FIFTH FRAMEWORK PROGRAMME 1998-2002

QUALITY OF LIFE AND MANAGEMENT OF LIVING RESOURCES

PROJECT SYNOPSIS

October 2002

Key Action 1
Food, Nutrition and Health

Volume 1 comprises Areas 1 and 2
Volume 2 comprises Area 3

Edited by
Rosanna D’Amario
Isabelle de Froidmont-Görtz
Jürgen Lucas

European Commission
Research Directorate General
EUR 19422 EN
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FOREWORD

The food and drink sector is a leading sector in the EU in terms of industrial value and output. It employs 2.6 million people¹, and its turnover is worth € 700 billion². The overall objectives of Key Action 1 “Food, nutrition and health” within the Programme “Quality of Life and Management of Living Resources” are to strengthen research in the agriculture, fisheries and food sector in universities, research centres and the industry. This will ensure that Europe maintains its strong position in this field into the future. By its funding of European projects and its links to national research activities on these topics, this key action aims to lead to a better understanding of consumers’ needs to provide a healthy, safe and high quality food supply leading to reinforced consumer confidence in the safety and wholesomeness of the European food supply.

The Key Action “Food, Nutrition and Health” with an overall budget of € 290 million has built upon earlier EU funding of research in food science in the FLAIR, AIR and FAIR RTD programmes of the European Commission. However, the research priorities and objectives have evolved considerably from previous programmes and in this key action the following three objectives were tackled:

• Addressing consumer needs and enhancing the competitiveness of the European food industry;
• Assuring the safety and integrity of the food supply;
• Understanding the role of nutrition in health and well being.

There has been an excellent response from researchers, industries and consumers to the research priorities defined, and now there is a comprehensive portfolio of collaborative projects funded and running. Cluster type projects were introduced in this key action, which are now running and producing valuable results. The External Advisory Group for Key Actions 1 and 4 and the Quality of Life Programme Committee has played an important role in the planning and implementation of this key action.

This catalogue gives details of all the running projects, but is also a useful guide to many of the principal research teams involved in food research in Europe. Most of the projects have a web site address, which can easily be accessed and gives further information on the project.

I hope the reader will find this publication both interesting and useful.

Bruno Hansen
Director “Biotechnology, Agriculture and Food”
Brussels, October 2002

¹ Eurostat Yearbook 2001
PREFACE FROM EAG CHAIR

It has been my pleasure over the last four years to chair the External Advisory Group (EAG) for the Key Actions “Food, Nutrition and Health” and “Environment and Health” of the Fifth Framework Programme (FP5), Quality of Life and Management of Living Resources. Our task has been to provide external independent advice to the Commission. Our advice has focused primarily on research priorities and annual revision of the Work Programme.

Our EAG was composed of 23 experts drawn from university medical and food faculties (e.g. occupational, environmental medicine departments), national institutes of public health, research institutes, health authorities, food industry, etc. The broad range of expertise and of geographical backgrounds guaranteed that we had appropriate experience available. Furthermore, we could call on networks of scientific peers to give guidelines for the detailed work programmes of FP5, to comment on the projects funded and to make the Commission aware of the latest scientific opportunities and high-priority areas for the European Union.

This advice has been provided on a continuous basis to the Commission services during the implementation of FP5 and has been particularly used in the annual revisions of the work programmes. The group has also focused on a number of emerging issues in the fields of both key actions and more detailed workshops in those areas were held. It has been particularly important to have these opportunities for focused workshops to ensure that funding is directed towards areas of major societal concern, including food and environmental safety, as well as identifying opportunities for future exploitation, such as nutritional genomics. We believe the work of the group has been useful and relevant and has helped considerably in the running and implementation of both key actions and is reflected in the projects funded and featured in this catalogue.

We also believe that information to, and involvement of, the public needs to be further improved. Therefore we have been helping and encouraging the European Commission and the research teams involved to make available the results and conclusions of the research to a wider public. This catalogue provides one such means of dissemination of information. Our hope is that through our contribution but primarily through the research supported, the results generated and their application, we might improve the quality of life of Europeans and other populations.

Professor Christine Williams
Chair of the External Advisory Group
Quality of Life Programme, Key Actions 1 and 4
INTRODUCTION

Key Action 1 “Food, Nutrition and Health” aims to provide a better understanding of consumer requirements and a healthy, safe and high quality food supply while improving the competitiveness of the European food industry.

The key action is organised into three main areas, which in turn are organised in sub-areas:

Area 1: Development of safe and flexible and new and/or improved manufacturing processes and technologies
   1.1 Novel and improved biological raw materials for high quality food;
   1.2 Advanced and optimised food technologies, packaging systems and process control;
   1.3 Quality monitoring and traceability throughout the food chain.

Area 2: Development of tests to detect and processes to eliminate infectious and toxic agents throughout the food chain
   2.1 Improved understanding and control of contamination conditions rising along the entire food chain from primary producer to consumer;
   2.2 Rapid detection tests particularly for pathogens and hormones;
   2.3 New and safer methods of food production and distribution;
   2.4 New methodologies for assessing microbial, chemical and allergenic risks and exposures.

Area 3: Research into the role of food in promoting and sustaining health with respect to diet and nutrition, toxicology, epidemiology, environmental interaction, consumer choice and public health
   3.1 Consumer needs, attitudes and responses with regard to food products, food processing and labelling;
   3.2 Role and impact of food on physiological functions, physical and mental performance;
   3.3 Particular nutritional needs of defined population groups;
   3.4 Links between diet and chronic diseases and disorders including the genetic factors involved.

Within the four calls of the Programme “Quality of Life and Management of Living Resources Programme” from 1999 to 2001, six deadlines for submission have been open for proposals for Key Action 1. This catalogue contains synopses of all of the projects that are funded following these deadlines. The projects have been sorted per area and listed by contract number within an area. Table 1 shows the number of projects submitted and selected by area for each deadline with the corresponding EU contribution.

The budget for Key Action 1 is € 290 million for the four-year period 1998 to 2002. The financial contribution from the EU for the 151 research and development projects selected amounts to € 239 million, which represents 82% of the total budget of the key action. The remainder of the budget goes to SME Specific Measures, Accompanying Measures, Training Grants, and administration.
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<th>Deadline</th>
<th>Number of proposals received</th>
<th>Number of proposals selected</th>
<th>EC contribution (€ million)</th>
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<td>182</td>
<td>18</td>
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<td>October 2000</td>
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<td>November 1999</td>
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<td>January 2002</td>
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<td>Area 3: Role of food in promoting health</td>
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<td>March 2001</td>
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<td>1017</td>
<td>151</td>
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Different types of actions are supported by KA1: Shared-Cost Actions, Thematic Networks, Concerted Actions, Training Fellowships, and Accompanying Measures. This publication contains only the three first types of actions. They are subdivided as following in:

- 137 Shared-Cost Actions, which include Research & Development projects, Demonstrations Projects, Combined R&D and demonstrations projects, and support for access to research infrastructures. This represents a total EU contribution of € 218.0 million.
- 4 Thematic Networks representing a total EU contribution of € 4.1 million.
- 12 Concerted Actions representing a total EU contribution of € 16.7 million.

A number of research projects that are focussed on a common subject have formed large clusters.

The average number of participants per project is nine. About 27% of the participants are companies. In 70% of the projects, at least one industrial partner is involved.

The objective of this publication is not to assess the projects or the results generated, but to give an overview on the ongoing research being carried out in Key Action 1 “Food, Nutrition and Health”.

This catalogue has been edited and compiled by Rosanna D’Amario, Isabelle de Froidmont-Görtz, Barbara Rens and Jürgen Lucas with the help of all Scientific Officers mentioned below. The European Commission would like to thank the coordinators of the projects for the replies to the requests and for supplying so many interesting photographs to complement the text of this publication.

Liam Breslin
Head of Unit DG Research E.2 “Health, Food and Environment”
Brussels, October 2002
ABBREVIATIONS

Country codes
A Austria
AUS Australia
B Belgium
BG Bulgaria
CA Canada
CH Switzerland
CZ Czech Republic
D Germany
DK Denmark
E Spain
EE Estonia
FIN Finland
F France
GB United Kingdom
GR Greece
HU Hungary
IL Israel
IRL Ireland
IS Iceland
I Italy
LU Luxembourg
LT Lithuania
LV Latvia
NL The Netherlands
NO Norway
PL Poland
P Portugal
RO Romania
SI Slovenia
SK Slovakia
S Sweden
USA USA

Types of projects
SC Shared cost actions
CA Concerted actions
CM Combined projects
SD Demonstration project
TN Thematic network
EU CONTACTS FOR KEY ACTION 1

Director E “Life Sciences: biotechnology, agricultural and food research”
Bruno Hansen
bruno.hansen@cec.eu.int
(+32-2) 296.36.95

Head of Unit E.2 “Health, Food and Environment”
Liam Breslin
liam.breslin@cec.eu.int
(+32-2) 295.04.77

Scientific officers:
Dyanne Bennink
dyanne.bennink@cec.eu.int
(+32-2) 295.91.83

Achim Boenke
achim.boenke@cec.eu.int
(+32-2) 296.07.56

Rosanna D’Amario
rosanna.d’amario@cec.eu.int
(+32-2) 298.43.74

Antonio di Giulio
antonio.di-giulio@cec.eu.int
(+32-2) 299.58.86

Alkmini Katsada
alkmini.katsada@cec.eu.int
(+32-2) 295.69.26

Jürgen Lucas
jurgen.lucas@cec.eu.int
(+32-2) 296.41.52

Barend Verachtert
barend.verachtert@cec.eu.int
(+32-2) 295.53.11

Sigurdur Bogason
sigurdur.bogason@cec.eu.int
(+32-2) 299.50.55

(in DG Fisheries)

Budget officer:
Jean-Claude Fatoux
jean-claude.fatoux@cec.eu.int
(+32-2) 296.74.50

Secretariat:
Antonio Cherenti
antonio.cherenti@cec.eu.int
(+32-2) 296.02.92

Andrea Heitkamp
andrea.heitkamp@cec.eu.int
(+32-2) 298.75.34

Barbara Rens
barbara.rens@cec.eu.int
(+32-2) 299.38.98

Rosemary Thompson
rosemary.thompson@cec.eu.int
(+32-2) 295.57.21

Mailing address:
European Commission, SDME 8-21, B-1049 Brussels
Tel.: +32-2-296.02.92, Fax: +32-2-296.43.22
Email: antonio.cherenti@cec.eu.int
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AREA 1.
Development of safe and flexible and new and/or improved manufacturing processes and technologies
Traceability of fish products
TRACEFISH

Contract number: QLK1-2000-00164
Contract type: Concerted Action
Total cost: € 992,112
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Scientific Officer: Sigurdur Bogason
Project website: www.tracefish.org

Coordinator:
Dr Petter Olsen
Norwegian Institute of Fisheries and Aquaculture Ltd.
Centre of Industrial Processing
Muninbakken 9-13
9291 Tromsø
Norway
Tel.: +47 77629231
Fax: +47 77629100
E-mail: petter.olsen@fiskforsk.norut.no

PARTNERS
Dr Magnusson, Olafur
Tölvmunydir Ehf
Mörkinni 4
108 Reykjavik
Iceland
Tel.: +354 5689010
Fax: +354 5689530
E-mail: olimag@tolvumyndir.is

Mr Jostein Storoy
Sintef Fisheries and Aquaculture Ltd
Pirsenteret
7010 Trondheim
Norway
Tel.: +47- 73595650
Fax: +47- 73595660
E-mail: jostein.storoy@fish.sintef.no

Mrs. Jensen, Lillan
Vensy España S.A.
C/Ernest Hemingway, Pol. Ind.
Guadalhorce, S/N
29004 Malaga
Spain
Tel.: +34-952 236410
Fax: +34-952 233359
E-mail: lillan@vensy.es

Mr Buysse, Bertil
Pieters Visbedrijf NV
Kolvestraat 4
8000 Brugge
Belgium
Tel.: +32-50 458585
Fax: +32-50 458611
E-mail: bertil.buysse@pieters.be

Dr Ryder, John
FAO Eastfish
UN Centre Midtermolen 3
PO Box 0896
2100 Copenhagen
Denmark
Tel.: +45 35467136
Fax: +45 35467181
E-mail: john.ryder@eastfish.org

Dr Kämmler, Eckhard
Gottfried Friedrichs GmbH & Co. KG
Borselstraße 26
22765 Hamburg
Germany
Tel.: +49-40 39828125
Fax: +49-40 39828178
E-mail: kaemmler@Gottfried.
Friedrichs.de
Traceability of fish products

BACKGROUND
The overall objective of this concerted action is to go some way towards establishing a broad consensus for what traceability data should be recorded and transmitted for fish products, and how these data should be coded. To accomplish this, we will establish a forum where representatives from various parts of the fish/product industries and research institutes can meet to discuss traceability related issues. This forum is implemented in the form of 4 conferences over 2 years with presentations, discussions and workgroups. Representatives from other food-chains will make presentations that will form a basis for discussion and a reference point in the fish/product chains. Suppliers and buyers of fish products will present their often conflicting views, systems and requirements. Researchers will share relevant results, especially relating to what data elements influence health, safety, shelf life and yield, and how these may be quantified.

OBJECTIVES
• To provide a forum for discussing traceability related industry issues in the fishing industry;
• To facilitate the transfer of traceability related ideas and technology from other food industries to the fish/product industry;
• To produce a document that recommends what data typically should be recorded and passed along for farmed fish and for captured fish;
• To produce a document that recommends how these data should be coded and transmitted/shared electronically;
• To result in implementation projects based on the common ground represented by the documents.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• 4 international conferences with focus on all the different aspects of traceability for fish products
• one voluntary industry standard, establishing consensus with respect to what data should be recorded and made available in the chain for captured fish, from vessel to consumer
• one voluntary industry standard, establishing consensus with respect to what data should be recorded and made available in the chain for farmed fish, from fish farm to consumer
• one voluntary industry standard, establishing consensus with respect to how the data should be coded and transmitted or made available electronically
Dr Larsen, Gunnar  
Akureyri Fishing and Processing Plc  
Fiskitanga  
600 Akureyri  
Iceland  
Tel.: +354 4604100  
Fax: +354 4604101  
E-mail: gl@ua.is

Dr Gudmundur Stefansson  
SIF Ltd  
Union of Icelandic Fish Producers  
Fjardargata 13-15  
PO Box 20  
220 Hafnarfirdi  
Iceland  
Tel.: +354-5508001  
Fax: +354-5508001  
E-mail: gst@sif.is

Dr Fitzgerald, Richard  
Shorescape Ltd.  
28 Chestnut Grove  
Carrigaline, Co. Cork  
Ireland  
Tel.: +353-0 21375611  
Fax: +353-0 21375611  
E-mail: shorescape@eircom.net

Dr Berge, Tove Pedersen  
Hydro Seafood As  
Sandviksbodene 66  
PO Box 4102 Dreggen  
5835 Bergen  
Norway  
Tel.: +47 55547200  
Fax: +47 55547281  
E-mail: tove.berge@hydro.com

Mr Martínez de Ubago Jr, Eugenio  
Conservas Ubago S. L.  
Carretera del Higuerón 135  
11304 La Linea  
Spain  
Tel.: +34-952 231610  
Fax: +34-952 245895  
E-mail: eugenio-jr@vensy.es

Ms Cooper, Mary  
Sainsbury Supermarkets Ltd  
J. Sainsbury Plc  
Meat Technical Dept.  
Stamford Street  
SE1 9L1 London  
United Kingdom  
Tel.: +44-171 6957397  
Fax: +44-171 6954976  
E-mail: mpc@tao.j-sainsbury.co.uk

Prof. Bremner, Allan  
Danish Institute for Fisheries Research  
Department of Seafood Research  
Soeltofts Plads  
Building 221  
2800 Lyngby  
Denmark  
Tel.: +45 45252539  
Fax: +45 45884774  
E-mail: hab@dfu.min.dk

Prof. Papagiannakis, Eleftherios  
National Technical University of Athens  
Department of Chemical Engineering  
Division of Process and Product Development IV  
Laboratory of Food Chemistry and Technology  
5 Iroon Polytechniou  
157 80 Athens  
Greece  
Tel.: +30-1 7722050  
Fax: +30-1 7721960  
E-mail: Ipap@central.ntua.gr
Barley beta-d-glucan and wheat arabinobioylan soluble fibre technologies for health promoting bread products
SOLFIBREAD

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Scientific Officer: Jürgen Lucas
Project website: http://www.solfibread.com/

Coordinator:
Prof. Dr Jan Delcour
Katholieke Universiteit Leuven
Food and Microbial Technology
Kardinaal Mercierlaan 92
3001 Heverlee
Belgium
Tel.: +32-16-321634
Fax: +32-16-321997
E-mail: jan.delcour@agr.kuleuven.ac.be

Dr Ingmar Börjesson
Cerealia Utveckling AB
153 81 Järna
Sweden
Tel.: +46-8-51 97 89 60
Fax: +46-8-51 97 89 65
E-mail: ingmar.borjesson@cerealia.se

Prof. Dr Per Aman
Sveriges Lantbruksuniversitet
Department of Food Science
PO Box 7051
750 07 Uppsala
Sweden
Tel.: +46-18-67 20 45
Fax: +46-18-67 29 95
E-mail: Per.Aman@lmv.slu.se

Prof. Dr David Schofield
University of Reading
Department of Food Science and Technology
Whiteknights
PO Box 226
RG6 1AP Reading
United Kingdom
Tel.: +44-118-93 18 712
Fax: +44-118-93 16 607
E-mail: j.d.schofield@tesco.net

Dr Jens Frisbak Sorensen
Danisco A/S
Danisco Ingredients
Edwin Rahrs Vej 38
8220 Brabrand
Denmark
Tel.: +45-89-43 52 88
Fax: +45-86-25 10 77
E-mail: g8jws@danisco.dk

PARTNERS
Barley beta-D-glucan and wheat arabinoxylan soluble fibre technologies for health promoting bread products

BACKGROUND
Soluble fibre in a diet is beneficial because it lowers the levels of blood cholesterol, a risk factor for coronary heart disease, and because it leads to a reduced postprandial glycaemic response, potentially beneficial in controlling the adverse effects of diabetes. The main objective is to provide and implement technologies for increased barley/wheat soluble fibre levels in staple food EU bread products. This requires optimisation of hull-less barley milling technology, research into barley proteins, endogenous endoxylanase inhibitors, their action towards endoxylanases, optimisation of different types of dough and bread making processes for increased soluble fibre levels and qualities, and assessment of their organoleptic properties and consumer acceptability.

OBJECTIVES
The general objective of the proposed work is to enhance the health promoting effect of different European bread products by providing and implementing technologies for increased barley and wheat soluble fibre levels in consumer acceptable staple food bread products.

Specific objectives are
- To optimise the production of health promoting barley flour and other products of barley milling both in terms of nutritional as well as in terms of functional effects.
- To investigate and exploit the functional potential in bread making of the protein (hordein) components of barley flour.
- To purify and characterise endoxylanase inhibitors.
- To identify endoxylanases, which, in the presence of endoxylanase inhibitors, will preferentially hydrolyse water-unextractable arabinoxylan while leaving the solubilised high molecular weight arabinoxylan intact.
- To identify the changes in levels of health promoting components of barley and wheat during the different phases of the dough and bread making processing.
- To exploit endoxylanase-endoxylanase inhibitor technology for the production of straight dough breads with enhanced nutritional quality from wheat and barley flour blends on a laboratory scale.
- To optimise the production of different styles/types of breads produced in different EU countries containing milled barley products in terms of both health promoting and organoleptic properties.
- To evaluate the organoleptic quality and the consumer acceptability of the novel health promoting breads from wheat and barley flour blends.

