in important role in the Finnish educational system. The units' scientists serve at various relevant committees within Finland and the EU. There are good level dissemination activities (41 radio, TV, journal outputs) of the high-quality research and publications. Few research interactions with the Food Technology and Microbiology units were observed.

UNIVERSITY OF HELSINKI
Faculty of Agriculture and Forestry
Department of Food Technology (HYET)

Overview and mission
This is a highly diverse Department with a strong commodity orientation and educational mission. Activities are centered on food material science, sensory research, cereal, meat and dairy technology.

Scientific quality, impact and viability
Overall, the unit has a relatively low amount of peer-reviewed publications, but the quality is generally good. The meat and cereal groups appear to be the most active ones. Limited future oriented approaches/activities (e.g. chain integration, new technologies) could be identified. Concentration of efforts of small units may be useful.

Research environment and organization
New facilities are available, although external funding is low, with no current EU-funded project identified in the evaluation period, and Tekes being the main source of external funds. The Academy of Finland contributed little (total of 239€). A difficulty with attracting PhD students to the unit was noted, as well as low mobility of PhD's from the unit.

It was noted that the commodity orientation of the research, and the lack of interaction with other food development at the unit are limitations to its future success. Consolidation and concentration of efforts, better teamwork and cooperation with other units could lead to new relevant research topics and funding.

The emphasis seems to be on teaching, with staff having a high teaching load (this unit is the only academic food technology unit in Finland).

Interaction between research and society
HYET is the largest academic food research unit in Finland and responsible for academic education. The national outreach and dissemination (website, TV presentation, reports) activity is important and all the PhDs graduating between 2000–2004 are currently employed (e.g. 2 at VTT, 2 post-docs in USA, 2 in government, 4 in industry). However, low international visibility/activity/exchange were apparent. Sensory and consumer response work is relevant.

UNIVERSITY OF HELSINKI
Faculty of Medicine
Department of Public Health (HYKT)

Overview and mission
Nutrition related public health research is a small component of this unit of 55 staff, active in both teaching and research. The core budget makes up to 53% of its total reflecting its broad mandate and heavy teaching responsibilities in public health. It does not have any position dedicated to nutrition research, although approximately 11 members are involved in nutrition related research. The focus of nutrition research is on the interaction of social factors, lifestyle, genetics and nutrition in determining health outcomes.

Scientific quality, impact and viability
This Department has an extensive international network that results in approximately 40% of its external funding coming from the EU and other international sources. It is publishing in high-ranked journals.

Research environment and organization
This is a unit that recognizes the multidisciplinary research environment required to understand the role of food in chronic diseases. Nutritional epidemiology and nutrigenomics are areas of development.

Interaction between research and society
The Department recognizes its responsibility in the application of its research and expertise to the health needs of the Finnish population. Results are communicated not only internationally, but also to health professionals and policy makers in Finland and serve staff on a number of advisory committees. In addition, staff is frequently visible to the public through radio, television and popular articles.

UNIVERSITY OF KUOPIO
Faculty of Medicine
Department of Clinical Nutrition (UKUNUT)
Food and Health Research Center (UKUFUNC), (UKUNUTFUNC)

These units were assessed together because the Food and Health Research Centre is administratively linked to the Department of Clinical Nutrition.

Overview and mission
The main research interest of the Department of Clinical Nutrition at Kuopio University is to examine the interaction of diet and other lifestyle factors with genetic factors in the aetiology of non-insulin dependent diabetes, cardiovascular disease, obesity, and cancer. The Department of Clinical Nutrition is in the Medical Faculty of the University of Kuopio. It has a research staff of approximately 40 with an additional 10 technical and administrative personnel. The core budget for personnel is small, including only two professors, three lecturers and two teaching positions for

the professional M.Sc. program in clinical nutrition and nutritional therapy. Among the Finnish Medical Schools, this is the only unit having a teaching program in nutritional sciences.

Research is focussed on the role of diet in the ethiology of chronic diseases, dietary strategies to prevent and treat diseases, and evaluation of the health effects and safety of food and food components.

Scientific quality, impact and viability
This is an extremely strong and unique unit in Finland. It is the only clinical nutrition research centre in Finland. The research is at the forefront of nutritional sciences and the unit is an international leader. It is part of the Centre of Excellence for Research in Cardiovascular Diseases and Type 2 Diabetes.

Publication record is impressive (171 international publications) and the impact factors are high. The unit has strong national and international collaborations.

Research environment and organization
The facilities for experimental and clinical studies in humans are excellent, and leadership is strong and visionary. It has a broad base of research support from all possible sources within Finland (Academy of Finland, Tekes, MAF, industry, other public sources, private foundations) and the EU.