(EXPECTED) RESULTS AND ACHIEVEMENTS
We expect to be successful in developing and industrially implementing technology for milling hull-less barley into flour, which will be useful in bread making and presumably in other food applications where increased soluble fibre levels are also desired. It should also be feasible to develop successfully novel forms of breads in the style of those consumed in different EU countries, which will have a significant added value in terms of health promoting effects through increasing the levels of both soluble β-D-
glucan and arabinoxylan of high molecular weight. This will be based on novel hull-
less barley milling technology, the physico-chemical characteristics of the barley pro-
teins, insight in the changes of β-D-glucan during bread making and new endoxy-
lanase-endoxylanase inhibitor technologies.
QLK1-2000-00324: Barley beta-d-glucan and wheat arabinoxylan soluble fibre technologies for health promoting bread products
Non-destructive NIR technology for fruit and vegetable internal quality assessment, eliminating the skin disturbing effect

NIQAT

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Scientific Officer: Dyanne Bennink
Project website: not yet available

Coordinator:
Dr Raina Chalucova
Institute for Horticulture and Canned Foods
Vassil Aprilov Blvd., 154
4000 Plovdiv
Bulgaria
Tel.: +359 32 952109
Fax: +359 32 952286
E-mail: cic@evro.net

PARTNERS

Dr Walker, Steven
Campden & Chorleywood Food Research Association
Chemistry and Biochemistry Department
Station Road
GL55 6LD Chipping Campden
United Kingdom
Tel.: +44 1386 842011
Fax: +44 1386 842100
E-mail: s.walker@campden.co.uk

Prof. Dr Kopola, Harri
Technical Research Centre of Finland
VTT Electronics
Kaitovaaylae 1
P.O. Box 1100
90571 Oulu
Finland
Tel.: +358-8 5512369
Fax: +358-8 5512320
E-mail: Harri.Kopola@vtt.fi

Mr Spassov, Peter
Index-6 Ltd
Kuklensko Shosse, PO Box 44
4004 Plovdiv
Bulgaria
Tel.: +359 32 672 190
Fax: +359 32 862 023
E-mail: index-6@rakursy.com
Non-destructive NIR technology for fruit and vegetable internal quality assessment, eliminating the skin disturbing effect

BACKGROUND
The consumer is most of all interested to know the fruit flesh quality regardless of the good looking appearance of the product offered. Up to now, there has not been a consistent approach that theoretically or in practice could lead to a solution of the internal quality assessment problem. The Project gives a solution particularly applicable to potatoes, apples and peaches. The overall objective is to demonstrate a new NIR method for virtual (optical and mathematical) stripping of the skin and a photometric camera for implementation of the method. The camera allows to measure the fruit flesh spectrum without the object physical peeling, hence to predict precisely the internal quality: inside diseases and defects, degree of maturity, flavour etc.

OBJECTIVES
The overall objective is to create a new technology for precise recognition of fruits and vegetables inside quality.

One of the objectives is to design and build a photometric camera for on-line sorting of mentioned products by their internal quality evaluation in real time. The camera will be investigated for the classification of potato tubers into categories according to their internal quality.

Another objective is to study apples and peaches and to demonstrate the applicability of the V-method with seeded and pitted fruits.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The expected results are:
• Affirmation of a novel V-method for nondestructive precise assessment of fruits and vegetables internal quality.
• A new NIR method for nondestructive measurement of the spectral transmittance of potatoes, apples and peaches fruit flesh.
• A photometric camera for sorting potatoes by means of the V-method, which can be operated independently or jointly with videocameras in on-line system. The simultaneous use of the two types of cameras could improve the overall – both external and internal – quality of the products being sorted, and it would extend the area of applicability of sorting systems.
• Proving the possibility of using the V-technology in NIR analysers and systems also for on-line sorting of apples and peaches.
• The new NIR-technology will have the potential for the usage in NIR analysers of the internal quality and on-line systems for sorting.
QLK1-2000-00455: Non-destructive NIR technology for fruit and vegetable internal quality assessment, eliminating the skin disturbing effect
Development of molecular genetic methods for the identification and quantification of fish and seafood

**DNAIQ**

**Contract number:** QLK1-2000-00476
**Contract type:** Shared Cost Project
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**EC contribution:** € 1,443,735
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**Scientific Officer:** Sigurdur Bogason
**Project website:** not yet available

**Coordinator:**
Dr. Kirsten Kerkhoff
GeneScan Analytics GmbH
Fahrenheitstraße 1
28199 Bremen
Germany
Tel.: +49-421 202466
Fax: +49-421 2024689
E-mail: k.kerkhoff@genescan.com

**PARTNERS**

Dr. Hartmut Rehbein
Federal Research Centre for Fisheries
Institute of Fishery Technology and Fish Quality
Palmaille 9
22767 Hamburg
Germany
Tel.: +49-40 38905167
Fax: +49-40 38905262
E-mail: rehbein.ibt@bfa-fisch.de

Dr. Emmanuel Gachet
Eurofins Scientific Analytics
Rue Pierre Adolphe Bobierre
PO Box 42301
44323 Nantes Cedex 3
France
Tel.: +33-2 51832100
Fax: +33-2 51832111
E-mail: EmmanuelGachet@eurofins.com

Dr. Ricardo Isaac Peréz-Martín/Dra.
Carmen G. Sotelo
Consejo Superior de Investigaciones Científicas
Instituto de Investigaciones Marinas
Eduardo Cabello 6
36208 Vigo
Spain
Tel.: +34-986-414471
Fax: +34-986-292762
E-mail: ricardo@iim.csic.es/carmen@iim.csic.es

Dr. Manuel Rey-Méndez
Universidade de Santiago de Compostela
Dpt. Bioquímica e Biología Molecular
Campus Universitario Sur
15706 Santiago de Compostela
Spain
Tel.: +34 981599800
Fax: +34 981599309
E-mail: bnreymen@usc.es

Inge W. Nilsen
Norwegian Institute of Fisheries and Aquaculture Ltd
University Campus Breivika
9291 Tromsø
Norway
Tel.: +476-776 29000
Fax: +476-776 29100
E-mail: ingewn@fiskforsk.norut.no
Development of molecular genetic methods for the identification and quantification of fish and seafood

BACKGROUND
So far it is not possible to quantify reliably the constituents of fish or other seafood products. The methods used today rely on the quantification of substances highly susceptible to processing conditions. Due to its stability the quantification of DNA is a very promising attempt to overcome this problem. Practicable, fast and easy to use methods for quantification are in the interest of consumers and industry to prevent fraud and mislabelling. The technical progress in DNA-quantification offers the opportunity to develop methods applicable in routine analysis. The excellent access to the European market, to fisheries along with long experience in DNA analytic and state of the art equipment will provide the fundament to achieve protocols and procedures for high throughput identification of fish and seafood and a sensitive, reliable technique to quantify species in fish and seafood products.

OBJECTIVES
• Improvement of DNA-based fish and seafood identification
• Development of reliable as well as sensitive quantification techniques for fish and seafood products. In recent years the growing interest in quantitative applications for the PCR has favoured the development of a large number of assay procedures suitable for this purpose. We will focus on two methodological approaches for quantitative PCR based on the use of fluorogenic probes. The remarkable technical and analytical progress made can now be exploited to gain routine analytical procedures.
• Evaluation of the developed techniques, protocols and procedures for identification and quantification by collaborative studies of the participants.
• Evaluation of the developed techniques in routine practice by end users.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Collection of authentic organisms, relevant fish and other seafood products
• DNA-identification and quantification methods will be adopted to fish and seafood products
• DNA-database will be complemented with information relevant for fish and seafood products
• Primers and probes for fish and seafood identification; DNA-arrays-PCR-quantification exploiting the properties of competitive-, on-line-PCR and HPLC
• Ring trials among participants and end users for harmonisation and maximum practicability
Improvement of the hygienic quality of raw milk, cheese made with raw milk, meat and meat products based on a new microbiological standard, the bifidobacteria BIFID

**Contract number:** QLK1-2000-00805  
**Contract type:** Shared Cost Project  
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**Duration:** 48 Months  
**Scientific Officer:** Antonio di Giulio  
**Project website:** http://www.bifid-project.org

**Coordinator:**  
Dr Françoise Gavini  
INRA  
Technologie des Produits Animaux  
369 rue Jules Guesde  
59651 Villeneuve d’Ascq  
France  
Tel.: +33 320 435 403  
Fax: +33 320 435 465  
E-mail: gavini@lille.inra.fr

**Coordinator:**  
Dr Mattias Upmann  
University of Veterinary Medicine  
Vienna  
Institute of Meat Hygiene, Meat Technology and Food Science  
Veterinärplatz 1  
1210 Vienna  
Austria  
Tel.: +43-1 250773317  
Fax: +43-1 25773390  
E-mail: matthias.upmann@vu-wien.ac.at

**Coordinator:**  
Mr George Daube  
Université de Liege  
Bd. de Colonster 20  
Bât. B43 Bis  
4000 Liège  
Belgium  
Tel.: +32-4 3664015  
Fax: +32-4 3664016  
E-mail: Georges.Daube@ulg.ac.be

**Coordinator:**  
Dr Jacques Criquelion  
ANIOS SA  
Pavé Moulin  
59260 Lille-Hellemmes  
France  
Tel.: +33 3 20 676741  
Fax: +33 3 20 676768  
E-mail: j.criquelion@anios.com

**Coordinator:**  
Mr Bernard Gaud  
L’Etoile du Vercors SA  
38680 Saint Just-de Claix  
France  
Tel.: +33 476 644 064  
Fax: +33 476 644 484  
E-mail: contact@etoile-du-vercors.com

**Coordinator:**  
Mr Philippe Isambert  
Fromagerie de la Vallée de Cléris  
Route de Chuelles  
45320 Courtenay  
France  
Tel.: +33 323 598 844  
Fax: +33 323 539 273  
E-mail: pisambert@unilep.fr

**Coordinator:**  
Mrs. Thérèse Couvreur  
Ferme du Vinage  
4, Carrière madame Desflandre  
59223 Roncq  
France  
Tel.: +33 320 94 60 67  
Fax: +33 320 94 20 90  
E-mail:
Improvement of the hygienic quality of raw milk, cheese made with raw milk, meat and meat products based on a new microbiological standard, the bifidobacteria

BACKGROUND

A new methodology is developed using bifidobacteria for improving hygienic quality of raw milk, raw milk cheese, meat and meat products. Bifidobacteria represent one of the major bacterial groups in the human as well as the animal intestine. It was also shown that *Bifidobacterium* species originating from human are different from those originating from animal. This methodology will quantify and identify at species level the bifidobacteria isolated from food and environment. This will (i) indicate the source of contamination (raw material, personnel) (ii) ensure traceability of the contamination along the entire food processing chain from raw material to food product. The development of molecular methods as Polymerase Chain Reaction (PCR) will enable the use of this test in routine diagnostic during food processing. In conclusion, a modification of the European directives 92/46 and 94/65 concerning the microbiology of these food products will be proposed.

OBJECTIVES

The general objective is to define a new standard, using the bifidobacteria (genus *Bifidobacterium*) as indicator organisms in order to point out unsatisfactory hygienic conditions of raw material and food products. These new indicators will be applied (1) to raw milk and cheese made with raw milk, the quality of which depends on the hygiene of milking, the farm environment and the hygiene along the cheese production chain, and (2) to meat and meat products in which bifidobacteria will indicate hygienic shortcomings during slaughter, cutting and deboning as well as retail trade. Good hygienic practices must lead to the elimination of all bacterial hazards such as *Listeria*, *E. coli* EHEC or *Salmonella* spp. Recently, the presence of *Listeria monocytogenes* mostly detected in French raw milk cheese lead to considerable disquiet of the consumers as do the fact that about 23.4% of the European foodborne disease outbreaks were associated with meat and meat products.

(EXPECTED) RESULTS AND ACHIEVEMENTS

- The knowledge or the *Bifidobacterium* species that contaminate raw milk, cheese made with raw milk, meat and meat products will point out the sites from which the contamination derives.
- The development of a fast, sensitive and generally applicable technique will enable industries to detect bifidobacteria during processing and to take corrective actions immediately.
- A new standard modifying the European directives 92/46 and 94/65 concerning the microbiology conditions will be proposed.
Ms Ulrike Vorberg
Johann Andert Fleischwaren AG
IZ-NÖ/Sud, Straße 3, Obj. 16
2355 Wiener Neudorf
Austria
Tel.: +43 2236 600 2920
Fax: +43 2236 600 2940
E-mail: u.vorberg@billa.co.at

Prof. Henri Beerens
Centre d’Enseignement et de Recherche en Microbiologie
Pharmaceutique
39, Rue Faidherbe
59260 Lille-Hellemmes
France
Tel.: +33 3 20 563120
Fax: +33 3 20 563120
E-mail: hbeerens@yahoo.fr

Dr Wolfgang Kneifel
University of Agriculture
Dept. of Dairy Science & Bacteriology
Gregor Mendelstraße 33
1180 Vienna
Austria
Tel.: +43 147 654 6121
Fax: +43 147 891 14
E-mail: cbonapar@edv1.boku.ac.at
QLK1-2000-00805: Improvement of the hygienic quality of raw milk, cheese made with raw milk, meat and meat products based on a new microbiological standard, the bifidobacteria
Solving the problem of glycosidase inhibitors in food processing

GEMINI

Contract number: QLK1-2000-00811
Contract type: Shared Cost Project
EC contribution: € 1,793,012
Starting date: 1/01/2001
Duration: 36 Months
Scientific Officer: Alkmini Katsada
Project website: not yet available

Coordinator:
Dr Antoine Puigserver
Université d’Aix - Marseille III
Mediterranean Research Institute in Nutrition
Av Escadville Normandie Niemen
13397 Marseille 20
France
Tel.: +33-491 288838
Fax: +33-491 288440
E-mail: antoine.puigserver@lbbn.u-3mrs.fr

Mr Whitfield, Peter
Institute of Food Research
Norwich Research Park
NR4 7UA Norwich
United Kingdom
Tel.: +44-1603 255000
Fax: +44-1603 507723
E-mail: peter.whitfield@bbsrc.ac.uk

Prof. Oosterlinck, André
Katholieke Universiteit Leuven
Food and Microbial Technology
Kardinaal Mercierlaan 92
3001 Heverlee
Belgium
Tel.: +32-16 324067
Fax: +32-16 324198
E-mail: andre.oosterlinck@rec.kuleuven.ac.be

Prof. Blasi, Carlo
Dipartirnento di Biologia Vegetale
Università di Roma “La Sapienza”
Piazzale Aldo Moro, 5
00185 Rome
Italy
Tel.: +39 06 49912436
Fax: +39 06 49912446
E-mail: Gripp@axrma.uniroma1.it

Dr Pedersen, Hans Elbek
Danisco A/S
Danisco Cultor
Edwin Rahrs Vej 38
8220 Brabrand
Denmark
Tel.: +45 8943 5415
Fax: +45 8625 1077
E-mail: g8hsp@danisco.com

Dr Alibes, Xavier
Institut de Recerca i Tecnología Agroalimentaries
Centre de Mas Bové
Department of Animal Nutrition
PO Box 415
43280 Reus Tarragona
Spain
Tel.: +39 467 40 46
Fax: +39 467 40 42
E-mail: xavier.alibes@irta.es
Solving the problem of glycosidase inhibitors in food processing

BACKGROUND
Glycosidases (pectin-degrading enzymes, amylases and xylanases) are essential to industrial competitiveness in brewing, fruit juice manufacture, baking and animal husbandry. The presence of specific protein inhibitors in plants used as starting materials jeopardises the economics of these processes. This project aims to understand the action of these multifunctional proteinaceous inhibitors, and to determine their biodiversity and expression patterns in the plant. This information will be used to optimise industrial processes by using modified enzymes, careful selection of raw material, choice of reaction conditions and with the option of developing modified crops in the future. The involvement of 3 industrial partners will ensure that improvements in processing are converted to gains in European competitiveness.

OBJECTIVES
• Determine the inhibition mechanism, the determinants governing the interaction between enzyme and inhibitor and the specificity of inhibitors towards glycosidases from various sources.
• Elucidate how widespread inhibitors are across the plant kingdom and assess their impact on target enzymes.
• Investigate the expression pattern of these inhibitors in plant tissues and evaluate their role in vivo in plant defence against pathogens.
• Use the information derived from 1-3 to design or choose modified enzymes with lower susceptibility to inhibitors, select materials, with lower inhibitor amounts and exploit new uses of inhibitors in plant defence.
• Transfer the knowledge gained into improved industrial processes using glycosidases with consequent gains in efficiency, more efficient enzyme usage and increased environmentally-friendly processes using enzymes.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Elucidation of inhibitor role and expression in the plant (month 20)
• Identification of novel glycosidase inhibitors and target enzymes (month 28)
• Structure-function of glycosidase-inhibitor interaction (month 33)
• Improved protein inhibitor technology in food, feed and agricultural sectors (month 36)
Dr Brelurut, Alain
INRA
Unité de Recherche sur les Polysaccharides, leurs Organisation et Interactions
Rue de la Géraudière
BP 71627
44316 Nantes Cedex 3
France
Tel.: +33 2 40 67 51 10
Fax: +33 2 40 67 50 05
E-mail: brelurut@nantes.inra.fr
Advanced electromagnetic solution for quality testing of packaging for horti-fruit products

QTEPACK

Contract number: QLK1-2000-00936
Contract type: Shared Cost Project
Total cost: € 2,999,005
EC contribution: € 1,498,998
Starting date: 1/01/2001
Duration: 30 Months
Scientific Officer: Alkmini Katsada
Project website: http://qtepack.rmee.upc.es/

Coordinator: Dr Jose Maria Martinez-Iglesias
Talleres Daumar SA
Wifredo 794-796
08918 Badalona
Spain
Tel.: +34 934601593
Fax: +34 933838505
E-mail: mziglesias@daumar.es

PARTNERS

Mr Garcia, Miguel
Anàlisis Tecnòlogica Innovadora per a Processos Industrials Competitius
Centre d’Empreses de Noves
Tecnologies
Parc Tecnològic del Vallès
08290 Cerdanyola
Spain
Tel.: +34-93 5820161
Fax: +34-93 5801354
E-mail: atipic@ptv.es

Prof. Oñate, Eugenio
Centre Internacional de Mètodes Numèrics en Enginyeria
Gran Capitan S/N
Edificio C-1-Campus Norte UPC
08034 Barcelona
Spain
Tel.: +34 932057016
Fax: +34 93 4016517
E-mail: onate@cimne.upc.es

Dr Hurley, David
Magnetic Solutions Ltd
Unit 13
IDA Centre
Pearse Street
01 Dublin 2
Ireland
Tel.: +353-1-6704046
Fax: +353-1-6704047
E-mail: dhurley@magnetic-solutions.com

Dr Fournier, Jean-Marc
Federation ELESA
PO Box 46
38402 Saint Martin d’Heres Cedex 9
France
Tel.: +33 476 826278
Fax: +33 476 826300
E-mail: Yves.Brunet@inpg.fr

Weick, J.M.
Zentrum Fertigungstechnik Stuttgart
Nobelstraße 15
70569 Stuttgart
Germany
Tel.: +49-711 1316230
Fax: +
E-mail: fiskforsk@fiskforsk.norut.no

Dr Bindslev Hansen, Jorn
Nordic Superconductor Technologies A/S
Praerparken 685
2605 Brondby
Denmark
Tel.: +45-43 482542
Fax: +
E-mail: jbh@nst.com
Advanced electromagnetic solution for quality testing of packaging for horti-fruit products

BACKGROUND

Main causes of damage in packaged fruit and vegetables are fungal infections, the most important of them being the green rot (*Penicillium digitatum*) causing 55-80% of the losses. Other rots (i.e., blue, black, acid and grey rots) can also be damaging. Fungal induced decay starts in the area between the soft part of the fruit/vegetable and its skin and destroys its cellular structure but cannot be detected visually in the packaging line. Due to the under skin-nature of the rot process, a single undetected damaged fruit or vegetable can ruin the whole package with severe economic losses. Fruit/vegetable decay can be detected at its early stage by measuring the frequency displacement of the nuclear magnetic resonance (NMR) proton line using NMR technology, which this project proposes to develop.