Interaction between research and society
The research programs are focussed on matters of practical and applied importance and use modern-day science and research methods to answer questions of significant benefit to the health of the population. Its research program is supportive of the food industry (new products, grains, berries, polyphenols, probiotics, food safety) and of clinical care. Staff is active in contributing time and expertise to a wide range of professional, non-profit and government organizations in health care and health services.

UNIVERSITY OF KUOPIO
Faculty of Natural and Environmental Science
Institute of Applied Biotechnology (UKUIBIO)

Overview and mission
This is a small unit, consisting of one professor, one assistant and 6 Ph.D. students. The research activities are varied, mainly in microbiology (intestinal microbes/probiotics) and food chemistry (phytochemistry).

Scientific quality, impact and viability
For size, the unit has a good output, with ~20 peer-reviewed papers, of medium impact.

Research environment and organization
This is a small unit/small team, with varied activities, a relatively high number of skilled technicians and all research based on Ph.D. studies. The unit is relatively new (established in 1999) with good facilities and good potential. Given that the unit is quite new, no PhD theses are yet completed.

There are a low level of senior research scientists and a clear business plan and strategy for future growth is lacking.

Interaction between research and society
The unit has good local and international contacts, with the majority of funds coming from external funds (mainly Tekes and the EU) and good interaction with industry, with many projects done in collaboration with industry, often SMEs, as well as graduate and post-graduate education.

UNIVERSITY OF KUOPIO
Research Institute of Public Health (UKUPUB)

Overview and mission
The mission of the Research Institute is to "contribute to the improvement of health in Finland and worldwide through the pursuit of excellence in research and post-graduate teaching in epidemiology and preventive cardiology". Current research staff is approximately 23 with not one position on core funding. The nutrition unit (7–10 research active staff) is focussed on the health promoting effects of food and nutrients and the applications of the research by the food industry and public health professionals. It has expertise in both nutritional epidemiology and clinical trials. Support, in order of amount, comes from Tekes, industry, private foundations, the EU and the Academy of Finland.

Scientific quality, impact and viability
Ability to secure funding and develop an international publication record are indications of the strength of the unit. Some international and national collaborations are documented and a number are in the planning and decision stages for funding.

Research environment and organization
Facilities are reported to be excellent. The team is enthusiastic, ambitious and competent. Lack of core funding and insecurity of long-term (beyond three years) leads to considerable insecurity and potential loss of valuable databases and expertise of considerable importance to the University and Finland.

Interaction between research and society
The members are keen to communicate the results of their work to emphasize the importance of food as a determinant of health to the public through radio, TV, public lectures and print media. The food industry is also a target of the outcome of the research.

UNIVERSITY OF OULU
Kajaani University Consortium
Sotkamo Laboratory of Biotechnology (OYSOLAB)

Overview and mission
This is a very small unit with about 20 fte, out of which seven is food research. The Unit has seen a major change in focus, when in 2003 the research professor Tapani Alatossava left with his expertise on food microbiology and lactic acid bacteria. The present focus is on health compounds of natural berries and other plants of the arctic region, food biotechnology and biomeasurements. While some teaching is done, the emphasis is on applied research in industry, also contract research, notably with SMEs in the region.

Scientific quality, impact and viability
The output includes only 15 papers, 14 of which are co-authored by Prof. Alatossava with medium to good impact – no PhD theses are listed. Serious concerns can be expressed on the viability of this unit that lacks critical mass and impact and yet has a broad research portfolio. This is becoming more pertinent as the EU structural funding is terminating in 2006 and the level of EU structural funding in the future is not clear at the moment.

Research environment and organization
The unit has sufficient equipment but the building is not adequate. There is limited support from the University of Oulu. There are notably collaborations with MTT and Kuopio University but these do not show yet from the output.

Interaction between research and society
There is considerable cooperation with food companies, notably local SMEs.

UNIVERSITY OF TURKU
Faculty of Mathematics and Natural Sciences
Department of Biochemistry and Food Chemistry (UTUBIO)

Overview and mission
The main research activities within the unit are food chemistry (analytical methods for food analysis), food development (functional foods containing probiotics and prebiotics) and food in vitro diagnostics (for rapid detection of hazardous chemicals, novel analytes and microbes in the food chain). Applied research is a strong element of the program, with such entities as the Functional Foods Forum and the concept of the Scandinavian supercritical CO2 factory arising from the unit.

Scientific quality, impact and viability
There was a good output of publications (213), across the food and biomedical sciences. The impact is good, with many high impact publications, and three patents. Noteworthy were the number of doctoral theses, ~40 in the reporting period. The research is well established and innovative, which was a major contributor to the

establishment of the Functional Foods Forum. Consumer-related research (such as sensory evaluation) is under development, with staff receiving training at a prestigious centre in the United States.