OBJECTIVES

The objective of this project is to develop and test innovative low cost nuclear magnetic resonance (NMR) techniques and fruit handling mechanisms for testing the quality level of horti-fruit products in the selection and packaging line. It is expected to reduce the shortcomings of quality control methods based on visual or manual inspection of fruit. Specifically, a prototype system (QTEPACK) will be developed consisting of: a) an NMR component (a magnet, a spectrometer and an electronic unit to process electromagnetic signals), b) a high-precision fruit handling mechanical unit to ensure efficient scanning of the fruit and c) a computer based fruit selection system correlating NMR electromagnetic signals with fruit quality. The above components of the QTEPACK prototype will be integrated into an autonomous control system for food packaging. The efficiency and reliability of the QTEPACK system will be evaluated by the end users in an orange packaging line. The result to be expected from future industrial applications of the new QTEPACK system is a 40% increase in the detection of damaged items in fruit and vegetable batches prior to the packaging step.

(Expected) RESULTS AND ACHIEVEMENTS

The project expects to achieve the following goals:

- Quality determination of organic materials from electromagnetic signals
- Definition of a new methodology to identify the NMR trace of fungus. The signal owing to the quality of the organic material needs to be isolated from other factors such as geometrical shape of the item, position or traces of non-critical substances.
- Innovative magnet solutions for industrial environments
- New low cost NMR magnets compatible with technical, industrial, and commercial requirements
- Development of innovative shimming strategies and testing procedures to achieve a high homogeneity field magnetically shielded from the environment
- Localised and non-destructive magnetic recognition
- A new spectrometer based on low-cost magnets will be designed and built. Specific sensors and advanced signal processing algorithms will be developed.
- Complete surface characterisation of the horti-fruit products
Design and manufacture of a new mechanical system to feed the fruit into the NMR based QC system. The handling strategy together with the mechanical system will be used for fast 3D scanning of fruits.

Advanced simulation software

Use of advanced computational tools to study the parameters of the individual QTEPACK modules, providing a fast way to test alternative designs. Two design and evaluation stages are required: the characterisation of each specific unit (magnet and sensor array) and the validation of the computer simulations.

Integration of the Innovative QC Methodology into Existing Fruit Selection and Packaging Systems

The prototype QTEPACK system will be integrated into existing fruit packaging machines manufactured by DAUMAR. Comparisons with existing QC systems will be performed from the technical point of view (processing & selection, compatibility) as well as the human one (working conditions & environmental).

Applications: The new NMR based quality control mechanisms will be implemented into existing fruit and vegetable weighting and packaging machines developed by the project partners. Spin-off applications of the NMR quality control methods developed in this project include the quality control of a wide range of horti-fruit products, as well as other products such as rubber tires, cloths, plastic, composite components, ceramic parts, etc. and other food, biological and medical products.

PARTNERS

Garcia Vicent, Jorge
Garcia Ballester Sl
Patriada Vintems S/N
12530 Burriana
Spain
Tel.: +34 967 571025
Fax: +34 964577270
E-mail: garba@garbasl.com
QLK1-2000-00936: Advanced electromagnetic solution for quality testing of packaging for horti-fruit products
Utilisation and stabilisation of by-products from cod species
FISHERY BY-PRODUCTS

Contract number: QLK1-2000-01017
Contract type: Shared Cost Project
Total cost: € 2.590.169
EC contribution: € 1.561.549
Starting date: 1/12/2000
Duration: 36 Months
Scientific Officer: Sigurdur Bogason
Project website: http://kibt.chembio.ntnu.no/fishbyprod/

Coordinator:
Dr Turid Rustad
Norwegian University of Sciences and
Technology
Department of Biotechnology
Sem Sælands Vei 6/8
7491 Trondheim
Norway
Tel.: +47 73 594066
Fax: +47 73 59 3337
E-mail: Turid.Rustad@chembio.ntnu.no

PARTNERS

Dr Marit Aursand
SINTEF Fisheries and Aquaculture
Gryta 2, Brattora
7465 Trondheim
Norway
Tel.: +47 73 59 6389
Fax: +47 73 59 6363
E-mail: marit.aursand@fish.sintef.no
Mr Sigurjon Arason
Icelandic Fisheries Laboratories
Skulagata 4
PO Box 1405
101 Reykjavik
Iceland
Tel.: +354-5620240
Fax: +354-5620240
E-mail: sigurjon@rifisk.is

Prof. Joe Kerry
Department of Food Science, Food Technology & Nutrition
University College Cork
Western Road
PO Box
Cork
Ireland
Tel.: +353 21 490 3798
Fax: +353 21 427 0213
E-mail: joe.kerry@ucc.ie

Mr Klaus Pommer
Novozymes A/S
Krogshøjvej 36
2880 Bagværd
Denmark
Tel.: +45 44 42 29 70
Fax: +45 44 98 50 96
E-mail: kpo@novozymes.com

Mr Jeroen Kals
Netherlands Institute for Fisheries Research
Haringkade 1
PO Box 68
1970 AB IJmuiden
The Netherlands
Tel.: +31 255 564607
Fax: +31 255 564644
E-mail: jeroen@rivo.wag-ur.nl

Dr Jean-Pascal Bergé
Laboratoire Biochimie et Molécules Marines
Département Valorisation des Produits
IFREMER centre de Nantes
Rue de l’Ile d’Yeu
BP 21105
44311 Nantes Cedex 3
France
Tel.: +33 2 40 37 40 79
Fax: +33 2 40 37 40 71
E-mail: jberge@ifremer.fr
Utilisation and stabilisation of by-products from cod species

BACKGROUND

By-products from cod species will be studied with the aim of increasing their utilisation to produce value added food ingredients. Work will focus on fat and protein fractions (liver, viscera, heads, skins and cut-offs). Increasing the proportion of fish catch used for human consumption will increase profitability, reduce waste and reduce pressure on overfishing. The project will aim to develop systems to sort, handle and store by-products on board vessels, find safe and effective preservation methods and develop well-functioning logistics. Chemical composition of the by-products will be characterised regarding species, seasonal and habitat variation. Processing methods to extract biomolecules with application in food, feed and pharmaceuticals will be studied and optimised. Finally the market for these compounds will be assessed.

OBJECTIVES

The main objective of this work is to increase the utilisation of by-products from cod species to produce value added food ingredients. This project will focus on the following species of gadidae/cod: cod (Gadus morhua), saithe (Gadus virens), haddock (Melanogrammus aeglefinus), tusk (Brosme brosme), ling (Molva molva).

This will be done by technology development onboard vessels to produce, handle and store by-products. The technology development will be made to ensure that the by-products are in a condition suitable for subsequent production of value-added isolates for food, pharmaceutical and other purposes. The work will focus on the fat and protein fractions mainly from liver, viscera, heads, skin and cut-offs from cod species.

Scientific and technological objectives:
• Develop value added food ingredients from by-products from cod species
• Develop systems to recognise and separate different fractions
• Characterise the chemical composition of different by-products
• Develop suitable methods for preserving the different fractions
• Develop methods to extract the interesting fractions/biomolecules.
• Where appropriate to develop the capacity to do all of the above on board vessels to optimise quantity and quality of high value added by-products
• Review the market potential for the selected by-products.

(EXPECTED) RESULTS AND ACHIEVEMENTS

• High value added products from by-products
• Characterisation of the chemical composition of the selected by-products including variations on the basis of season, habitat, individual and species.
• Develop an overview of new applications for the components from by-products in foods, healthcare products, pharmaceuticals and cosmetics.
• Increased knowledge about the market potential for the selected by-products by contact with potential industrial users
• Evaluation of which by-product operation that can practically be done on board the vessel and which can be on-shore - logistics.
• Find suitable equipment and machinery for handling the by-products.
• Build knowledge about the physical behaviour of the selected by-products
• Build knowledge about new technology for extraction and preservation by evaluating different processes with special focus on product stability, practicable and economic factors

Application of the knowledge gained in this project has three distinct phases. Gaining more scientific knowledge about the chemical composition and the stability of the by-products, especially the protein and lipid fractions with a view to extend the utilisation of the by-products. The project will look at extending the utility of fish collagen and gelatine as a substitute for mammalian gelatine and collagen. The project will also look at methods to extract and take care of the nutritionally valuable fish lipids. The knowledge gained in phase one will be used to find safe and effective preservation and storage methods. Further research will look at an extended range of by-products, which the research in phase one has shown is there in commercial quantities.
Microbiological quality monitoring of sterilised milk using innovative electrical, magnetic, electromagnetic and optical technologies for rapid reliable and sensitive detection of the total spoilage

MICROQUAL

Contract number: QLK1-2000-01036
Contract type: Shared Cost Project
Total cost: € 1.533.444
EC contribution: € 978.232
Starting date: 1/12/2000
Duration: 36 Months
Scientific Officer: Dyanne Bennink
Project website: not yet available

Coordinator:
Dr Christine Mielcarek
Ecole de Biologie Industrielle
32, Boulevard du Port
95094 Cergy-Pontoise Cedex
France
Tel.: +33 1 30756255
Fax: +33 1 30756251
E-mail: c.mielcarek@ipsl.tethys-software.fr

PARTNERS

Prof. Kay, Helen
Robert Gordon University
Food Science and Technology Research Centre
St Andrew Street
AB25 1HG Aberdeen
United Kingdom
Tel.: +44 1224 262859
Fax: +44 1224 262828
E-mail: H.kay@rgu.ac.uk

Dr Nychas, George
Agricultural University of Athens
Laboratory of Microbiology and Biotechnology of Foods
Iera Odos 75
11855 Athens
Greece
Tel.: +30 1 5294693
Fax: +30 1 5294693
E-mail: gnp@auadec.aua.gr

Dr Lorrain, Philippe
Agrotec
Site d’Agropole
PO Box 102
47931 Agen Cedex 9
France
Tel.: +33 5 53772001
Fax: +33 5 53683098
E-mail: agrotec@wanadoo.fr
Microbiological quality monitoring of sterilised milk using innovative electrical, magnetic, electromagnetic and optical technologies for rapid reliable and sensitive detection of the total spoilage

BACKGROUND

The main objective is the development of rapid and reliable electrical and electromagnetic methods for detection in sterile milk of the total spoilage microflora in less than 8 hours compared with 5 days (including incubation time) by the actual and traditional resazurin test. The consortium is a vertical grouping of 5 organisations (including the two SME subcontractors) from 4 European Union countries, combining organisation with a good track record in European RTD. The skills and backgrounds are complementary and technical and management capabilities are high.

OBJECTIVES

The main objective of this innovative RDT project is the development of more effective physical methods to translate consumer criteria of microbiological quality of sterilised milk into well defined, measurable parameters, including sensors and apparatus for measuring these parameters.

There is a need for more rapid, sensitive, reliable methods that will facilitate product release, and identify hygiene and safety problems more rapidly, so that, corrective action can be taken. These new physical methods easily to be fully automated, will enable and assure quality management and tractability throughout the food chain. It is also essential to control the growth, and survival of micro-organisms that may limit the shelf life of sterilised milk. One of the specific objectives of this project is to design a new generation of predictive model able to forecast the behaviour of micro-organisms in sterilised milk to assure food safety by anticipating risks, offering the possibility to trace the source of contamination throughout the complete food chain, and finally quantify risk factors.

Another specific main technological objective is to reduce the duration of the bacteriological test on sterilised milk, taking the resazurin method and the official incubation test of sterilised milk during 15 days at 30°C (according 91/180/EEG) as the normalised reference method, from several days (including incubation time) to only 8 hours, although 4 hours, whilst optimistic is not unattainable. In the dairy industry, the production of sterilised milk requires that end product contains zero organisms/litre to guarantee its shelf-life of the product.

(EXPECTED) RESULTS AND ACHIEVEMENTS

The expected results are:

- to develop and define two optimum bacterial growths medium to improve the sensitivity of detection of spoilage bacteria by different rapid detection techniques developed in the project,
- to design a new generation predictive model to forecast the behaviour of micro-organisms in sterilised milk by performing multifactorial experiments by electrical impedance measurement using the RABIT equipment,
- to develop innovative magnetic methods for concentration and recovery of micro-organisms from a clearer liquor.
• to develop and test other new methods for concentration, and recovery of micro-organisms from a clearer liquor. We want to make a comparison and select the more efficient technology, to achieve at least the same performance as magnetic method, but to reduce this task at only 2 operations (adsorption and desorption stages).

• to develop rapid, reliable and sensitive methods, sensors and apparatus for the early detection of the total spoilage microflora. To assure the complete success of the project, 3 technologies will be examined and compared (in terms of sensitivity, reliability, economic aspect, rapidity etc.) to reach the realistic objective of 8 hours and the optimistic objective of 4 hours. We aim with this multifunction electromagnetic biosensor, to perform simultaneously the amplification of bacterial numbers by incubation, the agglutination of bacteria onto adsorption medium and at the end the early detection of bacteria by an electromagnetic system.

• to do demonstration trials in laboratory, and then directly on a pilot food chain for selection and qualification of the best technique.

We expect this project to lead to proposals to CEN with a view to replacing the resazurin test with this new attractive method.

It is expected, after the end of the project, about two years of additional on site tests at the premises of end-users, and further developments will be needed to make the measurement equipment sufficiently reliable, and user friendly to function in a production environment. Full scale introduction of the system in the market will therefore start about two years after the end of the project.
QLK1-2000-01036: Microbiological quality monitoring of sterilised milk using innovative electrical, magnetic, electromagnetic and optical technologies for rapid reliable and sensitive detection of the total spoilage
Development and demonstration of polymerase chain reaction based methods for process control in breweries

BREWPROC

Contract number: QLK1-2000-01251
Contract type: Combined Project
Total cost: € 2,999,771
EC contribution: € 1,728,286
Starting date: 1/02/2000
Duration: 36 Months
Scientific Officer: Alkmini Katsada
Project website: not yet available

Coordinator:
Dr Auli Haikara
Technical Research Centre of Finland
VTT Biotechnology and Food Research
Tietotie 2
02044 Espoo
Finland
Tel.: +358-9 4565130
Fax: +358-9 4552103
E-mail: auli.haikara@vtt.fi

Prof. Dr Righelato, Renton
Brewing Research International
Process R&D
Lytel Hall
RH1 4HY Nutfield, Redhill
United Kingdom
Tel.: +44 1737 824 209
Fax: +44 1737 822 272
E-mail: rc.righelato@brewingresearch.co.uk

Dr Hodgson, Jeff
Scottish Courage Brewing Ltd.
Technical Centre
160 Canongate
EH8 8DD Edinburgh
United Kingdom
Tel.: +44 131 248 1140
Fax: +44 131 248 1101
E-mail: jeff.hodgson@scbrew.co.uk

Mr Haukeli, Alf Dagfin
Prapps Ringnes AB
Thu. Meyersgt 2
PO Box 7152 M
0307 Oslo
Norway
Tel.: +47 22 95 00
Fax: +47 22 99 02
E-mail: alf.dagfin.haukeli@priprpsringnes.com

Mr Loch Ahring, Stefan
Brauerei Veltins
An der Streue
59872 Meschede-Grevenstein
Germany
Tel.: +49-2934 959680
Fax: +49-2934 959481
E-mail: stefan.loch-ahring@veltins.de

PARTNERS
Development and demonstration of polymerase chain reaction based methods for process control in breweries

BACKGROUND
The quality control methods employed by breweries are too time-consuming and un-specific to allow the brewer to ensure the microbiological quality and safety of beer. The present proposal is a combined R & D- Demonstration project which aims at providing rapid, specific and thoroughly tested PCR methods for the microbiological monitoring of brewing processes. The aim of the R&D phase is to establish PCR methods which posses a level of sensitivity, simplicity and specificity to warrant their introduction to routine quality control. The PCR technology is expected to allow rapid detection and traceability of contaminants and determination of their harmfulness. The Demonstration phase aims at proving the technical and practical viability of the new methodology on a realistic scale in order to enable successful transfer of the PCR technology from the research phase to appliance. Effective dissemination of the project outcomes using existing organisational framework of the European breweries will facilitate the adoption and acceptance of the new technology.

OBJECTIVES
The over-all objective of this combined R&D and Demonstration project is to improve the microbiological quality and safety of European beer through implementation of PCR technology in brewery QC. The specific R&D aims are: 1) to establish robust PCR based assays for spoilage microorganisms in bright beer; 2) to develop novel PCR based methods for the detection of spoilage microorganisms in brewing process; and 3) to improve and facilitate the analysis of brewery contaminant specific PCR amplicons. The specific demonstration objectives are: 1) to demonstrate the applicability of the PCR technology to QC environment; 2) to evaluate the viability of the developed PCR applications for the microbiological monitoring of brewery samples; 3) to demonstrate benefits of the PCR technology in brewery QC; and 4) to create an early awareness of the possibilities of PCR in routine food control.

(EXPECTED) RESULTS AND ACHIEVEMENTS
- Robust PCR based methods for spoilage organisms in brewery process samples and final beer,
- Applicability of the PCR technology to routine food control,
- Technical performance and practicability of the new PCR methods,
- Real benefits of PCR in brewery QC in comparison to established methods,
- Standard PCR protocols for brewery samples in reference manuals,
- Exploitation of developed PCR kit prototypes,
- Transfer of the PCR technology to brewing industry.

The PCR protocols and kit prototypes resulting from the project can be used for
- rapid microbiological quality control of brewery samples,
- identification of the most common beer spoilage organisms,
- tracing the origin of the contaminating species in the production line.

It is expected that the developed methods can be also applied for the detection of the same microorganisms in other beverages.

The knowledge and experience gained in this project can be used as a basis for further application of PCR technology in other fields of food production.
Dr Lustig, Stefan
Brauerei Beck & Co
Qualitätswesen
Am Deich 18/19
PO Box 107307
28199 Bremen
Germany
Tel.: +0421-5094-4304
Fax: +0421-5094-4437
E-mail: slustig@becks.de

Prof. Glasson, John
Oxford Brookes University
Biological & Molecular Sciences
Gipsy Lane
O3 0BP Oxford
United Kingdom
Tel.: +44-1865 483744
Fax: +44-1865 484238
E-mail: jglasson@brookes.ac.uk

Mr Koch, Peter
Sternquell-Brauerei GmbH Plauen
Dobenastraße 83
PO Box 100286
08523 Plauen
Germany
Tel.: +49-3741-211 103
Fax: +49-3741-211 591
E-mail: ingrid.oertel@Sternquell.de
QLK1-2000-01251: Scanning Electron Micrograph of a biofilm, demonstrating contamination of beer with bacteria and wild yeast (Erna Storgård, VTT Biotechnology)
European network for hygienic manufacturing of food
HYFOMA

Contract number: QLK1-2000-01359
Contract type: Thematic Network
Total cost: € 1.762.000
EC contribution: € 1.762.000
Starting date: 1/01/2001
Duration: 48 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr Hilde J. Cnossen
TNO Nutrition and Food Research Institute
Risk Management and Microbiology Dept.
Utrechtseweg 48
3700 AJ Zeist
The Netherlands
Tel.: +31-30 6944132
Fax: +31-30 6944901
E-mail: Hyfoma@voeding.tno.nl;
Cnossen@voeding.tno.nl

PARTNERS

Dr. Gerhard Hauser
Technische Universität München
Lehrstuhl für Maschinen- und Apparatekunde
Freising 12
85350 Weihenstephan
Germany
Tel.: +49 8161713290
Fax: +49 8161714242
E-mail: G.Hauser@blm.tu-muenchen.de

Dr John Holah
Campden & Chorleywood Food Research Association
Food Hygiene Department
Station Road
Chipping Campden
GL55 6LD Gloucestershire
United Kingdom
Tel.: +44 1386 84 2041
Fax: +44 1386 84 2100
E-mail: J.Holah@campden.co.uk

Mr. Dick J.D. Uiterwaal
Innomas
Watersnip 57
2411 MB Bodegraven
The Netherlands
Tel.: +31-172 615191
Fax: +31-172 651160
E-mail: Dick.Uiterwaal@wxs.nl

Mr Ralf Stahlkopf
GEA Tuchenhagen GmbH
Am Industriepark 2-10
21514 Büchen
Germany
Tel.: +49 4155 49 2578
Fax: +49 4155 49 2776
E-mail: Stahlkopf.Ralf@tuchenhagen.de

Mr Henk P. van Ekelenburg
ProSafety Consult BV
Boortorenweg 20
7550 AN Hengelo
The Netherlands
Tel.: +31 74 244 4070
Fax: +31 74 250 8171
E-mail: h.van.ekelenburg@planet.nl

Dr Thierry Bénézech
INRA – Centre du Recherche de Lille
Technologie des Produits Animaux
Laboratoire de Genie des Procédés et Technologie Alimentaire
Rue Jules-Guesdo 369
59651 Villeneuve d’Ascq
France
Tel.: +33 3 20 435424
Fax: +33 3 20435426
E-mail: Benezech@lille.lille.inra.fr
European network for hygienic manufacturing of food

BACKGROUND
A most important factor in the safe and wholesome production of food is the good hygienic design of all facilities in food producing and processing in the food chain. The use of unhygienically designed equipment, farms and factories can result in product quality issues and food poisoning incidents. Furthermore, results include product losses due to spoilage, increased cleaning costs, and reduced production time. These aspects are of considerable environmental interest. It is, therefore, essential that both users and manufacturers of food processing equipment are aware of hygienic design principles and European requirements. To minimise the risk of incidents with food products, a network is set up to disseminate knowledge needed for hygienic design and processing. The network involves experts from many EU countries, of all disciplines involved.