Research environment and organization
The unit is a solid research environment, with a motivated research staff, good facilities, strong interdepartmental links, reasonable funding, and good interaction with industry (17/37 PhDs employed in industry). Low mobility of staff appears an issue, and difficulty in attracting high-quality international scientists.

Interaction between research and society
The main means of transmitting research outcomes by this group is via teaching (both internal and to external groups in the food industry). The unit has strong national links, particularly with the University of Turku Functional Foods Forum, University of Kuopio (UKUFUNC and UKUNUT) and MTT, as well as international links. Some links with the food industry are in place, and this may be an area for increased activity.

This unit is seen as a good academic food research centre, performing multidisciplinary research which has led to new employment with new spin off companies. Contributions via interactions with government and the EU are also noted.

UNIVERSITY OF TURKU
Functional Foods Forum (UTUFFF)

Overview and mission
The Functional Foods Forum (FFF) is a recently established research and development centre of the University of Turku linking the expertise of the University for a special research unit. Total number of active research staff is approximately 28, with 8.4 being senior staff. This is a large group established within the assessment period as a special university research centre that draws on the expertise of the University in health promoting foods. The role of the unit is to strengthen and enhance multidisciplinary skills that advance knowledge and application of functional foods in the promotion of health. Research teams have been established to focus on 1) Nutrition, Allergy, Mucousal Immunology and Intestinal Microflora 2) Probiotics and Prebiotics 3) Gut Immunology 4) Food Diagnostics 5) Plant Lignans and Phytoestrogens and 6) Sensory evaluation.

Core funding for about 10% of its total budget is derived from the University. The largest source of external funding comes from Tekes and the EU (total of 70%). Industry is a significant source with the rest coming from other foreign organizations, public sources and MAF. No funding from the Academy was reported.

Scientific quality, impact and viability
The group has a good publication record with many publications in high-quality journals (e.g. the Lancet). Furthermore, the high proportion of publications in international edited volumes and conference proceedings, as well as the many invited presentations attest to the quality and visibility of the group. Publication strength

is greatest in the areas of food safety and microbiology, and clinical/nutritional trials and interventions. Consumer related research (such as sensory evaluation) is currently under development and rapid growth.

Research environment and organization
The group has visionary leadership and a strong network with other units in Finland (e.g. UTUBIO, UKUNUT and VTT) and with international groups. Support for the activities is derived from a broad base. It provides a strong research environment for research trainees and encourages international exposure.

Interactions between research and society
Members are active in dissemination of research and application of their expertise through lectures in university courses, presentations to health professionals and the public, by serving on advisory committees in service of government and non-profit health-related organizations both nationally and internationally, professional societies and as advisors to the food industry.

UNIVERSITY OF TURKU
Research Center of Applied and Preventive Cardiovascular Medicine (UTUCAR)

Overview and mission
The Cardiorespiratory Research Unit is an independent institute of the University of Turku, established in 1956 in order to promote interdisciplinary research in cardiorespiratory physiology and pathophysiology. The most important nutrition project being carried out in the unit is the STRIP Project, a trial of atherosclerosis prevention in infancy and childhood. The unit has 7.3 research active staff and 8.2 technical personal. Funding for the research is primarily from private foundations and "other" public sources (75%) and with 25% from the Academy. The STRIP study is multidisciplinary; including physicians, nutritionists, physical activity educators and psychologists. Individuals in the areas of information technology, biotechnology, virology, microbiology, immunology, physiology, chronic disease risk and genetics are likewise involved. This diversity contributes to the richness of the dataset and conclusions derived from it.

Scientific quality, impact and viability
The high quality, productivity and longevity of the project reflect favourably, with publications in top internationally recognized scientific journals with high impact factors. The group reports an impressive number of peer-reviewed publications, with high impact (i.e. JAMA, Circulation). The research project is ambitious in its scope. It has also flexibility programmed in so that as new biomarkers are identified they can be assessed in the archived samples of DNA and plasma.

Research environment and organization
STRIP is a unique study that has resulted in important observations that have been used internationally to shape diet and physical activity recommendations for children with the intent of preventing cardiovascular diseases (CVD). The past 15 years have

been spent collecting data. It is likely the most productive phase will commence after completion of the data collection phases of the work. Consequently, the upcoming phase will offer significantly increased opportunities for training graduate students/postdoctoral fellows. The research is well posed and flexible in direction to respond to future scenarios. Archiving DNA and plasma samples is one major aspect of these efforts.