OBJECTIVES
The principal aim of the project, is to provide practical guidance for the hygienic manufacturing of food in order to promote compliance with European food safety requirements. Producing guidelines, including test methods, and training and education materials in the field of hygienic design and processing will ensure this. Topics to deal with are hygienic manufacturing, design of food processing machinery (e.g. homogenisers, pumps, cooling/chilling equipment and components like couplings, valves, sensors), process lines, food factories, transport, storage, handling and environment. Guidelines will help industry to comply with relevant EC Directives. Efforts will be made to obtain consensus between EHEDG and organisations with similar objectives, like NSF International and 3A.

The project also focuses on dissemination of knowledge on hygienic manufacture in the food processing industry and engineering sectors (e.g. equipment design, building contractors). Training and education materials will be used to promote hygiene awareness and understanding among all staff/personnel involved in the food chain, ‘from farm to fork’. Special attention will be given to those groups, which have not been trained in microbiology, such as equipment designers. Furthermore, standards organisations, e.g. CEN, will be provided with specialist views on hygienic aspects of equipment design.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The expected results of this project are a series of guidelines produced (in English), covering the hygiene aspects of design and operation of the food chain, including e.g. handling, processing, packaging, storage and transport. Guidelines will be translated into other European languages where applicable. Training and education materials on hygienic manufacture will be produced, based on the guidelines and test methods. Hygienic-manufacture requirements and mechanical-engineering requirements to assure safe food will be integrated in these materials. Knowledge will also be disseminated through publications on hygienic manufacture in international journals and magazines and on the EHEDG Internet web site (www.ehedg.org) as well as through contributions to appropriate symposia. All this will further promote the hygienic manufacturing of food.
The insights obtained in integral processing regarding food safety and hygiene and EHEDG guidelines on hygienic manufacture will benefit the food industry, equipment industry and building contractors, consumers, authorities and standardisation organisations:

• The food industry will gain a broader perspective of the production of safe products, helping to reduce the number of food safety incidents and product recalls. This will also result in a reduction of waste. A more hygienic production process will eliminate the need for excessive heating of raw materials and final products to eliminate undesirable micro-organisms, improving product quality.

• The equipment industry and building contractors will be supported in the design of equipment and buildings, including its maintenance and auxiliary services, such that these do not create hygiene problems and cleaning will be easier. In many cases, the cleaning frequency may be reduced, so that the production of waste (lost product and used cleaning materials) is reduced as well.

• Consumers will get safe and wholesome food products.

• Authorities will receive input for regulations, public health policies, and directives regarding hygiene and preventing contamination during food processing. Standardisation organisations will receive input for standards on hygienic equipment and manufacture.
Increase in nutritional value of food raw materials by addition, activity, or in situ production of microbial nutraceuticals

NUTRA CELLS

Contract number: QLK1-2000-01376
Contract type: Shared Cost Project
Total cost: € 3.594.090
EC contribution: € 2.056.446
Starting date: 1/01/2001
Duration: 48 Months
Scientific Officer: Dyanne Bennink
Project website: http://www.nutracells.com

Coordinator: Dr Jeroen Hugenholtz
Department of Flavour and Natural Ingredients
Kernehemseweg 2
6710 BA Ede
The Netherlands
Tel.: +31 318 659540
Fax: +31 318 650400
E-mail: hugenhol@nizo.nl

Dr Kuipers, Oscar
University of Groningen
Department of Genetics
Biomolecular Sciences and Biotechnology Institute
Kerklaan 30, P.O. Box 14
9750 AA Haren
The Netherlands
Tel.: +31 50 3632152
Fax: +31 50 3632154
E-mail: o.p.kuipers@biol.rug.nl

Dr Hols, Pascal
Université Catholique de Louvain
Department of Biology
Croix du Sud, 5
1348 Louvain-la-Neuve
Belgium
Tel.: +32 10 478205
Fax: +32 10 472840
E-mail: hols@gene.ucl.ac.be

Dr van Sinderen, Douwe
University College Cork
National Food Biotechnology Centre
Western Road
Cork
Ireland
Tel.: +353 21 902347
Fax: ++353 21 903018
E-mail: douwe@ucc.ie

Dr Piard, Jean-Christophe
INRA Jouy-en-Josas
Unités de Recherches Laiteries et Génétique Appliquée
Domaine de Vilvert
78352 Jouy-en-Josas
France
Tel.: +33 1 34652079
Fax: +33 1 34652088
E-mail: piard@diamant.jouy.inra.fr

Dr Savoy, Graciela
Centro de Referencia para Lactobacilos
Department of Biotechnology
Chacabuco 145
PO Box 211
4000 San Miguel de Tucumán
Argentina
Tel.: +54 381 4310465
Fax: +54 381 4311720
E-mail: gsavoy@cerela.org.ar

Dr Joyeaux, André
Lallemand S.A.
PO Box 4412
31405 Toulouse Cedex 4
France
Tel.: +33 562 172828
Fax: +33 562 172380
E-mail: ajoyeaux@lallemand.com
Increase in nutritional value of food raw materials by addition, activity, or in situ production of microbial nutraceuticals

BACKGROUND

This proposal’s main objective is to improve the nutritional value of food raw materials and fermented food products. This will be accomplished by increasing the level of nutraceuticals in food products of dairy and soy origin. The targeted nutraceuticals are low-calory-sugars, digestion-stimulating oligosaccharides and essential B-vitamins. These components will all be produced by food-grade microorganisms. In addition, some undesirable sugars such as lactose, galactose and raffinose will be selectively removed from either dairy or soy-containing food products. The involvement of industrial partners in the area of dairy, nutritional foods and starter production ensures dissemination of the scientific results in a broad range of Food (and Pharma) applications.

OBJECTIVES

The objectives are to improve the nutritional value of foods by either fermentation with nutraceutical-producing food-grade microorganisms, by addition of nutraceuticals produced as ingredients by the bacterial cells or by direct (oral) delivery of the nutraceutical-producing microorganism to stimulate food digestion.

The health-promoting foods or food components (“Nutraceuticals”) targeted in this proposal can be categorised into five groups;

• No- or low-calory sugars such as mannitol and trehalose.
• Dairy products or dairy components with low lactose and/or galactose content and bacterial (starter) cultures with high lactose/galactose utilising activities.
• Soy products with low raffinose content and bacterial (starter) cultures with high raffinose-converting activity.
• Oligosaccharides as stimulants for the digestive system.
• B-vitamins such as folic acid (B11) and riboflavin (B2).

These five groups of food components will be enhanced in different foods through production or converting-activity of specific food-grade microorganisms. The nutraceutical-producing microorganisms will either be directly selected from natural sources, or induced for high production by specific fermentation conditions, or modified by food-grade genetic engineering techniques. The resulting strains and production processes will be implemented in food fermentation by the technological involvement of industrial experts.

(Expected) RESULTS AND ACHIEVEMENTS

R&D via line A will yield scientific results within one or two years and development of new or improved foods will be possible within three years. These potential products can be launched on the Food Market on short term basis since only natural strains are involved.

The scientific results obtained via R&D line B will become available after two to three years and the subsequent food products after three to four years. The results obtained will be more spectacular in the sense of bigger improvements in health status of the foods and food ingredients, but introduction on the Food (or Pharma) Market will be on a long term basis since genetically modified microorganism are involved.
Dr Santos, Helena
Instituto de Biologia Experimental e
tecnológica
PO Box Apartado 12
2781-901 Oeiras
Portugal
Tel.: +351 214427787
Fax: +351 214421161
E-mail: santos@itqb.unl.pt

Dr Bruinenberg, Paul
Campina Melkunie BV
Cheese Division
Jules Verneweg 87
PO Box 9294
5000 HG Tilburg
The Netherlands
Tel.: +31 13 5490436
Fax: +31 13 5436389
E-mail: bruinp@campina.com

Dr Kleerebezem, Michiel
Wageningen Centre for Food Sciences
Diedenweg 20
PO Box 557
6700 AN Wageningen
The Netherlands
Tel.: +31 318 659632
Fax: +31 318 650400
E-mail: kleerebe@nizo.nl
QLK1-2000-01376: Increase in nutritional value of food raw materials by addition, activity, or in situ production of microbial nutraceuticals
Plant food allergies:  
Field to table strategies for reducing their incidence in Europe  
SAFE

Contract number: QLK1-2000-01394  
Contract type: Shared Cost Project  
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Duration: 36 Months  
Scientific Officer: Barend Verachtert  
Project website: http://www.akh-wien.ac.at/safe/

Coordinator: Dr Karin Hoffmann-Sommergruber
University of Vienna
Währinger Gürtel 18-20
1090 Vienna
Austria
Tel.: +431 404000
Fax: +431 404005199
E-mail: Karin.Hoffmann@akh-wien.ac.at

Dr. Clare Mills
Institute of Food Research
Food Quality and Materials Science
Norwich Research Park, Colney
NR4 7UA Norwich
United Kingdom
Tel.: +44-1603 255000
Fax: +44-1603 307723
E-mail: clare.mills@bbsrc.ac.uk

Dr Ronald van Ree
Central Laboratory of The Netherlands
Red Cross Bloodtransfusion Service
Department of Allergy / C.L.B.
University of Amsterdam
Plesmanlaan 125
PO Box 9190
1006 AD Amsterdam
The Netherlands
Tel.: +31-20-5123479
Fax: +31-20-5123650
E-mail: r_van_ree@clb.nl

Dr Luud Gilissen
Plant International
Droevendaalsesteeg 1
PO Box 16
6700 AA Wageningen
The Netherlands
Tel.: +31-317 477250
Fax: +31-317 418094
E-mail: L.J.W.J.Gilissen@plant.wag-ur.nl

PARTNERS

Dr. Clare Mills
Institute of Food Research
Food Quality and Materials Science
Norwich Research Park, Colney
NR4 7UA Norwich
United Kingdom
Tel.: +44-1603 255000
Fax: +44-1603 307723
E-mail: clare.mills@bbsrc.ac.uk

Prof. Dr Margit Laimer da Camara
Machado
Institute of Applied Microbiology
Plant Biotechnology
University of Agriculture
Muthgasse 18
1190 Wien
Austria
Tel.: +43-1-360 06 62 01
Fax: +43-1-369 76 15
E-mail: M.Laimer@iam.boku.ac.at

Dr Montserrat Fernandez Rivas
Fundación Hospital Alcarcón
Unidad de Alergía
C/ Budapest 1
28922 Alcorcón
Spain
Tel.: +34 916219889
Fax: +34 916219902
E-mail: mfernandez@fhalconcon.es

Dr Schwald, Wolfgang
Rauch Fruchtsäfte GmbH
Langgasse 1
Postfach 170
6830 Rankweil
Austria
Tel.: +43-5522-401234
Fax: +43-5522-401 519
E-mail: wolfgang_schwald@rauch.cc

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Plant food allergies: Field to table strategies for reducing their incidence in Europe

BACKGROUND
The EU is actively encouraging consumption of fruit and vegetable for positive health benefits. Apples are the most widely grown and consumed fruit in Europe, but around one million people are apple allergic. A number of major apple allergens have been identified but detailed information on sensitisation patterns is lacking. Focusing on apple allergy the project will characterise allergens, and linkages with severe versus mild symptoms using fruit-allergic patients from across Europe. It will also provide the European Agro-Food industry with strategies to ensure the availability of high quality low allergen foods in European and export markets thus extending consumer choice of fresh or processed food stuffs with reduced or abolished allergenicity. It will also supply the consumer with reliable and independent information about low allergenic alternatives (existing cultivars and GMO).

OBJECTIVES
The major objective of this project is the reduction of the incidence of fruit allergy in Europe focusing on apple with findings then being extended to other fruits of the rosaceae. The agro-food industry will be provided with advice on agronomic practices storage conditions and processing methods that ensure production of marketable fruit with low allergen levels and thereby contribute to reducing the incidence of fruit allergies. Consumers will be provided with information about low allergenic alternatives and greater opportunity to purchase fresh or processed food stuffs with reduced or abolished allergenicity. Methods will be developed (i) to improve diagnosis of food allergy (ii) for quality control of apple allergenicity in fresh fruit/processed foods.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Year 1: Web site for information dissemination.
Year 2: Screening techniques for allergen levels in fresh fruits/fruit products; identification of cultivars with low allergen; production of recombinant allergens.
Year 3: Patient allergen profiles linked to geographic areas and mild severe symptoms. Effects of ripening/treatments/processing on allergen levels determined. Consumer attitudes towards low allergenic cultivars evaluated. Methods established to investigate the function of one apple allergen.

Exploitation will be evaluated during this project in relation to the following aspects:
- evaluation of low allergen varieties;
- marker-assisted breeding;
- processing strategies to minimise allergen contents in foods;
- exploitation of fundamental knowledge of allergen properties in diagnosis and prevention of food allergies.
QLK1-2000-01394: Plant food allergies: field to table strategies for reducing their incidence in Europe
Enhancing the content of beneficial fatty acids in beef and improving meat quality for the consumer

HEALTHYBEEF

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Contract type: Shared Cost Project
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EC contribution: € 1,920,272
Starting date: 1/11/2000
Duration: 36 Months
Scientific Officer: Antonio di Giulio
Project website: www.healthybeef.iger.bbsrc.ac.uk

Coordinator:
Dr Nigel Scollan
Institute of Grassland and Environmental Research
Animal Science and Microbiology
Plas Gogerddan
SY23 3EB Aberystwyth, Ceredigion, Wales
United Kingdom
Tel.: +44-1970 823075
Fax: +44-1970 828357
E-mail: nigel.scollan@BBSRC.ac.uk

PARTNERS

Prof. Jeff Wood
The University of Bristol
Division of Food Animal Science
Langford
BS40 5DU Bristol
United Kingdom
Tel.: +44 117 928 9293
Fax: +44 117 928 9324
E-mail: jeff.wood@bristol.ac.uk

Dr Michel Doreau
INRA
Unité de Recherches sur les Herbivores
63122 St Genes-Champanelle
France
Tel.: +33 473 624113
Fax: +33 473 624519
E-mail: Doreau@clermont.inra.fr

Prof. Stefaan de Smet
University of Gent
Division of Food Animal Science
Proefhoevestraat 10
9090 Melle
Belgium
Tel.: +32-9 2649000
Fax: +32-9 2649099
E-mail: Stefaan.DeSmet@rug.ac.be

Mr Mark Field
Southern Counties Fresh Foods Ltd
Muchelney Road
Huish Episcopi, Langport
TA10 9HE Somerset
United Kingdom
Tel.: +44 1458 254545
Fax: +44 1458 254534
E-mail: mark@scff-rwm.co.uk

Dr Aidan Moloney
Teagasc
Grange Research Centre
Dunsinea, County Meath
Ireland
Tel.: +353-46 25214
Fax: +353-46 26154
E-mail: amoloney@grange.teagasc.ie

Dr Karin Nuernberg
Research Institute for The Biology of Farm Animals
Wilhelm-Stahl-Allee 2
18196 Dummerstorf
Germany
Tel.: +49/38208/68857
Fax: +49/38208/68852
E-mail: knernbg@fhn-dummerstorf.de
Enhancing the content of beneficial fatty acids in beef and improving meat quality for the consumer

BACKGROUND

The aim of this project is to improve the quality of life for the EU consumer by developing strategies for the production of beef with improved nutritional value and quality. The content of saturated fat will be decreased while increasing the content of beneficial n-3 polyunsaturated fatty acids and conjugated linoleic acid. The project seeks to exploit more extensive beef production practices with higher forage inputs (grass and clover), which are the primary source of n-3 fatty acids (mainly alpha-linolenic acid; C18:3n-3). Four beef production systems representative of those used in the EU, but varying in level of intensification will be examined. Beef produced will be characterised for fatty acid composition and meat quality, especially flavour. The role of the rumen and post absorption processes in regulating the dietary potential to manipulate the fatty acid composition of beef will be examined.

OBJECTIVES

To develop strategies (nutritional, use of different breeds and types of animals) for production of beef which is healthier for the consumer by having a higher content of n-3 fatty acids and conjugated linoleic acid (CLA). These fatty acids also affect meat quality (in particular shelf life and flavour). This work will aim to produce levels of fatty acids in beef which optimise healthiness, shelf life and flavour. The research will offer added value to the consumer in terms of a more healthy and wholesome food produced using methods, which are safe and more natural, based on local breeds and feed resources. The producer will also benefit by adapting strategies to produce more healthy and natural beef, which may command a premium in the market.

The project consists of four Workpackages which have the following objectives:

• To examine novel strategies, nutritional and genotypic, to produce beef with a fatty acid composition which is more consistent with current human health recommendations and consumer requirements (increased P:S ratio, higher amounts of n-3 polyunsaturated fatty acids and CLA) and improved meat quality. The nutritional regimes will focus on the strategic use of grass and/or concentrates rich in C18:3n-3 such as linseed. This Workpackage also contains important exploitation and dissemination plans for the project, including a consensus platform.

• To understand events in the rumen (lipolysis and biohydrogenation) and post-absorption which determine the ability of the diet to manipulate the fatty acid composition of beef.

• To assess the impact of strategies imposed in Workpackage 1 on the fatty acid composition of beef, focusing on long chain PUFA, CLA, trans- and branched-chain fatty acids.

• To assess the impact of strategies imposed in Workpackage 1 on flavour attributes of beef an important part of meat quality and to establish relationships between fatty acid amounts and intensity of individual flavours.
(EXPECTED) RESULTS AND ACHIEVEMENTS

• Completion of a number of experiments designed to produce beef with improved nutritional characteristics. Four beef production systems representative of those used across the EU, but varying in intensification will be examined: (i) grass silage and concentrates-based steer beef; (ii) total herbage-based steer beef, (iii) high energy bull beef, and (iv) high energy bull (with the muscular hypertrophy condition) beef.

• Characterisation of feeds and ruminal and post-absorptive events which may alter and/or regulate the fatty acid composition of beef. The following are targets, rumen lipolysis and biohydrogenation, composition of absorbed fatty acids, the impact of dietary n-3 PUFA on lipid transport, muscle metabolism and fatty acid peroxidation.

• Characterisation of the fatty acid composition and meat quality characteristics of beef. Fatty acids will be principally n-3 PUFA, CLA, trans- and branched-chain fatty acids. Flavour attributes of beef and interactions with fatty acids are key targets for the project.

Applications:

• Novel systems which will permit the production of beef with improved nutritional value in terms of fatty acids thus providing a healthier quality product for the consumer.

• An improved understanding of the interactions which exist between fatty acid composition of beef and meat quality (shelf-life and flavour).

• The research will contribute to the development of food raw materials better adapted for consumer requirements and will promote nutritionally beneficial food components. In achieving this, efficient use of natural resources (for example grass and legumes; local breeds) will be exploited.

PARTNERS

Dr P. Dirinck
Chemisch en Biochemisch Onderzoekscenrum
KaHo Sint-Lieven
Gebr. Desmetstraat 1
9000 Gent
Belgium
Tel.: +
Fax: +
E-mail:
QLK1-2000-01423: Enhancing the content of beneficial fatty acids in beef and improving meat quality for the consumer
Structure engineering of emulsions by micro-machined elongational flow processing

STRUCTURE PROCESSING

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EC contribution: € 1.011.778
Starting date: 1/12/2000
Duration: 36 Months
Scientific Officer: Alkmini Katsada
Project website: not yet available

Coordinator: Dr Anne-Marie Hermansson
Institutet för Livsmedel och Bioteknik AB (SIK)
402 29 Gothenburg
Sweden
Tel.: +46 31 3355658
Fax: +46 31 833782
E-mail: amh@sik.se

PARTNERS

Prof. Dr. Windhab, Erich J.
Swiss Federal Institute of Technology
Zürich Institute of Food Science
Laboratory of Food Process Engineering
Universitätstrasse 2
8092 Zürich
Switzerland
Tel.: +41-1 6325348
Fax: +41-1 6321155
E-mail: Windhab@ilw.agrl.ethz.ch

Prof. Dr. Rehage, Heinz
Universität-Gesamthochschule Essen
Institut für Physikalische Chemie
Universitätsstraße 3-5
45141 Essen
Germany
Tel.: +49-201 183 3987
Fax: +49-201 183 3951
E-mail: heinz.rehage@uni-essen.de

Dr Lammers, Jan
Unilever Nederland BV
Unilever Research Vlaardingen
Weena 455
PO Box 114
3133 AT Vlaardingen
The Netherlands
Tel.: +31 10 4605911
Fax: +31 10 4605383
E-mail: jan.lammers@unilever.com

Mrs Arph, Helena
Tetra Park Processing Systems Ab
Ruben Rausings Gata
22186 Lund
Sweden
Tel.: +46 46 362447
Fax: +46 46 362970
E-mail: helena.arph@tetrapak.com
Structure engineering of emulsions by micro-machined elongational flow processing

BACKGROUND
The results of this project lead to new technology for production of emulsion-based food products with innovative functional properties and improved product quality. This project provides a unique structure-engineering concept, where knowledge of structure formation is combined with process design and completely new concepts for micro-machine processing. New functionality will be generated by structures of active particles with designed size and shape. The project is multidisciplinary and bridges the gap between fundamental knowledge about structure formation and equipment available to produce products based on this technology. The objectives will be achieved by work on particle structuring, interfacial behaviour, fluid dynamics, process design, equipment development and particle functionality.

OBJECTIVES
The overall objective of the project is to enhance the competitiveness of the European food industry by providing new technology that will enable the production of new types of emulsion-based food products with structure-related functional properties. Consumer demands for high quality products with improved texture and nutritional properties require not only a scientific basis but also new technology on how to engineer and produce such products. In this project, micro-machining in combination with flow processing design and in depth knowledge of structure formation will provide new technology for structure engineering of particles on the micron-scale. Structured particles with improved functionality can provide new products with a range of textures. Technology for the production of narrow- sized particles with designed surface properties as carriers for active compounds creates opportunities for a new generation of functional foods.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The project will provide new technologies for structure engineering of emulsion based-food products by micro-machine processing with structure related functional properties. Important milestones are:

- Technologies for process-structured particles with regard to shape, size and surface properties;
- Process design for the construction of new equipment;
- Model and bench scale equipment;
- Relationships between particle structure and functionality with emphasis on rheological properties.
STRUCTURE PROCESSING

- Particle structuring
- New interfaces
- Particle functionality
- Flow process
- New equipment design
- Micro-Machining
Improved quality of smoked salmon for the European consumer
EUROSALMON

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Starting date: 1/12/2000
Duration: 36 Months
Scientific Officer: Sigurdur Bogason
Project website: www.mmedia.is/matra/eurosalmon

Coordinator:
Dr Helga Gunnlaugsdóttir
Technological Institute of Iceland
Matra
Keldnaholt
112 Reykjavik
Iceland
Tel.: +354 5707100
Fax: +354 5707111
E-mail: helgag@iti.is

Dr Ole Johan Torrissen
Institute of Marine Research
Nordnesgaten 50
PO Box 1870
5817 Bergen
Norway
Tel.: +47 561 80342
Fax: +47-56180398
E-mail: olet@imr.no

Mr Jean-Luc Vallet
Institut Français de Recherche pour l'Exploitation de la Mer IFREMER
Laboratoire Génie Alimentaire
Rue de l’Île d’Yeu
PO Box 21105
44311 Nantes Cedex 3
France
Tel.: +33-240374000
Fax: +33-240374071
E-mail: jean.luc.vallet@ifremer.fr

Ms Huguette Nicod
Adriant
Rue Pierre Adolphe Bobierre
BP 62303
44323 Nantes Cedex 3
France
Tel.: +33-2 51776800
Fax: ++33-2 40401658
E-mail: h.nicod@adriant.com

PARTNERS
Improved quality of smoked salmon for the European consumer

BACKGROUND

Over 80% of the world production of farmed Atlantic salmon is farmed in Europe. About 40% of this quantity, or above 250,000 tons, is smoked. Recently, concerns have been expressed by smoked salmon producers regarding the flesh quality and suitability for smoking of salmon that is farmed today. The main purpose of the project is to establish the necessary technical base to solve the main quality problems related to smoked salmon products. This will be carried out by multidisciplinary research activities carried out in a continuous chain from farming to the consumer using physical, chemical and sensory measurements. To understand the origin of these phenomena, an experimental design is proposed to identify influential factors such as feed/feeding and salting and smoking processes on the quality of the final product and to adapt the results to consumer’s expectations in five different market segments in Europe.

OBJECTIVES

The main objectives of the project are to improve the quality of smoked salmon by enabling the European industry to deliver salmon with adapted quality to the different market segments in Europe. Furthermore, the aim of the project is to establish the necessary technical base to solve the main quality problems, i.e. fat leakage in processing and colour fading during storage, related to smoked salmon products.

This will be achieved by:

• Mapping differences between preferences and deliveries by:
  • Map the preference/habit of consumption of smoked salmon in selected EU-countries
  • Map sensorial, chemical and physical characteristics of smoked salmon in selected EU-countries.
  • Tailoring smoked salmon according to consumer preferences by:
    • Investigate the effects of chilled storage prior to smoking, final product salt content and smoking temperature during smoking on the predicted quality characteristics for different raw materials.
  • Understand the mechanism behind fat leakage to be able to control it.
  • Understand the mechanisms behind colour fading to be able to control it.

(EXPECTED) RESULTS AND ACHIEVEMENTS

• The project will increase the competitiveness of the European salmon production and smoking industry by enable them to deliver products to the European markets that satisfy the consumers preferences.
• Better understanding on the mechanism behind fat leakage and colour fading will make it easier to control the quality of smoked salmon, hence, fewer incidences where unequal quality causes significant losses can be expected.
• Products that are of consistent quality will result in increased competitiveness as well as improved image of the product and producer.

The extension of possible markets for SMEs within Europe could be achieved with the dissemination of results through an established user group. The information will enable farmers and SME processors to tune the attributes of their products more efficiently to different market requirements.
Traceability of DNA fragments throughout the food chain
by DNA/PNA technologies: Application to novel foods
DNA-TRACK

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EC contribution: € 1,787,510
Starting date: 1/01/2001
Duration: 36 Months
Scientific Officer: Rosanna d’Amario
Project website: http://www.dsa.unipr.it/~foodhealth/

Coordinator:
Dr Nelson Marmiroli
University of Parma
Parco Area delle Scienze
43100 Parma
Italy
Tel.: +39-0521 905606
Fax: +39-0521-905665
E-mail: marmirol@ipruniv.cce.unipr.it

Dr Paolo Donnini
National Institute of Agricultural Botany
Huntingdon Road,
Cambridge CB3 0LE
United Kingdom
Tel.: +44 01223 342338
Fax: +44 01223 277602,
E-mail: paolo.donmini@niab.com

Dr Sergio Schmid
University of Applied Sciences
School of Engineering Valais
Route du Rawyl 47
1950 Sion
Switzerland.
Tel.: +41 27 606 8653
Fax: +41 27 606 8615,
E-mail: sergio.schmid@hevs.ch

Dr Gianluca De Bellis
Istituto di Tecnologie Biomediche
Consiglio Nazionale delle Ricerche
Via Fratelli Cervi 93
20090 Segrate Milano
Italy
Tel.: +39 02 26422762
Fax: +39 02 26422770,
E-mail: debellis@itba.mi.cnr.it

Dr Claudia Salati
PROGEO Soc. Coop. ARL
Via Asseverati 1
42029 Villa Masone (Reggio Emilia)
Italy
Tel.: +39 0521 346459
Fax: +39 0522 346411
E-mail: c.salati@progeo.it

Dr Wolfgang Knoll
Max-Planck-Institut für Polymerforschung
Ackermannweg 10
55128 Mainz
Germany
Tel.: +49 6131 379 160
Fax: +49 6131 379 360
e-mail: knoll@mpip-mainz.mpg.de

Dr Corrado Fogher
Plantechno S.R.L
Via Staffolo 60
26040 Vicoscosano Cremona
Italy
Tel.: +39 0375 201366
Fax: +39 0375 200678
E-mail: info@plantechno.com
Traceability of DNA fragments throughout the food chain by DNA/PNA technologies: Application to novel foods

BACKGROUND
The project concerns DNA detection in raw materials and foods. Traceability of DNA tracts through the food chain will be studied. The project involves well-established methods based on PCR, advanced PCR methods, and Real Time PCR, which allow precise quantification, and development of new method development of DNA microarrays. A new PNA-technology, actually aimed at biomedical diagnostics will be established as complementary to PCR, aimed at improving sensitivity, selectivity and increased detection limits in food. Validation of different methods will be performed, in order to provide updated criteria of choice in food control through the food chain. Application to genetically modified organisms (GMOs) will be performed. Food industries, retailer’s groups, consumers’ associations and universities are involved.

OBJECTIVES
• to develop advanced analytical methods for DNA fragments targeting throughout the food chain;
• to validate these methods at the level of a food network and to evaluate their applicability;
• to establish a “de minimis” threshold of detection for these methods which can help in discriminating adventitious contamination;
• to provide the technical innovation that will be utilised by decision makers and regulators to establishing the so called “negative list” i.e. the list related to products which have been excluded, because they should not contain DNA of alien origin;
• All the above mentioned methods will be validated by partners who have a long experience in food sampling and food analysis.

EXPECTED RESULTS AND ACHIEVEMENTS
• to develop advanced analytical methods for targeting DNA fragments throughout the food chain;
• to validate these methods at the level of food network and to evaluate their applicability;
• to establish a de minimis threshold of detection for these methods which can help in discriminating adventitious contamination;
• to provide the technical innovation that will be utilised by decision makers and regulators to establishing the so called “negative list” i.e. the list related to products which have been excluded, because they should not contain DNA of alien origin;
• to validate all the above mentioned methods by partners who have a long experience in food sampling and food analysis.
Dr Peter Nielsen  
University of Copenhagen  
Department of Medical Biochemistry and Genetics  
Blegdamsvej 3c  
2200 Copenhagen N  
Denmark  
Tel.: +45 353 27762  
Fax: ++45 353 96042,  
E-mail: pen@imbg.ku.dk

Dr Rosangela Marchelli  
University of Parma  
Department of Chemistry  
Parco Area delle Scienze 17/A  
43100 Parma  
Italy  
Tel.: +39 0521 905410  
Fax: +39-0521-905472  
E-mail: marchell@unipr.it
QLK1-2000-01658: Traceability of DNA fragments throughout the food chain by DNA/PNA technologies: Application to novel foods
Nutritional enhancement of probiotics and prebiotics: Technology aspects on microbial viability, stability, functionality and on prebiotic function

PROTECH

Contract number: QLK1-2000-30042
Contract type: Shared Cost Project
Total cost: € 3.007.294
EC contribution: € 1.680.059
Starting date: 1/12/2000
Duration: 48 Months
Scientific Officer: Jürgen Lucas
Project website: http://www.vtt.fi/virtual/proeuhealth/

Coordinator:
Prof. Dr Dietrich Knorr
Technische Universität Berlin
Lebensmittelbiotechnologie und -prozesstechnik
Königin-Luise-Straße 22
14195 Berlin
Germany
Tel.: +49-30-31471250
Fax: +49-30-8327662
E-mail: dietrich.knorr@tu-berlin.de

Prof. Dr Ir. Fons Voragen
Wageningen Agricultural University
Department of Food Technology and Nutritional Sciences
Bomenweg 2
PO Box 8129
6703 HD Wageningen
The Netherlands
Tel.: +31-317-48 32 09
Fax: +31-317-48 48 93
E-mail: Fons.Voragen@chem.fdsci.wau.nl

Dr Margareta Nyman
Lund University
Applied Nutrition and Food Chemistry
Getingevägen 60
P.O. Box 124
221 00 Lund
Sweden
Tel.: +46-46-22 24 567
Fax: +46-46-22 24 532
E-mail: Margareta.Nyman@inl.se

Prof. Dr Gerald Fitzgerald
National University of Ireland
University College Cork
Dept. of Microbiology
National Food Biotechnology Centre
Cork
Ireland
Tel.: +353-21-90 27 30
Fax: +353-21-27 63 18
E-mail: g.fitzgerald@ucc.ie

Dr Maria Saarela
Technical Research Centre of Finland
VTT Biotechnology and Food Research
Tietotie 2
PO Box 1500
02044 VTT Espoo
Finland
Tel.: +358-9-45 61
Fax: +358-9-45 52 028
E-mail: Maria.Saarela@vtt.fi

Dr Roberto Reniero
Nestec S.A.
Nestlé Research Center
Department of Bioscience
PO Box 44
1000 Lausanne Cedex 26
Switzerland
Tel.: +41-21-785 82 08
Fax: +41-21-785 89 25
E-mail: roberto.reniero@rdls.nestle.com

Dr Riitta Korpela
Valio Ltd
Meijeritie 4
PO Box 30
00039 Helsinki
Finland
Tel.: +358-10-381 3026
Fax: +358-10-381 3019
E-mail: Riitta.Korpela@Valio.fi

PARTNERS
Nutritional enhancement of probiotics and prebiotics: Technology aspects on microbial viability, stability, functionality and on prebiotic function

BACKGROUND
The purpose of the project is to address and to overcome specific scientific and technological hurdles that impact on the performance of functional foods based on probiotic-prebiotic interactions. Such hurdles include the lack of strong knowledge on the primary factors for probiotic viability, stability and performance as well as on probiotic-prebiotic interactions. The project will systematically explore effects of processing on functionality of probiotics and on probiotic performance, apply selected processing techniques for prebiotic modification, and use the information generated for new process and product options.

OBJECTIVES
The project has three general objectives:
• to systematically explore effects of processing on the functionality of probiotics and on the performance of prebiotics;
• to apply selected processing techniques for prebiotic modification to identify and optimise probiotic-prebiotic combinations;
• to use the information generated as the basis for new process and product options.

The five specific objectives are:
• to systematically consolidate quantitative data regarding physiological and processing effects on the viability of probiotic organisms;
• to acquire methodologically quantitative information on the processing induced stability of probiotic organisms;
• to evaluate the potential of prebiotic-probiotic interactions for favourable effects on probiotic performance within food matrices;
• to identify critical process parameters for targeted transformation and modification of prebiotics;
• to obtain sufficient knowledge on processing dependent and prebiotics supported probiotic functionality in food systems.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Expected achievements include the establishment of unique data sets that include the identification of critical process parameters for probiotics and prebiotics and results from systematic studies suggesting means to overcome existing process and product limitations. The compilation of protocols for probiotic performance, prebiotic function and probiotic-prebiotic interactions will also be provided. Further, it is expected to establish probiotic viability models and functionality biomarkers. In addition, it is attempted to achieve optimisation of probiotic viability, stability in culture and real food systems at pilot plant scale, generation and modification of unique prebiotics, of probiotic interactions and of environmentally and processing induced functionality of probiotics. Application of the expected results will lead to new process concepts for probiotics, for prebiotics and for probiotic-prebiotic combinations. Special emphasis of the development of product concept will be on cereal and dairy-based products and on the development and incorporation of unique plant based prebiotics for optimum interaction between prebiotics performance and probiotics function.
Dr Juha Apajalahti
Danisco Cultor Innovation
Sokeritehtaantie 20
02460 Kantvik
Finland
Tel.: +358-9-29 74 684
Fax: +358-9-29 82 203
E-mail: juha.apajalahti@danisco.com

Mr Rudy Wouters
Tiense Suikerraffinaderij NV
Aandorenstraat 1
3300 Tienen
Belgium
Tel.: +32-16-80 1213
Fax: +32-16-80 1308
E-mail: rudy_wouters@tnn.raftir.be
Production of fungal carotenoids for healthy nutrition
FUNGAL CAROTENOIDS

Contract number: QLK1-2001-00780
Contract type: Shared Cost Project
Total cost: €1,659,459
EC contribution: €1,337,052
Starting date: 1/11/2001
Duration: 36 Months
Scientific Officer: Dyanne Bennink
Project website: not yet available

Coordinator:
Dr Javier Avalos
Universidad de Sevilla
Departamento de Genética
41012 Sevilla
Spain
Tel.: +34 954 557110
Fax: +34 954 557104
E-mail: avalos@cica.es

PARTNERS

Prof. Dr Bramley, Peter
Royal Holloway and Bedford New College
University of London School of Biological Sciences
Egham Hill
TW20 0EX
United Kingdom
Tel.: +44 1784 443555
Fax: +44 1784 434326
E-mail: p.bramley@rhbnc.ac.uk

Dr Sandmann, Gerhard
J.W. Goethe-Universität
Botanisches Institut
Siesmayer Straße 70
PO Box 11932
60054 Frankfurt/M.
Germany
Tel.: +49 69 798 24746
Fax: +49 69 798 24822
E-mail: sandmann@em.uni-frankfurt.de

Dr Verdoes, Jan
Wageningen University
Department of Food Technology and Nutritional Sciences
Bomenweg 2
PO Box 8129
6700 EV Wageningen
The Netherlands
Tel.: +31 317 482302
Fax: +31 317 484978
E-mail: jan.verdoes@imb.ftns.wau.nl

Dr Barredo, José Luis
Antibioticos S.A.
Avda. de Antibióticos, 59-61, PO Box
Apdo. 255
24080 León
Spain
Tel.: +34 987 895819
Fax: +34 987 895810
E-mail: acollados@antibioticos.it

Dr Christiansen, Christian
Wild R&D Colors
Am Schlangengvalen 3
13597 Berlin
Germany
Tel.: +49 30 33087214
Fax: +49 30 33087207
E-mail: Christian.Christiansen@wild-group.de
Production of fungal carotenoids for healthy nutrition

BACKGROUND
The project intends to promote a more extensive use of natural carotenoids as safe food additives in Europe. Carotenoids, which have important beneficial effects on human health, are produced by chemical or biological means. The fungi *Blakeslea* and *Xanthophyllomyces* are used by European industry for the production of beta-carotene and astaxanthin. Biological production is favoured by current preferences for natural products, but to compete with chemical industries, fungal carotenoid yields must be improved. The major goal of this project is to increase the knowledge on (a) the genes and the enzymes of the carotenoid pathway; (b) the relationships between gene expression, enzyme levels, and carotenoid production; and (c) the mechanisms of accumulation or sequestering of carotenoids in the cell. This information will allow the scientific partners to get through genetic engineering fungal strains with improved carotenoid biosynthesis; to be used by industrial partners for the biotechnological production of carotenes and the development of new carotene-rich food products.

OBJECTIVES
The objectives are grouped in five main topics:

• Genes and enzymes of the carotenoid pathway. Cloning of new crt and car genes in *Xanthophyllomyces* and *Blakeslea*. Expression of available and newly isolated genes in *E. coli*, characterisation of the enzymes, and production of specific antibodies.