Interaction between research and society
The senior scientists are active in the greater scientific community and well established in the international nutrition and pediatric community, and are actively engaged in communicating the findings at all levels, from peer-reviewed journals to forms intended for the lay public. The researchers associated with the study serve on scientific advisory committees, give invited presentations at international conferences, are members of editorial boards and have been awarded an impressive number of honours. This allows them to interact with the international scientific community and develop external collaborations that maximize the number of questions that can be addressed with the current dataset. The sterling reputation of the investigators and the quality of the study affords the opportunity to develop sufficient networks to maximize the value of the study. Archived DNA and plasma samples ensure the data set will expand and new science emerges. Five individuals have completed doctoral dissertations using data from the STRIP study. It is likely this number will increase as the study nears completion assuming financial support is available for both students and thesis advisors.

HELSINKI UNIVERSITY OF TECHNOLOGY
Department of Chemical Technology
Laboratory of Biochemistry and Microbiology (TKKBIMIC)

Overview and mission
This unit with on average of 16 fte has two professors (Simo Laakso and Katrina Nordström) and aims to perform multidisciplinary research in biosciences and process technologies. The unit assists product developers by applying new innovations and integrating these into successful products. This is translated into three topics, namely development of health properties in cereals and cereal lipids, production of CLA from free linoleic acid, and improvement of the customer usability of healthy berries.

Scientific quality, impact and viability
The output of 45 papers is reasonable but has a medium to low impact. A high number of 9 PhD theses have been defended in the reporting period and a total of 19 patent applications are listed relating to a total of nine different patent filings in Finland, the EU and USA. The viability of the unit is questionable as there is no apparent strategy to publish in (high) impact journals.

Research environment and organization
The unit has attracted sufficient funding for the necessary equipment, regardless of the concern that food research has not been a priority at Helsinki University of Technology. There are collaborations with VTT, MTT and various industries.

Interaction between research and society
The unit aims to perform multidisciplinary research and assist product developers in applying new innovations and integrating these into successful products. It also provides training and expert advice on food hygiene, processing technologies and integration of food legislation related to new product development, mainly at the level of SMEs and regional partners. There is significant Tekes and industry funding. Several spin-off companies have been created.

HELSINKI UNIVERSITY OF TECHNOLOGY
Department of Chemical Technology
Laboratory of Bioprocess Engineering (TKKBIOTEC)

Overview and mission
This is a good sized group (1 prof., 3 senior researchers, 4 post docs, 10 Ph.D.s) with emphasis on biotechnology (90%; microbial cultivation techniques, protein engineering, metabolic engineering, enzyme technology) and food processing technology (10%; purification processes).

Scientific quality, impact and viability
The outputs include a high publication rate, of 101 publications in respected journals (Biochem., Prot. Engin., Appl. Microb. Biotechnol., Biotech. Progress, Biotech. Bioeng.). The head of the Laboratory is well integrated in the Finnish industrial environment (currently a member of 5 boards). The unit has a number of good international collaborations, and is seen as a leading department in enzyme technology/protein technology.

Research environment and organization
New facilities are planned for 2006. The unit has strong leadership with excellent knowledge of industry needs. The composition of the research group is strong consisting of a number of experienced staff with good industry interaction. There is continuity due to senior researchers, although the limited mobility of staff could also hinder future success of the unit.

Interaction between research and society
There is a publication of Finnish textbook in biotechnology, and close cooperation with local and national industry. While there are no EU activities, there is strong national interaction.

A very good placement program for graduates is in operation. There is low mobility of personnel, very narrow and limited activity in food science, and limited interaction with other fields (e.g. nutrition).

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
Department of Chemical Technology
The LUT Centre for Separation Technology (LUTKEM)

Overview and mission
Two professors with 40% activity in food research concentrating on membrane technology (water, proteins, nanoparticles, scale up) and industrial chemistry (chromatographic separations, extraction, subcritical water), but with little food science expertise. Networking with other groups outside LUTKEM should help to broaden the research focus, given that research on water and functional ingredients require microbiology, nutrition etc. (not available at LUTKEM).

Scientific quality, impact and viability
The unit has an output of 24 peer-reviewed publications related to food science, with rather narrow areas of interest, but with no clear indication of actual areas of concentration – no clear strategy was found. However, the unit is highly active and visible on an international level and funds could be secured via the EU, Academy and Tekes.

Research environment and organization
This is a small group (few Ph.D.'s), which appears to have a strong position within Lappeenranta University of Technology. The laboratories are well equipped (via EU funding). There is strong expertise in separation technologies (application of CoE). The unit has very good industry interactions, and has some national and international interactions.

Interaction between research and society
The unit seems to have difficulty in positioning itself within the food industry. The work on purification of water and recovery of functional ingredients are promising topics. There are no outreach/dissemination activities reported, and tools for technology transfer (e.g. from paper industry) are lacking. Low mobility of graduate students was apparent, with three of the five Ph.D.'s completed now employed at the unit.