• Cellular mechanisms for carotenoid storage in *Xanthophyllomyces* and *Blakeslea*. Relation between lipid biosynthesis and carotenoid accumulation. Subcellular localisation of carotenoid biosynthesis. Proteins and genes responsible for carotenoid storage in lipid globules.

• New improved strains of *Xanthophyllomyces*. Metabolic pathway engineering. Manipulation of regulatory signals and expression of engineered homologous and heterologous genes.

• New improved strains of *Blakeslea*. Development of a transformation method.

• Applied use of improved fungal strains. Improvement of fermentative conditions. Formulation of carotenoid products. Development of new carotene-rich food and beverages.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The set of available genes will be completed with new isolations, including the first carotene hydroxylase and ketolase genes from fungi. The genes will be expressed in *E. coli* and their protein products will be characterised and purified for the preparation of specific antibodies. A single biofunctional gene, responsible for phytoene synthase and lycopene cyclase, will be investigated at the biochemical level and their respective domains will be separated in independent peptides. The relationship between carotenoid accumulation and lipid composition in *Xanthophyllomyces* and *Blakeslea* will be established. The compartments where carotenoids are accumulated will be identified and characterised. The identification of the proteins and lipids involved in carotenoid storage in *Blakeslea* will allow the cloning of the corresponding genes. Overexpression of these genes may remove the upper limits for the production of carotenoids. The regulatory mechanisms governing the expression of the carotenoid genes of *Blakeslea* and
Xanthophyllomyces will be investigated. Cloned genes will allow the determination of transcription levels and antibodies that of enzyme levels. Checking the effect of targeted deletions on gene expression will identify key sequences for promoter activity.

Novel strains of Xanthophyllomyces with improved quantitative and qualitative production of carotenoids will be obtained. Structural genes will be overexpressed to overcome bottlenecks in the biosynthetic pathway. Gene shuffling in E. coli will improve the activity of heterologous gene products. New genes inducing or repressing carotenoid biosynthesis will be identified.

A transformation method will be developed for Blakeslea and novel strains with improved beta-carotene and lycopene production will be created. The hydroxylase and ketolase genes of Xanthophyllomyces will be expressed in Blakeslea to obtain new strains producing xanthophylls.

The industrial partners will verify the practical value of the new strains of Xanthophyllomyces and Blakeslea provided by the scientific partners. The fermentation conditions at pilot and industrial scale will be improved for these new strains. New raw materials will be tested to reduce fermentation costs. The new carotene fermentation products will be formulated to produce new carotene-rich food and beverages.
QLK1-2001-00780: Production of fungal carotenoids for healthy nutrition
DNA biosensor for analytical investigation and labelling in food
DNA-BAILIF

Contract number: QLK1-2001-00876
Contract type: Shared Cost Project
Total cost: € 1.899.440
EC contribution: € 730.220
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Barend Verachtert
Project website: not yet available

Coordinator:
Dr Helen Berney
National University of Ireland, Cork
National Microelectronics Research Centre
Prospect Row
Cork
Ireland
Tel.: +35321904010
Fax: +35321270271
E-mail: hberney@nmrc.ucc.ie

PARTNERS

Dr Schinkinger, Manfred
Sy-Lab Geräte, Zubehör und Systeme GmbH
Tullnerbachstraße 61-65
PO Box 47
3002 Purkersdorf
Austria
Tel.: +43-2231-622 5220
Fax: +43-2231-621 93
E-mail: pm-microbiology@sylab.com

Ana Carmen Martin Rodríguez
Bionostra, S.L.
Ronda de Poniente 4, 2 C
28760 Tres Cantos (Madrid)
Spain
Tel.: +00 34 91 8060068
Fax: +00 34 91 8060349
E-mail: acmartin@bionostra.com

Dr Steingrimsdottir, Herdis
Microzone Ltd
112 Malling Street
BN7 2RJ Lewes
United Kingdom
Tel.: +44-1273 483 349
Fax: +44-1273 483 391
E-mail: info@microzone.co.uk

Prof. Gijs, Martin
Ecole Polytechnique Fédérale de Lausanne
Department of Microengineering
Institute of Microsystems
Ecublens
1015 Lausanne
Switzerland
Tel.: +41-216-93 67 34
Fax: +41-216-93 59 50
E-mail: martin.gijs@epfl.ch
DNA biosensor for analytical investigation and labelling in food

BACKGROUND

The requirement to distinguish GM and non-GM crops has become an increasing burden on EU food processors, retailers and feed merchants, given the labelling requirements demanded by EU legislation (Regulations 258/97 and 1139/98). The non-segregation policy of US farmers and distributors has created a situation in which costly certification processes have to be managed in order to assure the consumer of the correct labelling of foods and food ingredients. Given the increase in the extent of GM crop cultivation worldwide (over 70 million acres in 1998), and within the EU (primarily in Spain and France), the need for labelling and validation of labelling legislation demands efficient and reliable analysis to allow importers, processors and retailers to identify crops which have been genetically modified. The design of rapid and economically viable detection methods based on DNA probes allied to microchip technology will allow validation and identification of GM crops. The added value to the community will come from a number of sources. Obviously, the market for such detection modules will be enormous, both inside and outside of the Community. Equally, the ability to reassure the customer base of the validity of EU labelling legislation will lead to increased confidence in foods of EU origin, with a concomitant increase in sales.

The EU policy can be simply stated in that Regulation 1139/98 requires the development of validated analytical methods. We believe that the combination of technologies, research groups, and industries involved in this proposal can deliver on this vital EU policy objective.

OBJECTIVES

The overall aim of this project is to develop methodologies and sensor arrays for the accurate, sensitive and rapid identification of DNA associated with genetically modified (GM) plant material. Bearing in mind the importance of consumer confidence and the necessity to adequately test and label foods, it is necessary to develop a system, comprising methodologies and state of the art technologies, for high throughput screening of plant materials. It is envisaged that such an approach will ultimately make possible effective monitoring and policing of the distribution and labelling of GM and non-GM foods.

(EXPECTED) RESULTS AND ACHIEVEMENTS

• Development of a DNA release and multiplex PCR protocol
• Development of a miniaturised detection system based on sensor array technology
• Development of a handheld instrument for the measurement of output signals from the sensor arrays.
DNA-Bailif: DNA Biosensor for Analytical Investigation and Labelling in Food

A: DNA Extraction from Plant Cells

B: Multiplex PCR Amplification

C: Hybridisation Detection

Promoter (CaMV 35S)
Transgene (e.g. herbicide resistance)
 Terminator (NOS)
Stress-tolerant industrial yeast strains for high-gravity brewing
HIGH-GRAVITY STRESS

Contract number: QLK1-2001-01066
Contract type: Shared Cost Project
Total cost: € 3.214.800
EC contribution: € 2.320.800
Starting date: 1/09/2001
Duration: 48 Months
Scientific Officer: Dyanne Bennink
Project website: not yet available

Coordinator:
Dr Johan Thevelein
Katholieke Universiteit Leuven
Laboratory of Molecular Cell Biology
Kasteelpark Arenberg 31
3001 Leuven-Heverlee
Belgium
Tel.: +32 16 321507
Fax: +32 16 321979
E-mail: johan.thevelein@bio.kuleuven.ac.be

PARTNERS

Prof. Hohmann, Stefan
University of Göteborg
Dep of Cell and Molecular Biology/Microbiology
Medicinaregatan 9C
PO Box 462
41390 Göteborg
Sweden
Tel.: +46 31 7732595
Fax: +46 31 7732599
E-mail: hohmann@gmm.gu.se

Dr Bond, Ursula
Department of Microbiology
Moyne Institute of Preventive Medicine
Trinity College
University of Dublin
Dublin 2
Ireland
Tel.: +353 1 6082578
Fax: +353 1 6799294
E-mail: ubond@tcd.ie

Dr Steensma, Yde
Leiden University
Institute for Molecular Plant Sciences
Wassenaarseweg 64
PO Box 9505
2333 AL Leiden
The Netherlands
Tel.: +31 71 5274947
Fax: +31 71 5274999
E-mail: steensma@rulbim.leidenuniv.nl

Dr Kielland-Brandt, Morten
Carlsberg A/S
Gamle Carlsberg Vej 10
2500 Copenhagen
Denmark
Tel.: +45 33 275331
Fax: +45 33 274765
E-mail: mkb@crc.dk

Prof. Penttilä, Merja
VTT Biotechnology
PO Box 1500
02044 VTT Espoo
Finland
Tel.: +358 9 4564504
Fax: +358 9 4552103
E-mail: merja.penttila@vtt.fi

Dr Walsh, Michael
Heineken Technical Services
Heineken Technical Services
The Netherlands
Tel.: +31 71 5457817
Fax: +31 71 5457208
E-mail: m.c.walsh@heineken.nl
Stress-tolerant industrial yeast strains for high-gravity brewing

BACKGROUND
European breweries realise 25% of world beer production, representing total sales of 4.5 billion euros, and employ 115,000 people. A process of increasing importance is High-Gravity Brewing which permits more efficient and cleaner production of beer of high quality. It makes use of a higher-density wort with a higher initial sugar level. The higher osmolarity and final alcohol content cause a significant delay in fermentation and drop in yeast viability, resulting in undesirable flavour profiles. This project will isolate mutants in brewer’s yeast strains with improved tolerance to the stressful HGB conditions. The mutants will be characterised with genomic approaches. Genetic alterations will be identified and used to construct strains with further improved resistance. Evaluation will be done on lab and pilot scale and in a demonstration project.

OBJECTIVES
The main goal of this project is to solve the problems of delayed fermentation, reduced viability and undesirable flavour profile in High-Gravity Brewing, due to the lack of stress resistance of brewer’s yeast. A wort density of e.g. 18°Plato results in a final alcohol content of 7.5%, representing an increase of 50% in productivity. Mutants in brewer’s yeast strains will be isolated with improved fermentation under HGB conditions. They will be evaluated for all commercially important properties in lab and pilot scale. Further objectives are their characterisation using genomic approaches, determination of resistance to individual stress factors, identification of the genetic alterations responsible for higher resistance, construction of strains with further improvement and extension of the scope of stress resistance and evaluation in a demonstration project.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Development of novel genetic tools for investigation of polyploid industrial yeast strains. A transposon insertion mutagenesis library and a constitutive promoter cDNA library will be constructed with a marker selectable in polyploid strains.
• Isolation of mutant and transformant strains with a higher resistance to High-Gravity Brewing (HGB) conditions. Brewer’s strains will be mutagenised by classical and transposon mutagenesis and transformed with the cDNA library. Genetic screens will be established for strains with a better fermentation rate and survival on media mimicking HGB and media with individual stress conditions considered to be relevant for HGB: high osmolarity, high ethanol, starvation and forced intracellular acidification. Stress-resistant mutants and transformants will be selected directly in the industrial strains.
• Characterisation of the stress-resistant strains. Genomic approaches with micro-array hybridisation and 2D separation of proteins will be used to identify components responsible for enhanced stress resistance. The strains isolated under HGB conditions will be tested for resistance to the individual stress conditions while the strains isolated under the latter conditions will be tested for cross-resistance to HGB and individual stress conditions.
• Identification of the genetic alterations responsible for enhanced stress resistance. For this purpose the flanking DNA of the transposons and the cDNA on the plasmid in the transformants will be sequenced.
• Construction of strains with further improvement and/or extension of the scope of stress resistance. This will be accomplished by combining specific mutations and/or overexpression constructs.

• Evaluation of the novel strains. The strains will be tested in lab and pilot scale for performance under HGB conditions and the best strains will be evaluated in a demonstration project.
Improved antioxidant content for food applications

PROFOOD

Contract number: QLK1-2001-01080
Contract type: Shared Cost Project
Total cost: € 3.184.942
EC contribution: € 2.381.021
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Barend Verachtert
Project website: not yet available

Coordinator:
Prof. Dr Uwe Sonnewald
Institute for Plant Genetics and Crop Plant Resarch
Molecular Cell Biology
Corrensstraße 3
06466 Gatersleben
Germany
Tel.: +49 39 4825214
Fax: +49 39 4825515
E-mail: sonnewald@ipk-gatersleben.de

PARTNERS

Prof. Alain Michel Boudet
University Paul Sabatier - Toulouse III
UMR CNRS/UPS 5546
24 Chemin de Borde-Rouge
Pôle de Biotechnologie Végétale
PO Box 117 Auzville
31326 Castanet Tolosan
France
Tel.: +33562193521
Fax: +33562193502
E-mail: amboudet@smcv.ups-tlse.fr

Prof. Ulf-Ingo Flügge
University of Cologne
Botanical Institute
Gyrhofstraße 15
50931 Köln
Germany
Tel.: +49 22 14 702 484
Fax: +49 22 14 70 50 39
E-mail: ui.fluegge@uni-koeln.de

Dr Robert Hall
Plant Research International B.V.
Cell Cybernetics
Droevendaalsesteeg 1
PO Box 16
6700 AA Wageningen
The Netherlands
Tel.: +31317477058
Fax: ++31317418094
E-mail: R.D.Hall@plant.wag-ur.nl

Dr. Cathie Martin
John Innes Centre
Department of Genetics
Norwich Research Park, Colney
NR4 7UH Norwich
United Kingdom
Tel.: +44 160 34 50 279
Fax: +44 160 34 50 045
E-mail: Cathie.martin@bbsrc.ac.uk

Prof. Catherine Rice-Evans
King’s College London
Centre for Age-Related Diseases
Hodgkin Bldg
Guy’s Hospital
St Thomas’ Street
SE1 9RT London
United Kingdom
Tel.: +44 20 78 48 61 41
Fax: +44 207 84 86 143
E-mail: catherine.rice-evans@kcl.ac.uk

Prof. Mark Stitt
Max-Planck-Institute for Molecular Plant Physiology
Am Mühlenberg 1
14424 Potsdam
Germany
Tel.: +49 33 156 78 100
Fax: +49 33 146 78 101
E-mail: mstitt@mpimp-golm.mpg.de

Prof. Ulf-Ingo Flügge
University of Cologne
Botanical Institute
Gyrhofstraße 15
50931 Köln
Germany
Tel.: +49 22 14 702 484
Fax: +49 22 14 70 50 39
E-mail: ui.fluegge@uni-koeln.de

Dr Robert Hall
Plant Research International B.V.
Cell Cybernetics
Droevendaalsesteeg 1
PO Box 16
6700 AA Wageningen
The Netherlands
Tel.: +31317477058
Fax: ++31317418094
E-mail: R.D.Hall@plant.wag-ur.nl

Dr. Cathie Martin
John Innes Centre
Department of Genetics
Norwich Research Park, Colney
NR4 7UH Norwich
United Kingdom
Tel.: +44 160 34 50 279
Fax: +44 160 34 50 045
E-mail: Cathie.martin@bbsrc.ac.uk

Prof. Catherine Rice-Evans
King’s College London
Centre for Age-Related Diseases
Hodgkin Bldg
Guy’s Hospital
St Thomas’ Street
SE1 9RT London
United Kingdom
Tel.: +44 20 78 48 61 41
Fax: +44 207 84 86 143
E-mail: catherine.rice-evans@kcl.ac.uk

Prof. Mark Stitt
Max-Planck-Institute for Molecular Plant Physiology
Am Mühlenberg 1
14424 Potsdam
Germany
Tel.: +49 33 156 78 100
Fax: +49 33 146 78 101
E-mail: mstitt@mpimp-golm.mpg.de

Prof. Ulf-Ingo Flügge
University of Cologne
Botanical Institute
Gyrhofstraße 15
50931 Köln
Germany
Tel.: +49 22 14 702 484
Fax: +49 22 14 70 50 39
E-mail: ui.fluegge@uni-koeln.de

Dr Robert Hall
Plant Research International B.V.
Cell Cybernetics
Droevendaalsesteeg 1
PO Box 16
6700 AA Wageningen
The Netherlands
Tel.: +31317477058
Fax: ++31317418094
E-mail: R.D.Hall@plant.wag-ur.nl

Dr. Cathie Martin
John Innes Centre
Department of Genetics
Norwich Research Park, Colney
NR4 7UH Norwich
United Kingdom
Tel.: +44 160 34 50 279
Fax: +44 160 34 50 045
E-mail: Cathie.martin@bbsrc.ac.uk

Prof. Catherine Rice-Evans
King’s College London
Centre for Age-Related Diseases
Hodgkin Bldg
Guy’s Hospital
St Thomas’ Street
SE1 9RT London
United Kingdom
Tel.: +44 20 78 48 61 41
Fax: +44 207 84 86 143
E-mail: catherine.rice-evans@kcl.ac.uk

Prof. Mark Stitt
Max-Planck-Institute for Molecular Plant Physiology
Am Mühlenberg 1
14424 Potsdam
Germany
Tel.: +49 33 156 78 100
Fax: +49 33 146 78 101
E-mail: mstitt@mpimp-golm.mpg.de
Improved antioxidant content for food applications

BACKGROUND
Flavonoids and phenolic acids are widely distributed in higher plants and form part of the human diet. Recent interest in these substances has strongly been stimulated by the potential health benefits arising from the antioxidant activity of these polyphenolic compounds. Although the protective effect of flavonoids against cardiovascular disease and some forms of cancer is widely accepted, little is known about the different pharmacokinetic properties of individual groups of flavonoids. The aim of the proposal is to develop strategies to create tomato plants with elevated contents of flavonoids, to evaluate the biological properties of individual members, and to transfer the knowledge to additional crops including cereals. To achieve this goal, an interdisciplinary team has been put together with outstanding expertise in plant molecular physiology, genetics, biochemistry, nutritional and analytical biology, complemented by an SME as an active participant and responsible for the exploitation of the results obtained.

OBJECTIVES
Plants produce an immense range of natural metabolites, many of which are of medical value. These metabolites exhibit antioxidative activities, due to the scavenging of reactive oxygen and reactive nitrogen species and may serve as antioxidants in plants themselves or in plant-derived components of the human diet, without being toxic or dangerous. The major objectives of the proposal are

• to decipher the regulation of flavonoid biosynthesis,
• the production of engineered plants tailored for the synthesis of phytoprotectants
• the development of molecular and biochemical tools to assist plant breeding and to allow risk assessments of the engineered plants by carefully following metabolic changes in pathways not directly targeted by the genetic manipulation.