FOLKHÄLSAN RESEARCH CENTER
Institute for Preventive Medicine, Nutrition and Cancer
Division of Clinical Chemistry (FOLK)
University of Helsinki

Overview and mission
This is one of the few research laboratories in the world that is focused on method development in the area of phytochemicals (lignans, isoflavones and alkylresorcinols). These compounds are thought to be related to chronic disease prevention. The group then establishes collaborations to apply their newly developed assays on an epidemiological level.

Scientific quality, impact and viability
The analytical methods developed are innovative and hence, this is a leading laboratory

in the field. To a certain extent this is an orphan field. The laboratory addresses issues studied by few others in the field. A good example is the alkylresorcinol work. Currently, there are no biomarkers for whole grain intake, yet there is a lot of interest in the area of whole grain intake and chronic disease risk. Were a high throughput relatively low cost assay available, it would allow questions as yet unanswered to be addressed.

Research environment and organization
The unit has focused and highly trained staff conducting research on unique areas in the field of diet and chronic disease risk. There is an impressive network of collaborations that facilitates the interdisciplinary nature of the work, ranging from breast cancer to heart disease.

The group is highly productive, for the very small core group, with limited facilities and resources for the current work, and the continuous threat of financial instability. This unit appears to function relatively independently of the accommodating organization. However, it is difficult to evaluate this without knowing the scope of the accommodating organization.

Interaction between research and society
The research is oriented towards developing better tracking mechanisms for chronic disease risk factors that are important both in Finland and internationally. Rapid publication of the research results and active collaborations ensure timely transfer of the methodology to the international research community. It is not clear whether any of the method development is patentable. Results of technology transfer can be seen in the impressive list of publications and public appearances.

MTT AGRIFOOD RESEARCH FINLAND (MTT)

Overview and mission
MTT is a research organization operating under the authority of the Ministry of Agriculture and Forestry. MTT provides research and development services that promote the competitiveness of the Finnish food industry, the vitality of rural areas, and care for the environment.

This unit was presented as four separate research programs with little overlap, i.e. Food Research, Chemistry Laboratory, Animal Production Research, and Economic Research. Currently, the unit is undergoing reorganization, with biotechnology being integrated into the Food Research program.

Food Research is the biggest section within MTT comprised of approx. >22 active research staff, consisting of 4 senior researchers (Heads of Research), with the majority of active research staff having MSc degree, and very little post-doctoral students undertaking research in the unit. The research activities are mainly food chemistry and food processing technology and chemistry, and to a lesser extent biotechnology and microbiology. The chemistry laboratory is mainly a testing laboratory, accredited by the Center for Metrology and Accreditation of Finland providing a service to the wider research center, and industry.

Animal Production Research is a small subunit, with activities in the field being directed towards the nutritional quality of ruminant derived foods, with funding for

these activities being low, primarily arising from external EU funds.

The Economic Research group is also small, consisting of 1.2 senior researchers, with 2–3 total active research staff per year, with a small budget, with all external funding coming from the Ministry of Agriculture. The activities of Economic Research are mainly in food safety (70%), and consumer/customer behaviour and consumer marketing.

A major reorganization with an expected increase in staffing was announced, but the underlying reasons for this expansion were not clarified and no clear future business plan could be presented.

Scientific quality, impact and viability

Overall, the unit has relatively low output for the number of active research staff.

During the evaluation period, 55 papers were published in international journals from the food research program, some of which had good impact factor, but a significant proportion in medium to low IF journals, and five patents, either already processed or in preparation, and a large number of 'other' scientific publication, and only three doctoral theses.

The Animal Production group had relatively few publications in the field (7 in international journals), e.g. Animal Science and Dairy journals, with the majority reflecting international collaboration, and no doctoral theses during the evaluation period.

Output from Economic Research is low, with four papers in refereed journals, and no doctoral training ongoing and no doctoral theses during the evaluation period.

Research environment and organization

Needs revitalization. The unit lacks modern facilities and equipment (technology), as well as well trained human resources in some key areas, hinders maximum output and contributes to lack of innovation. An inability to attract experts in the area jeopardizes long-term future, and no policy for attracting post-graduate students, partly due to the remote location and financial constraints.

Interaction between research and society

The unit has experienced personnel, particularly (traditionally) dairy, also food research. There are a number of collaborations, mainly in Finland. While the activities of the unit span a number of disciplines, on an international level, the unit has some recognition, particularly in bioactive peptides. The research on bioactive peptides is well established, with products on the market, based on output of the research, but outside this, low uptake of the research outputs by local industry was noted.

The unit offers an analytical service to industry, and monitors food contaminants in the Finnish food chain, has organized workshops publicizing the information, at national and international levels, and a small number of articles by senior researchers popularizing science. In some areas, however, there were no international collaborations, no visits of researchers from abroad during the period under evaluation, and no involvement in international conference presentations, membership of editorial boards of international journals, etc.

A very low level of teaching, particularly post-doctoral research training was noted. The low number of Ph.D.s trained at the unit is a concern given the size of the unit, which is well established and of long standing.

NATIONAL CONSUMER RESEARCH CENTRE
Food Research Group: Consumers in the Food Economy (NCRC)

Overview and mission

The National Consumer Research Centre operates under the Ministry of Trade and Industry. The unit focuses its research on the quality of consumer goods and services, and consumer behaviour. Food Research Group makes a small unit, operating since the late 1990s, consisting of (in 2004) one senior researcher with PhD, four other research staff (no PhDs), and one part-time researcher. One staff member is currently undertaking a PhD. The group is multidisciplinary, but within a somewhat narrow range (sociology/economics), undertaking mostly qualitative (focus group) studies on consumer views and expectations of food, food production and the food chain (100% Consumer and behavioural research). There is a recent shift towards quantitative studies.

Scientific quality, impact and viability

Even if taken into consideration that this is a relatively new unit, the scientific output is low, with very few publications in refereed journals (3 in international journals; 2 in Finnish journals), and as such, it is difficult to assess the scientific quality of their work. This limitation is acknowledged in the submission, and the research strategy for the next three years includes an emphasis on increasing output in this regard.

Research environment and organization

The funding for the group is largely from the government with additional funds from the Academy, the Ministry of Agriculture and Forestry, and to a lesser extent, Tekes and the EU. There has been no industry funding. There are a number of potential obstacles to increasing research output. Staffing of this group is low, with only one PhD-level researcher at present; the group would benefit from additional staff in complementary, consumer-related disciplines. In the longer term, it will also be much more effective in influencing government policy if it takes on a doctoral and post-doctoral training role, in collaboration with university departments.

There appears to be a number of demands on this group incompatible with a greater research output. These include a demand to perform an information provision function both to government and to the public. This activity, if maintained, requires a staff member recruited for this role. In addition, requests to perform small-scale studies do not fit in with an overall research strategy. Undertaking such studies should be critically evaluated, unless they can be shown to facilitate longer-term research. There needs to be a clear statement of what important, substantial questions the group intends to address, and why. The strategy for 2006–2008 may address the apparent lack of an overall research focus. The research to date seems very descriptive, which may reflect both the nature of the research methods (e.g. focus groups; surveys) and the type of questions addressed. It is unclear to what extent the work of this group is determined by government priorities or demands, or is self-directed. In addition, are there restrictions on funding sources? Is the unit addressing questions that the public (and not just in Finland) wants answered? How is this determined?

Interaction between research and society
The group obviously takes seriously its role to provide information to government and the general public, but it should consider if adapting well-conducted, internationally published studies for domestic, information providing purposes might be a better approach. The group will be much more effective in this task if it gathers prestige from international recognition.

NATIONAL PUBLIC HEALTH INSTITUTE (KTL)

Overview and mission
The National Public Health Institute of Finland (KTL) has the responsibility of researching, promoting and monitoring the health of the Finnish people. KTL studies the most important health problems of the Finns, seeks possible solutions, and monitors the health situation in the country. In addition, it informs the people about causes of health hazards, supervises the national vaccination program, and designs novel laboratory tests for the prevention, and diagnosis of diseases. KTL is a research institute and expert body operating under the authority of the Ministry of Social Affairs and Health.

There are four departments out of nine and 12 units out of 50 within the National Public Health Institute involved in this area of research. There appears, in some cases, to be overlap among these. The mandate of the institution is broad and includes research, expert functions, health monitoring, publish health services, education and training, international collaboration, development, assessment and performance of laboratory research and participation in dissemination of health information and health education.

The areas covered include nutritional epidemiology, public health nutrition, clinical nutrition, nutritional sociology, nutritional behavioural research, nutrition monitoring, chronic disease risk factor assessment, biochemistry, microbiology, infectious epidemiology, food safety monitoring and environmental issues.

Some of the research and data collection done by KTL is specific to Finland (i.e. FINDIET and FINRISK). The dietary and biomarker data monitoring and collection appear to be of high quality. Few countries have such a comprehensive system in place to accomplish this on a regular basis. Other work has more of general international public health orientation, for example, the Diabetes Prevention Study (DPS), Type 1 Diabetes Prediction and Prevention (DIPP) study and the Alpha Tocopherol Beta Carotene (ATBC) study. They are considered hallmark studies that are used internationally to set primary prevention guidelines and nutrient recommendations. These are three examples from a number generated by this group that have made major contributions to the international scientific community. Other similar studies are ongoing as international collaborations (TEDDY study) or pooling projects with Harvard School of Public Health. The general orientation of KTL's work is to assess current major public health issues (diet, risk factors, food borne illness) and use those data to guide national lifestyle policy in the future with the intent of decreasing chronic disease risk in Finland. In some cases, well designed and executed trials are conducted to assess the effect of interventions. Much of this work is applicable on an international level. The monitoring functions of the unit are not necessarily innovative but do meet the mandate of the organization.