To reach these goals, existing concepts will be tested by altering expression of known genes (cardinal gene approach), *Arabidopsis* will be utilised to isolate novel genes (black box approach), and genetic resources of different tomato accessions will be exploited by transcriptional and metabolic profiling.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Dr. Karin Herbers  
Sungene GmbH & Co. KGaA  
Corrensstraße 3  
06466 Gatersleben  
Germany  
Tel.: +49 39 4827 60 103  
Fax: +4939482760199  
E-mail: karin.herbers@sungene.de
QLK1-2001-01080: Improved antioxidant content for food applications
Molecular analysis and mechanistic elucidation of the functionality of probiotics and prebiotics in the inhibition of pathogenic microorganisms to combat gastrointestinal disorders and to improve human health

PROPATH QLK1-2001-01179
Contract number: Shared Cost Project
Contract type: € 1.636.484
Total cost: € 1.310.600
EC contribution: 1/01/2002
Starting date: 36 Months
Duration: Jürgen Lucas
Scientific Officer:
Project website: http://www.vtt.fi/virtual/proeuhealth/

Coordinator:
Prof. Dr ir Luc De Vuyst
Vrije Universiteit Brussel
Research Group of Industrial Technology and Downstream Processing
Pleinlaan 2
1050 Brussels
Belgium
Tel.: +32-2-6293245
Fax: +32-2-6292720
E-mail: lduvyst@vub.ac.be

PARTNERS

Dr Alain Servin
Institut National de la Santé et de la Recherche Medicale
INSEERM Unité 510
Faculté de Pharmacie Paris XI
Rue Jean Batiste Clément
92296 Châtenay-Malabry
France
Tel.: +33-1-46 83 56 61
Fax: +33-1-46 83 56 61
E-mail: alain.servin@cep.u-psud.fr

Prof. Dr Ingolf F. Nes
Agricultural University of Norway
Department of Chemistry and Biotechnology
Laboratory of Microbial Gene Technology
Meieribygningen
PO Box 5051
1432 Ås
Norway
Tel.: +47-64 94 9 471
Fax: +47-64 94 14 65
E-mail: ingolf.nes@ikb.nlh.no

Prof. Dr George Kalantzopoulos
Agricultural University of Athens
Department of Food Science and Technology
Iera Odos 75
11855 Athens
Greece
Tel.: +30-1-52 94 661
Fax: ++30-1-52 94 661
E-mail: kalatz@aau.gr

Dr Andreas Mentis
Hellenic Pasteur Institute
Laboratory of Bacteriology
127, Vas Sofias Avenue
115 21 Athens
Greece
Tel.: +30-1-64 78 816
Fax: +30-1-64 23 498
E-mail: mentis@mail.pasteur.gr

Dr Lorand Savu
Dexter Com Srl
Popa Rusu 9 Ap 6
PO Box 37-34
Bucharest
Romania
Tel.: +40-1-21 22 369
Fax: +40-1-21 22 370
E-mail: dexter@itcnet.ro
Molecular analysis and mechanistic elucidation of the functionality of probiotics and prebiotics in the inhibition of pathogenic microorganisms to combat gastrointestinal disorders and to improve human health

BACKGROUND

Recently, much attention has been paid to the health-promoting properties of lactobacilli and bifidobacteria. Probiotics and prebiotics are the driving forces of the functional foods market. However, a major problem is that many of these health-promoting properties are still questioned. For instance, the fundamental basis of the inhibition of Gram-negative pathogenic bacteria - like the enterovirulent diarrheagenic Salmonella, and Helicobacter pylori causing gastrointestinal disorders - by probiotic lactic acid bacteria has not been elucidated. This project will focus on the identification of the responsible compounds. In addition, the mechanism of the inhibition of Gram-negative pathogens by probiotic lactobacilli and bifidobacteria will be studied using coculture models (simulated gut fermentations, human cell lines, and animal models). Clinical studies will be performed too.

OBJECTIVES

• to obtain a selection of probiotic lactobacilli and bifidobacteria that display a clear inhibition of diarrheagenic Gram-negative pathogenic bacteria and Helicobacter pylori;
• to identify the metabolite(s) responsible for the inhibition and/or killing of Gram-negative pathogenic bacteria;
• to have the conditions and kinetics elucidated of the production of antimicrobials active towards Gram-negative pathogens and to predict the in vivo action;
• to establish co-culture models (simulated gut fermentations, human cell lines, animal models) to study the interaction between inhibitory lactic acid bacterium strains and Gram-negative pathogens causing gastrointestinal disorders;
• to have the selected probiotic lactic acid bacterium strains tested in clinical studies.

EXPECTED RESULTS AND ACHIEVEMENTS

• A project culture collection of probiotic lactobacilli and bifidobacteria strains together with characteristic data and inhibitory spectrum;
• A molecular typing method for selected probiotic strains;
• Identified compound(s) responsible for the inhibition of Gram-negative pathogenic bacteria;
• The conditions of antimicrobial production in the gut environment;
• Co-culture models (simulated gut fermentations, human cell line cultures, animal models) showing the inhibitory action by the probiotic strains.
Dr Thierry Dauvin
Beldem S.A.
Research & Development Laboratory
Rue Bourrie 12
5300 Andenne
Belgium
Tel.: +32-85-82 32 50
Fax: +32-85-82 32 60
E-mail: TDauvin@beldem.com
Molecular analysis and mechanistic elucidation of the functionality of probiotics and prebiotics in the inhibition of pathogenic microorganisms to combat gastrointestinal disorders and to improve human health.
Towards highly advanced membrane emulsification systems

THAMES

Contract number: QLK1-2001-01228
Contract type: Shared Cost Project
Total cost: € 3,073,634
EC contribution: € 2,163,218
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Barend Verachtert
Project website: not yet available

Coordinator:
Dr Jo Janssen
Unilever Nederland B.V.
Unilever Research Vlaardingen
Dept. Food Processing
Olivier Van Noortlaan 120
3133 AT Vlaardingen
The Netherlands
Tel.: +31 104 606324
Fax: +31 104 605025
E-mail: jo.janssen@unilever.com

PARTNERS

Ir Clauwaert, Werner
Friesland Madibic Food Services
R&D Department
Blanklaarstraat 6
3560 Lummen
Belgium
Tel.: +3213350264
Fax: +3213350334
E-mail: w.clauwaert@fmfs.be

Dr Van Rijn, Cees J.M.
Aquamarijn Micro Filtration B.V.
Beatrixlaan 2
7255 DB Hengelo Gld.
The Netherlands
Tel.: +31534894372
Fax: +31534894364
E-mail: aquamarijn@introweb.nl

Prof. Dr. Boom, Remko
Wageningen University
Department of Agrotechnology and Food Sciences
Food and Bioprocess Technology Group
Bomenweg 2
PO Box 8129
6700 EV Wageningen
The Netherlands
Tel.: +31317482882
Fax: +31317482237
E-mail: remko.boom@algemeen.pk.wau.nl

Prof. Dr Schubert, Helmar
Universität Karlsruhe
Institut für Lebensmittelverfahrenstechnik
Kaiserstraße 12
76128 Karlsruhe
Germany
Tel.: +49 72 160 82 497
Fax: +49721694320
E-mail: helmar.schubert@lvt.uni-karlsruhe.de

Prof. Dr Wessling, Matthias
Universiteit Twente
Mesa Research Institute
Drienerlolaan 5
PO Box Posbus 217
7500 AE Enschede
The Netherlands
Tel.: +31534892951
Fax: +31534894611
E-mail: m.wessling@utwente.nl

Prof. Dr. Barrow, David
University of Wales
Cardiff School of Engineering
Electronic Division
Queen’s Buildings
The Parade, PO Box 689
CR24 3TF Cardiff
United Kingdom
Tel.: +44 029 208 75 92
Fax: +44 029 208 74 716
E-mail: barrow@cf.ac.uk
Towards highly advanced membrane emulsification systems

BACKGROUND
Today’s food industry is putting considerable effort in the manufacturing of products with high quality, nutritional value and a natural taste. Appropriate processing methods are at the core of this development, because processing determines the product microstructure to a significant extent. Moreover, delicate ingredients and structural elements can be adversely affected in their functionality and nutritional value if the processing is too harsh. In the past decade, membrane emulsification (ME) has been identified as a promising method for making emulsions under relatively mild conditions. However, the irregular microstructure of current membranes limits the full exploitation of the benefits of ME. The project will combine ME expertise and micro-engineering technology to design and manufacture high precision, tailor-made membranes and membrane modules for ME, and will demonstrate their use in food-type emulsions.

OBJECTIVES
The proposed project has three main objectives:

• To develop advanced, tailor-made microengineered membranes that are designed for optimal emulsification of food grade materials, both oil-in-water and water-in-oil. These membranes are either passive or piezo-actuated.

• To use the membranes in small-scale and bench-scale rigs for the production of food-type emulsions with a narrow droplet size distribution and/or very small droplet size, and improved ingredient functionality.

• To develop fine, multiple emulsions, which will provide new opportunities in the field of ingredient encapsulation and release (relevant for e.g., flavours and biofunctional ingredients).

EXPECTED RESULTS AND ACHIEVEMENTS
Central to the project’s approach is the achievement of thorough understanding of the process and the interaction between process and membrane. The academic partners will use modern computational methods like Computational Fluid Dynamics and Lattice-Boltzmann type methods to further the current understanding. The effect of piezo-actuated vibrations will be considered also. The theoretical approach will be augmented by small-scale experimental work. This part of the project will thus deliver validated computational tools for a detailed analysis of the effect of various membrane properties on the membrane emulsification process.

The use of these tools will lead to design rules for the membranes and the modules in which they are incorporated. On this basis, tailor-made membranes for passive and piezo-actuated systems will be designed, manufactured, and assembled into membrane modules.

These systems will then be applied by the end-users to produce food-type emulsions on laboratory- and (later on) bench-scale. The emulsion properties will be compared with the theoretical predictions, and with the properties of comparable emulsions manufactured in a conventional way. It is expected that the emulsions produced via the ad-
vanced membranes will be superior in terms of controlled drop size distribution and ingredient functionality.

Finally, the accumulated knowledge will be used to create stable double emulsions with small outer droplet sizes, and their properties in terms of shear stability, and sensory and release properties will be explored. The theoretical models developed will be used to obtain first process designs; experimental prototype production will enable product evaluation. The end-users will explore new product options, and seek patent protection.
Removal of spinal column from cattle and sheep carcasses

REMCOLM

Contract number: QLK1-2001-01259
Contract type: Shared Cost Project
Total cost: € 1,499,049
EC contribution: € 680,579
Starting date: not yet determined
Duration: 18 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr Andrew Knight
Silsoe Research Institute
Bio-Engineering Division
Livestock Engineering Group
West Park, Silsoe
MK45 4HS Bedford
United Kingdom
Tel.: +441525860000
Fax: +441525861735
E-mail: andy.knight@bbsrc.ac.uk

PARTNERS

Mr Pole, Andrew
Avocet Engineering Services Ltd.
Unit 2 Elborough Farm, Banwell Road, Locking
BS24 8PB Weston-Super-Mare
United Kingdom
Tel.: +4401934824092
Fax: +4401934824456
E-mail: avoeng@compuserve.com

Mr Freund, Robert
Freund Maschinenfabrik GmbH & Co.
Schulze-Delitzsch-Straße 38
33100 Paderborn
Germany
Tel.: +49525116590
Fax: +495251165977
E-mail: mail@freund-germany.com

Prof. Dr Koegl, Hans
Universität Rostock
Institute for Agricultural Economics and Engineering
Justus-von-Liebig-Weg 7
18051 Rostock
Germany
Tel.: +49 381 498 2084
Fax: +49 381 498 2086
E-mail: hans.koegl@agrafak.unirostock.de

Mr Francia, Jean-Pierre
Association pour le Développement de l’Institut de la Viande
2 Rue Chappe
63036 Clermont Ferrand Cedex 2
France
Tel.: +33473 985 380
Fax: +33 473 985 385
E-mail: jp.francia@adiv.fr

Mr Fisher, A.
The University of Bristol
Department of Clinical Veterinary Science
Langford House
BS80 7DU Bristol
United Kingdom
Tel.: +44 1179289271
Fax: +44 1179289505
E-mail: Alan.Fisher@Bristol.ac.uk

Dr Framstad, Knut
Norwegian Meat Cooperative
Department of Research and Development
PO Box 360
0513 Oslo Cedex Økern
Norway
Tel.: +47 22092100
Fax: +47 22155908
E-mail: magnus.wahlgren@gilde.no
Removal of spinal column from cattle and sheep carcasses

BACKGROUND
Regulations are required in all EU states to ensure that spinal cord material and spinal column in some states is removed from cattle and sheep carcasses. Carcasses are contaminated with CNS material during conventional splitting operations, and washing does not remove the contamination. A novel saw, for complete removal of the vertebral column from inside the eviscerated carcass before splitting, has been developed under laboratory conditions; this ensures that all cord material remains encased in bone. Prototype saws for cattle and sheep carcasses will be used to validate the above laboratory results under commercial slaughterhouse conditions. Functional tests, will evaluate the commercial viability of this new approach and the results will be used in an economic appraisal. The main objective of this project is to ensure that the results are disseminated to an extended audience across the EU.

OBJECTIVES
• A new technique for removal of spinal column from cattle and sheep carcasses.
• To construct demonstration equipment, conduct proving trials to validate the oval saw under commercial slaughter conditions and conduct an economic analysis.
• To disseminate the results to an extended audience.

It is generally accepted that the same agent causes BSE in cattle and vCJD in humans. Controls are designed to prevent the parts of slaughtered animals most likely to contain the BSE agent from entering the food chain, but current practices are inadequate. The Action aims to provide a healthy food supply and acknowledges that undesirable components pose a challenge to the safety of food.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Mr Lindars, David  
Anglo Beef Processors Ltd  
Northampton Road, Blisworth  
NN7 3DR Northampton  
United Kingdom  
Tel.: +441604858001  
Fax: +441604859238  
E-mail: davidlindars@abpltd.com
ROSEPROMILK

Contract number: QLK1-2001-01617
Contract type: Shared Cost Project
Total cost: €1,305,425
EC contribution: €879,528
Starting date: 1/12/2001
Duration: 36 Months
Scientific Officer: Dyanne Bennink
Project website: not yet available

Coordinator:

Coord: Prof. Dr Giuseppe Palleschi
Università degli Studi di Roma “Tor Vergata”
Dipartimento di Scienze d Tecnologie Chimiche
Via della Ricerca Scientifica, 18
00133 Rome
Italy
Tel.: +39 06 72594423
Fax: +39 06 72594328
E-mail: giuseppe.palleschi@uniroma2.it

Dr Pilloton, Roberto
Ente Nazionale per le Nuove Tecnologie, l’Energia e l’Ambiente
Biotechnology and Agriculture
Via Anguillarese 301
00060 S.Maria di Galeria - Rome Italy
Tel.: +39 06 30483814
Fax: +39 06 30484965
E-mail: pilloton@mclink.it

Prof. Marconi, Emanuele
Università del Molise
Dipartimento di Scienze e Tecnologie Agro-Alimentari Ambientali e Microbiologiche
Via de Sanctis, Snc
86100 Campobasso
Italy
Tel.: +39 0874 404616
Fax: +39 0874 404652
E-mail: marconi@unimol.it

Dr Hart, John
University of The West of England
Bristol Faculty of Applied Sciences
Frenchay Campus, Coldharbour Lane
BS16 1QY Bristol
United Kingdom
Tel.: +44 117 3442808
Fax: +44 117 3442688
E-mail: john.hart@uwe.ac.uk

Dr Lind, Ole
DeLaval International AB
Hamragaardsvägen
PO Box 39
14721 Tumba
Sweden
Tel.: +46 8 53065924
Fax: +46 8 53039055
E-mail: ole.lind@delaval.com

Dr Vadgama, Pankaj
Queen Mary University of London
Mile End Road
E1 4NS London
United Kingdom
Tel.: +44 20 78825151
Fax: +44 20 8983179
E-mail: p.vadgama@qmw.ac.uk
Robust chemical sensors and biosensors for rapid on-line identification of freshly collected and processed milk

BACKGROUND
This proposal addresses issues of quality management, traceability and safety during the production and processing of milk. It is proposed to design and develop novel sensing devices for a range of key analytes as indicators of milk contamination and milk processing efficiency. Faecal contamination and aflatoxin M1 detection will be monitored during fresh-milk collection. Then marker compounds as lactulose, lactose, lactosilated proteins and alkaline phosphatase and lactoperoxidase enzymes will be analyzed and quantified in real time using screen printed or composite biosensors and immunosensors coupled with flow-through or fia technology.

OBJECTIVES
The objectives of this proposal are the development novel sensing devices for a range of key analytes, selected as indicators of milk contamination or milk processing efficiency. Faecal contamination and mycotoxin contamination will be measured with screen printed electrodes. Also the detection of marker enzymes as alkaline phosphatase and lactoperoxidase mid compounds lactose and lactulose, lactosilated proteins in real time, on-line, with effective cost instrumentation and directly ‘in loco’ will be the major objective of this proposal to assess quality, safety and traceability of freshly collected and processed milk.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Faecal contamination sensor based on electrochemical detection using screen printed electrode technology;
• Immunosensor for aflatoxin M1;
• Integration of both the sensors into a robotic milking machine;
• Screen printed electrochemical sensors for AP and LPOX;
• Screen printed and/or biocomposite probes for lactose and lactulose;
• Immunosensor for lactosilated protein;
• Development of instrumentation ad hoc;
• Validation in operational milk processing plant.
Dr Cagnasso, Patrizio
S.P.A. Parmalat
Research Center
Via S. Vitale, 22
43038 Sala Baganza, Parma
Italy
Tel.: +39 0521 808902
Fax: +39 0521 808903
E-mail: patrizio_cagnasso@parmalat.net

Dr Mottram, Toby
Silsoe Research Institute
Wrest Park, Silsoe
MK45 4HS Bedford
United Kingdom
Tel.: +44 1525 864029
Fax: +44 1525 861735
E-mail: toby.mottram@bbsrc.ac.uk
Robust chemical sensors and biosensors for rapid on-line identification of freshly collected and processed milk
A new method for the objective measurement of the quality of seafoods

SEQUID

Contract number: QLK1-2001-01643
Contract type: Shared Cost Project
Total cost: € 1,864,533
EC contribution: € 1,397,230
Starting date: 1/09/2001
Duration: 36 Months
Scientific Officer: Sigurdur Bogason
Project website: http://sequid.tf.uni-kiel.de

Coordinator:
Dr Reinhard Knöchel
Christian-Albrechts-Universität zu Kiel
Technische Fakultät
Kaiserstraße 2
24143 Kiel
Germany
Tel.: +49 431 88 06 150
Fax: +49 431 88 06 152
E-mail: rk@tf.uni-kiel.de

Ms U-K Barr
SIK - Institutet för Livsmedel och Bioteknik AB
PO Box 5401
40229 Gothenburg
Sweden
Tel.: +46-313351351
Fax: +4631833782
E-mail: ukb@sik.se

Dr Maria Lenor Nunes
Instituto de Investigacao das Pescas e do Mar
Departamento de Inovacão Tecnologica e Valorizao dos Produtos da Pesca
Avenida de Brasilia
1449-006 Lisboa
Portugal
Tel.: +351-213027029
Fax: +351213015948
E-mail: mlnunes@ipimar.pt

M. Tejada
Consejo Superior de Investigaciones Científicas
Instituto del Frío
Ciudad Universitaria, S/N
28040 Madrid
Spain
Tel.: +34915492300
Fax: ++34915493627
E-mail: mtejada@if.csic.es

Prof. Dr J. Öhlenschläger
Institute for Fishery Technique and Fish Quality
Palmaillé 9
22767 Hamburg
Germany
Tel.: +49 403 89 05 151
Fax: +49 403 89 05262
E-mail: oehlenschlaeger@ibt.bfa-fisch.de

PARTNERS
A new method for the objective measurement of the quality of seafoods

BACKGROUND
There exists no satisfactory physical method for the objective measurement of the quality of seafood products. So concluded the project AIR3 CT94 2283. This proposal concerns a completely new physical method for seafood quality measurement. It arises from observations made in FAIR project CT97 3020. It is proposed to carry this work further with determination of quality as the main objective. The quality factors to be studied will be:

• post catching/slaughter deterioration of fresh fish;
• changes due to frozen storage and to multiple freezing;
• correlation with organoleptic variables, texture, and other quantifiable quality related variables.

Prototype instruments will be built for validation in the field.