Scientific quality, impact and viability
The high quality of the work is reflected in the wide array of international publications, presentations and participation of staff in international conferences, editorial boards and advisory committees.

Research environment and organization
The unit has a strong national and international reputation, and has strong national and international collaborations. KTL is a large organization with a broad mandate. This ensures individuals with a wide range of expertise will have the opportunity to interact. The unit has established a model system for regular monitoring of Finnish diets and chronic disease risk factors.

A large number of doctoral students are listed. From the titles of their dissertations they appear to cover a broad range of topics. Their current positions also attest to the sound foundation they obtain that allows them to move on to a wide range of academic and non-academic positions.

Interaction between research and society
The research areas, chronic disease tracking and prevention will continue to be major areas of interest and importance both nationally and internationally.

The researchers have listed extensive radio and television program appearances and articles for the general public. From the material presented, it appears KTL does well connecting their research to the outside community. In addition, the material developed for the community on the basis of KTL's work is of high quality (samples provided to review group). KTL is a large organization with a diverse group of professionals. The departments/units are highly interdisciplinary. There is considerable cross-fertilization with other institutions in Finland and internationally.

The senior scientists are internationally recognized leaders in their respective fields. They actively publish their research findings, participate in international symposia, present international lectures, and are interviewed for radio and television programs. Two computer programs and algorithms are listed. In addition, considerable applied data on food intake patterns are generated which would likely be used to make decisions on new product development, etc.

NATIONAL VETERINARY AND FOOD RESEARCH INSTITUTE (EELA)

Overview and mission
This unit headed by Prof. Tuula Honkanen-Buzalski receives core funding from the Ministry of Agriculture and Forestry and includes about 30 fte mainly located at Helsinki but with some activities at other sites (mainly Kuopio but also Oulu and Seinäjoki). The research aims to promote both food safety and animal health care and welfare, and is covering three main areas, animal diseases, food safety and zoonoses. It is incorporating both risk assessment and risk communication in these areas. The most important disciplines are food safety, hygiene and toxicology as well as food (bio)chemistry and all groups are headed by scientists with professor status. A new field of interest is the application of genomics and metabolomics technologies for

diagnostics while predictive modelling is also being initiated. Altogether the research project portfolio is balanced but broad in order to be in line with the mission. It is noteworthy to mention here that there is an excellent monitoring of the production chain and the Finnish agro products have low to zero presence of pathogens (eggs are Salmonella-free) contributing to export potential.

Scientific quality, impact and viability
The output of more than 100 publications is high in number and shows an orientation to the outside. Noteworthy is the completion of 6 PhD theses in the reporting period.

The impact is good with some high impact papers. This is a very good situation when benchmarked to international public health service-oriented institutions.

Research environment and organization
The unit has excellent facilities and will move soon to the Viikki Centre allowing further integration with the other units, notably those from the veterinary faculty. It will be integrated into a "Finnish Food Safety" agency and it is essential that its independence from the risk management will be ensured and that the science remains independent.

Interaction between research and society
This unit is essential for Finland as it responds to public and industrial needs in the area of food safety and toxicology (note there is no Chair on food toxicology in Finland). It is noteworthy to mention that food safety is an extremely important issue for the society and that risk communication is an important aspect of the EELA activities.

VTT TECHNICAL RESEARCH CENTRE OF FINLAND (VTT)

Overview and mission
The Technical Research Centre of Finland (VTT) is an impartial expert organization that carries out technical and techno-economic research and development work. VTT Biotechnology is one of the nine research institutes of VTT. It develops process and product innovations, based on biological materials and biotechnology, in order to improve the competitiveness of the clients. Research and development work is carried out in interdisciplinary projects with research partners in the industry and in the universities.

There is an excellent science base regarding plant and microbial physiology, biochemistry, material science, with the key activities of this unit being mainly applied research, but also basic research.

There is no unit operational engineering competence.

Scientific quality, impact and viability
This unit is a premier food and bioscience research institution (22 senior researchers, 16 PhDs, 2 postdocs, 30+ other research staff, 55 technical personnel). While there is an impressive output of ~301 peer reviewed scientific publications (with some top

food science and other life science journals) the output per fte is rather low. Impressive networking was noted, and the unit has been part of a Centre of Excellence (CoE) of the Academy of Finland but this CoE has not been continued in the latest round.

Research environment and organization

This is a solid research environment with good exchange of information through industry collaboration and EU projects, with impressive contacts with key peers worldwide. There is a strong permanent staff, good facilities, well-equipped, highly sophisticated laboratories.

It was noted that the number of MS, PhD and postdocs at the unit could be enhanced. Age and mobility of personnel seems an issue (out of 14 PhD working at VTT, 9 stayed). The unit is very competitive, but researchers need to secure their own salary (overheads). This unit has undergone many reorganizations.

Furthermore, it was noted that the research activities are too diverse and the group appeared slow in responding to cutting edge issues. Low mobility of most personnel in the unit was noted, as well as a small number of research students (MS, PhD, Postdocs) in the group. It appeared also that the unit may not be fully aware of industry needs and this is a serious issue in view of the mission of this research institute.

Interaction between research and society

The unit has very good national and international interactions and funding, and are involved in numerous EU projects including coordination of a current IP, with good interdisciplinary interactions. A strong funding base was identified (Tekes, MAF, industry, EU, other foreign organizations), with little contribution from the Academy. The unit has very sophisticated tools useful for multinationals.

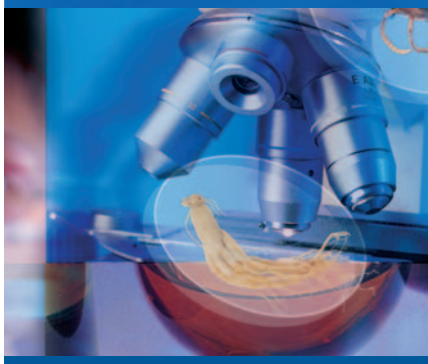
There is an impressive outreach/dissemination program, with many extension activities ongoing (170 radio, TV, popular journal outputs). It was noted that many of the ongoing projects are relevant to Finnish society (grain, berries, enzyme, probiotics etc) as well as consumer research, and it was noted that there is good technology transfer.

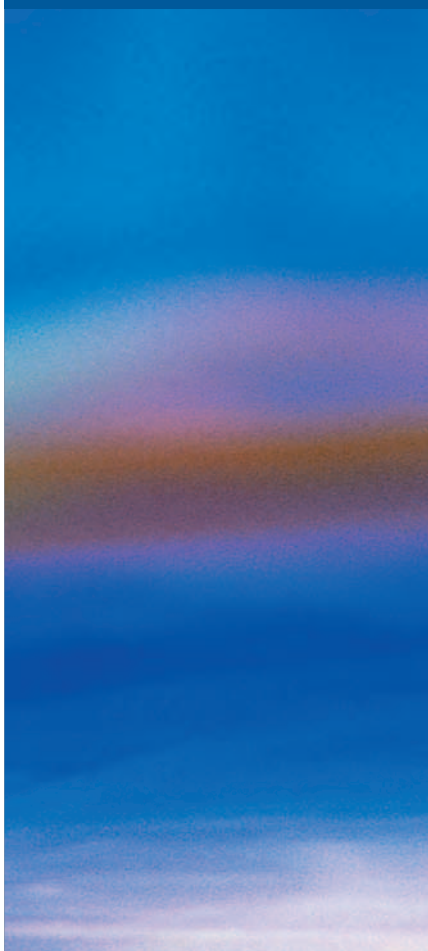
Joint supervision of MS and PhDs with collaborating universities could improve transfer of more basic work to applied research (strength of VTT), and could ease current structure problems, with the new structure appearing too fragmented. A balance between applied and basic research needs to be identified as well as concentration on core competence. There is a good basis for becoming a premier institution in food biotechnology, and VTT has an impressive networking potential which could be improved. The overheads at VTT are an issue as well as the low funding through the Academy (3%). The age of the majority of research personnel at the unit can become a future threat. There is an opportunity for creation of a Helsinki Centre of Food Science, which would aid interactions in Helsinki/Espoo region.

Much of the program outputs may be too sophisticated for industry needs.

An international evaluation of the quality and status of Finnish food sciences and related research has been carried out by the Academy of Finland in collaboration with other Finnish research funding agencies. This nationwide field assessment is aimed at producing information on the international level and impact of the research in the field as well as of its strengths and weaknesses. A special aim is to provide means for further development of the field in the future.

This report presents the results and recommendations of the evaluation by an international expert panel. The report also includes proposals for the future development of research in the field.





ACADEMY OF FINLAND

Vilhonvuorenkatu 6 • PO Box 99, FI-00501 Helsinki
Tel. +358 9 774 881 • Fax +358 9 7748 8299
www.aka.fi/eng • viestinta@aka.fi