OBJECTIVES
To develop and validate a new rapid method and instrumentation for determination of the quality of seafood products. This objective will be achieved through several secondary objectives:

• The acquisition of dielectric data of seafood products under the influence of various quality changes.
• These dielectric data will comprise
  • The dielectric spectra of seafood materials over a frequency range from 100 MHz to 12 GHz
  • Time domain dielectric responses to input electromagnetic pulses of well-defined characteristics of the materials under investigation.
• The quality changes will be
  • Spoilage of freshly harvested fish kept on ice at 0°C
  • Changes of quality in frozen fish subjected to different thermal histories.
• The analysis of the dielectric data obtained to provide calibration equations for use in hand held and on-line instruments.
• Design and construction of a hand held instrument.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Completion of initial trials results demonstrating feasibility of method for each area of quality
• Completion of prototypes three instruments for full trials calibrated from results at milestone 2
• Completion of full quality trials
• Completion of full chill spoilage trials and end of project
QLK1-2001-01643: A new method for the objective measurement of the quality of seafoods
Innovation in the process of cork production for elimination of odours responsible for cork taint

**INNOCUOUS**

**Contract number:** QLRT-2001-01678  
**Contract type:** Demonstration Project  
**Total cost:** Under negotiation  
**EC contribution:** Under negotiation  
**Starting date:** not yet determined  
**Duration:** 36 Months  
**Scientific Officer:** Dyanne Bennink  
**Project website:** not yet available

**Coordinator:**  
Dr Nunes Nuno  
Alvaro Coelho Irmãos S.A.  
Research and Development  
Zona Industrial de Prime, Mozelos,  
LFR  
4535 Santa Maria de Lamas  
Portugal  
Tel.: +351-227-470050  
Fax: +351-227-470080

**PARTNERS**

E-mail: nunonunes@acoelhoirmaos.com  
Prof. Dr Fransesc Xavier Rius Ferrús  
Universitat Rovira i Virgili  
Bioengineering and Bioelectrochemistry Group  
Avinguda Països Catalans, 26  
43007 Tarragona  
Spain  
Tel.: +34977558014  
Fax: +34977558022  
E-mail: viceinv@orgov.urv.es

Dr Vassilios Marinos  
Ampelooeniki Ltd.  
Viti-Vinicultural Research Center, Ltd.  
Thessaloniki Technology Park,  
6th km Harilaou-Thermi Road  
57001 Thessaloniki  
Greece  
Tel.: +3031476244  
Fax: +3031476244  
E-mail: ampeolo@thestep.gr

Prof. Dr Costas Vayenas  
University of Patras  
Department of Chemical Engineering  
1 Karatheodori St.  
26500 Patras  
Greece  
Tel.: +3061997608  
Fax: +3061991711  
E-mail: rectorate@upatras.gr

Mr Paul Cartledge  
The University of Nottingham  
School of Chemical, Environmental and Mining Engineering  
University Park  
NG7 2RD Nottingham  
United Kingdom  
Tel.: +441159515679  
Fax: +441159513633  
E-mail: Paul.cartledge@nottingham.ac.uk
Innovation in the process of cork production for elimination of odours responsible for cork taint

BACKGROUND
The wine and cork industry incur almost 1000 million euros per year losses due to cork taint, substances that develop naturally or through contamination of the cork stopper and cause products of inferior quality.

OBJECTIVES
The cork stopper elaboration process shall be refurbished through the incorporation of novel and modular unit operations and a new quality assurance method that could be applied to any size enterprise in the sector. The redesigned process includes novel unit operations of physicochemical treatment, membrane application, photocatalytic oxidation and on-line quality control with immunosensors aimed to render the cork stopper production at least 99% taint-free through complimentary incremental improvements. The project proposes to implement the refurbished process in a modular prototype plant.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Radio-frequency heating technology for minimally processed fish products
RF-FISH

Contract number: QLK1-2001-01788
Contract type: Shared Cost Project
Total cost: €1,781,138
EC contribution: €890,568
Starting date: 1/01/2002
Duration: 36 Months
Scientific Officer: Sigurdur Bogason
Project website: not yet available

Coordinator:
Dr Thomas Pfeiffer
Fraunhofer-Institut für Verfahrenstechnik und Verpackung
Giggenhauser Straße 35
D-85354 Freising
Germany
Tel.: +498161491424
Fax: +498161491444
E-mail: t.pfeiffer@ivv.fhg.de

Mr Skipnes, Dagbjørn
The Norconserv Foundation
Alexander Kiellandsgata 2
PO Box 327
4002 Stavanger
Norway
Tel.: +4751844634
Fax: +4751844650
E-mail: dagbjorn.skipnes@norconserv.no

Mr Páll G. Pálsson
Icelandic Fisheries Laboratories
Skulgata 4
PO Box 1405
101 Reykjavik
Iceland
Tel.: +354-562-0240
Fax: +354-562-0740
E-mail: palp@rfisk.is

Mr Sigurgeirsson, Gunnar
Haraldur Bodvarsson Ltd.
Barugata 8-10
300 Akranes
Iceland
Tel.: +3544301800
Fax: ++3544301805
E-mail: gunnarbs@hb.is

Mr Vidvei, Jarle
Fjordkjoekken AS
Djuphodl 2
PO Box 4
4368 Varhaug
Norway
Tel.: +4751791500
Fax: +4751432623
E-mail: jarle.vidvei@fjordkjoekken.no

Mr Hinterseer, Heinz
Paul Kiefel GmbH
Industriestraße 17-19
83395 Freilassing
Germany
Tel.: +49865478210
Fax: +49865478666
E-mail: h.hinterseer@kiefel.de

Dipl.-Ing. Kerbstadt, Torsten
Huhtamaki Van Leer Packaging Deutschland GmbH & Co. KG
Heinrich Nickolaus Straße 6
87671 Ronsberg
Germany
Tel.: +49830677377
Fax: +49830677550
E-mail: torsten.kerbstadt@hvlgroup.com
Radio-frequency heating technology for minimally processed fish products

BACKGROUND
The proposed project will investigate radio-frequency heating of foods in flexible vacuum pouches during water immersion and its application to minimally processing of convenience cook/chill or cook/freeze fish products. The rapid volume heating of the process is expected to reduce overcooking of the heat sensitive fish flesh and to result in better product quality while maintaining product safety and shelf life. Application of the process is expected in fish processing as well as in large food service companies, the processed products will go to the retail market and to food service. The proposed project covers process adaptation and optimisation, investigation of safety and microbiological process validation, validation of achieved product quality, and estimation of processing cost and of potential convenience fish product markets. Expected project results will enable the industrial implementation of the process and will help to judge the potential and economy of the novel process for producing high quality prepared fish meals.

OBJECTIVES
• Explore the potential of a combination of radio-frequency-heating (RF-heating) with water immersion for production of minimally processed cook/chill or cook/freeze convenience fish dishes. It is intended to use a mild thermal treatment with temperatures $<100^\circ C$, which requires a subsequent chilling or freezing for safe storage and distribution.
• Investigate and optimise the process with respect to heating uniformity, rapidity, reproducibility and develop a temperature-time treatment, that will retain most of the desired fish quality while achieving safe reduction of potential hazardous microorganisms.
• Adopt and develop methods and predictive models for process validation and demonstrate experimentally microbiological safety of the heating process.
• Verify quality achievements with respect to texture, cook-out, taste, colour, and shelf life of heated products and compare to conventionally autoclave or hot water-bath processed products.
• Estimate economic feasibility of the process and investigate markets and distribution system for minimally processed fish products.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Demonstration of microbiological safety and product quality achievement of the novel RF-heating process for minimally processed fish products.
• Availability of experimental tools and predictive models to optimise the process, to perform microbiological validation, to implement the process on industrial scale, and to adopt process to other prepared foods or to temperature-time regimes with short-time sterilisation.
• Estimation of economic feasibility and competitiveness of the process for both, the fish/food processor as well as the manufacturers of process equipment and packaging material.
Safe and eco-efficient packaging solutions for the food industry

ECO-PAC

Contract number: QLK1-2001-01823
Contract type: Concerted Action
Total cost: € 752,880
EC contribution: € 752,880
Starting date: 1/12/2001
Duration: 36 Months
Scientific Officer: Achim Boenke
Project website: not yet available

Coordinator:
Dr Luke Savage
Egli Research Ltd
Egli House, Meadfoot Road
TQ1 2JP Torquay
United Kingdom
Tel.: +441803213688&
Fax: +441803201066&
E-mail: Is@egli.co.uk

Prof. Dr Klöck, Gerd
Verein zur Förderung des Technologietransfers an der Hochschule Bremerhaven e.V. ttz-BILB
Am Lunediech 12
27572 Bremerhaven
Germany
Tel.: +49471972970
Fax: +49471972722
E-mail: bilb@ttz-bremerhaven.de

Ir. Enguix, Carlos
Instituto Tecnológico Agroalimentario
Packaging Technologies Department
C/Benjamin Franklin 5-11
PO Box 103
46980 Paterna
Spain
Tel.: +34961366090
Fax: +34961318008
E-mail: cenguix@ainia.es

Mr Nielsen, Ib
Polarcup Earthshell Aps
Länsituleentie 7
02100 Espoo
Finland
Tel.: +358968688406
Fax: ++358968688520
E-mail: ib.nielsen@hvlgroup.com

Dr McCarthy, Brian
British Textile Technology Group Limited
Shirley House, Wilmslow Road
M20 2RB Didsbury
United Kingdom
Tel.: +441614458141
Fax: +441614349957
E-mail: BjMcCarthy@bttg.co.uk

Mr Sear, Marcel
Fardis N.V.
Toekmestlaan 18
2340 Beerse
Belgium
Tel.: +3214622997
Fax: +3214615039
E-mail: marcel.sear@fardis.org

Dr Tsagaropoulos, George
Interchem Hellas S.A.
Department of Research and Development
Vathi-Avildos
34100 Evia-Halkida
Greece
Tel.: +3022134101
Fax: +3022131647
E-mail: g_tsagarapoulos@interchem.gr

PARTNERS
Safe and eco-efficient packaging solutions for the food industry

BACKGROUND
At present much food packaging is not recyclable and is therefore discarded into landfill. Most recycling efforts to date have focussed on materials such as paper, card, glass and metals whereas fresh food packaging is often based on non-recyclable plastic materials. In 1994 the EC passed a Directives for Packaging and Packaging Waste (94/62/EEC). All Member States have consequently to recover and recycle a specified part of the packaging waste. As a result in many countries companies who produce packaging have to pay fees for a recovery and recycling system to collect and process packaging materials. These fees are dependent on the material and the amount of packaging put on the market. In contrast recyclable packaging materials will have a positive environmental effect and are much cheaper to dispose. These materials can be used in short-term packaging solutions designed for low temperature purposes. The European market for recyclable plastics is a young and growing, highly diverse and fragmented one. The high costs of research and development in the recyclable plastics market have been identified as a substantial risk to profitability. Consequently, it is essential that were there are on-going research activities, they should be coordinated and focus is also needed on recyclable food packaging which will ensure the development of safe and efficient packaging and processing technologies to maximise food quality and encourage eco-friendly practices.

OBJECTIVES
The common scientific and technological objective of this network is to promote and optimise recyclable packaging for a range of food products to conform to current food packaging legislation. This will be done using existing and/or new materials. There exists a very wide range of food products, which must be stored and prepared in different conditions. While the network proposes to identify solutions for most of these, it is necessary to be realistic and set specific targets to be achieved within the network. The primary target will be recyclable packaging for the replacement of plastic food packaging trays, films and cartons currently used for eg frozen goods, refrigerated goods, microwave products, ready oven-cook foods, fast-food products, perishable products (raw meat, cooked meat, fish, dairy, vegetables and fruit etc.).

(EXPECTED) RESULTS AND ACHIEVEMENTS
Network outputs will be:
- a report detailing the state-of-the-art and the recommended packaging technology for different types of food to form the basis upon which industrial standards and future legislation will be based.
- a dissemination programme, to raise awareness on the importance and advantages of recycling food packaging. 3 workshops in Europe, 2 open days for operators active in the food packaging industry, a dedicated web page and the publication of articles to targeted groups.
Mr Leistner-Mayer, Christian
Konrad Fischer GmbH
Bundesstraße B14
3424 Zeiselmauer
Austria
Tel.: +43224272326
Fax: +4322427232614
E-mail: info@konrad-fisher.com

Prof. Dr Ir. Dukalska, Lija
Latvia University of Agriculture
Faculty of Food Technology
Liela Iela 2
3001 Jelgava
Latvia
Tel.: +3713021075
Fax: +3713022829
E-mail: liad@cs.llu.lv

Dr Sionkowska, Alina
Nicolaus Copernicus University
Faculty of Chemistry
Division of General Chemistry
Gagarin 7
87-100 Torun
Poland
Tel.: +48566114312
Fax: +48566542477
E-mail: as@chem.uni.torun.pl

Dr Stading, Mats & Dr Leufven, Anders
Institutet för Livsmedel och Bioteknik
AB SIK
Frans Perssons Vag 6
PO Box 5401
40229 Gothenburg
Sweden
Tel.: +46313355600
Fax: +4631833782
E-mail: mats.stading@sik.se & anders.leufven@sik.se

Mr Peree, Philip
WBI Technology Ltd
101 Furry Park Road,
Howth Road
5 Dublin
Ireland
Tel.: +35316791382
Fax: +35316600211
E-mail: techcodes@zynet.com
QLK1-2001-01823: Safe and eco-efficient packaging solutions for the food industry

PLEASE RECYCLE
Quantification of coeliac disease toxic gluten in foodstuffs using a chip system with integrated extraction, fluidics and biosensoric detection

CD-CHEF

Contract number: QLRT-2001-02077
Contract type: Shared Cost Project
Total cost: Under negotiation
EC contribution: Under negotiation
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Duration: 42 Months
Scientific Officer: Jürgen Lucas
Project website: not yet available

Coordinator:

Dr Ciara O’Sullivan
Bioengineering & Bioelectrochemistry Group
Department of Chemical Engineering
Universitat Rovira i Virgili
Avinguda Països Catalans, 26
43007 Tarragona
Spain
Tel.: +34-977 55 81 74

Fax: +34-977 55 96 67
E-mail: ckosulli@etse.urv.es

Dr Roberto Orselli
Technobiochip S.c.a.r.L.
Via Aldo Moro 15
57030 Marciana Marina
Italy
Tel.: +39-05-65 90 12 50
Fax: +39-05-65 90 11 36
E-mail: rorselli@technobiochip.com

Dr Luud Gilissen
Plant Research International B.V.
Droevendallsesteeg 1
6700 AA Wageningen
The Netherlands
Tel.: +31-317-47 71 68
Fax: +31-317-41 80 94
E-mail: l.j.w.j.gilissen@plant.wag-ur.nl

Prof. Paul Ciclitira
King’s College London
St. Thomas Hospital
Rayne Institute
Lambeth Palace Road
SE1 7EH London
United Kingdom
Tel.: +44-207-960 55 29
Fax: +44-207-261 06 67
E-mail: paul.ciclitira@kcl.ac.uk

Dr Jean-Jacques Toulmé
INSERM U 386
Université Victor Segalen Bordeaux 2
146 Rue Léo Saignat
33076 Bordeaux
France
Tel.: +33-557 57 10 17
Fax: +33-557 57 10 15
E-mail: Jean-Jacques.Toulme@bordeaux.inserm.fr

Dr Martin Wieland
TRACE Biotech AG
Mascheroder Weg 1b
38124 Braunschweig
Germany
Tel.: +49-531-2613327
Fax: +49-531-2613338
E-mail: mw@trace-ag.de

Dr Steffen Hardt
Institut für Mikrotechnik Mainz GmbH
Carl-Zeiss-Straße 18-20
55129 Mainz
Germany
Tel.: +49-6131-99 04 12
Fax: +49-6131-99 02 05
E-mail: hardt@imm-mainz.de

PARTNERS
Quantification of coeliac disease toxic gluten in foodstuffs using a chip system with integrated extraction, fluidics and biosensoric detection

BACKGROUND

The overall objective of this project is the development of a disposable microsystem with integrated optimal extraction and detection for the precise and accurate quantification of coeliac disease toxic gluten (sequences of gluten to which coeliac disease sufferers show intolerance) in all types of foodstuffs. Screening studies currently being carried out both in Europe (CD-Cluster project) as well as in the United States are highlighting that the occurrence of coeliac disease is far higher than previously believed. This will inevitably lead to an increased control and the allowable limits and assay for measurement recommended by the WHO/FAO Codex Alimentarius Commission will be internationally recognised and implemented and it is thus crucial, in terms of European competitiveness, that this be a European based product.

The work proposed here not only addresses the problems previously observed with gluten assays, but also aims at the simplifying of the assay to a biosensoric format: facile, inexpensive and rapid, which will be integrated with a microextraction module in a disposable microsystem allowing complete assay within 15 minutes on site or online. It is envisaged that the proposed technology can be used to monitor quality throughout the processing of gluten-free ingredients and production of gluten free foods, for use by regulatory authorities (e.g. the proposed European Food Authority), by vendors of gluten free food, and eventually, with high production resulting in lowered costs, by the coeliac disease sufferer themselves.

OBJECTIVES

• The development of detection-compatible protocols for extraction of gluten from all types of foodstuffs.
• The production of aptamers, antibody cocktails and antibody fragments to toxic sequences identified by in vitro and in vivo testing
• The isolation and purification of solvent resistant thermophilic enzymes for use as aptamer/antibody labels
• The development of ELISAs/ ELONAs /mixed ELISA-ELONAs.
• The development of immuno- and apta- sensor generic platforms with optical/electrochemical/ quartz crystal nanobalance detection
• The integration of extraction and detection on a disposable microsystem with the time required for total assay being less than 15 minutes and the cost less than 15, meeting the PDRs listed both for extraction and for detection.
• The analytical validation, end-user evaluation and dissemination of the developed technologies.

(EXPECTED) RESULTS AND ACHIEVEMENTS

• Standardised and fully validated protocols and universal protocol for the efficient extraction of gluten from raw, cooked, unprocessed and processed foodstuffs
• Standardised and fully validated assay based on aptamers and antibodies/fragments for the selective, specific, and sensitive determination of CD-toxic gluten from all cultivars of wheat, barley, rye and oats with no cross-reactivity
• Standardised and fully validated assay based on aptamers and antibodies/fragments compatible with extraction solvents facilitating detection of CD-toxic gluten in raw, cooked, unprocessed and processed foodstuffs
• Standardised and fully validated immuno-/apta- sensor platforms for the detection of CD-toxic gluten in raw, cooked, unprocessed and processed foodstuffs using electrochemical, optical and quartz crystal nanobalance transduction
• Prototype biosensor immuno-/apta- sensor platform integratable with microsystem, based on optimum mode of transduction
• Fully validated microsystem extraction of CD-toxic gluten from raw, cooked, unprocessed and processed foodstuffs
• Fully validated disposable microsystem with integrated extraction and biosensoric detection
• End user evaluation and feedback of project products
• Consumer-science studies - feedback on increased consumer confidence based on project’s developed technologies
• Technology Implementation Plan and widespread dissemination
Electronic sensor system for the characterisation of packaging emissions

ESCAPE

Contract number: QLK1-2001-02194
Contract type: Shared Cost Project
Total cost: € 2,692,924
EC contribution: € 1,289,384
Starting date: 1/09/2001
Duration: 36 Months
Scientific Officer: Achim Boenke
Project website: www.escape-project.org

Coordinator:
Dr Udo Weimar
Eberhard-Karls-Universität Tübingen
Institute of Physical and Theoretical Chemistry
Auf der Morgenstelle 15
72076 Tübingen
Germany
Tel.: +49 7071 2977634
Fax: +49 7071 295960
E-mail: upw@ipc.uni-tuebingen.de

PARTNERS

Dr Ulmer, Heiko
Applied Sensor GmbH
Aspenhauserstrasse 25
72770 Reutlingen
Germany
Tel.: +49 7121 514860
Fax: +49 7121 5148629
E-mail: heiko.ulmer@appliedsensor.de

Dr Visani, Piero
Nestlé S.A.
Nestlé Research Center
Vers-chez-les-Blanc
PO Box 44
1000 Lausanne 26
Switzerland
Tel.: +41 21 785 80 39
Fax: +41 21 785 85 54
E-mail: piero.visani@rdls.nestle.com

Mr Kleine-Benne, Eike
Gerstel GmbH & Co. KG
Aktienstrasse 232 - 234
45473 Mulheim an der Ruhr
Germany
Tel.: +49 2087 65030
Fax: +49 2087 650333
E-mail: eike_kleine-benne@gerstel.de

Mr Ehmann, Ehrenfried
Alfred Wall AG
Grillweg 15
8053 Graz
Austria
Tel.: +43 3162500244
Fax: +43 31625006244
E-mail: e.ehmann@wallgroup.com

Mr Mielle, Patrick
INRA
Laboratoire de Recherches sur les Arômes
17, Rue Sully
BP 86510
21065 Dijon Cedex
France
Tel.: +380693086
Fax: +380693086
E-mail: patrick.mielle@dijon.inra.fr
Electronic sensor system for the characterisation of packaging emissions

BACKGROUND
Providing healthy, safe and high quality food to the consumer is a big challenge for the manufacturers involved in the complete food chain. To prevent food from degradation through environmental factors, today nearly every product is packaged. Problems with off-odours or off-tastes of packaged food occur, when undesired components like residual solvents, additives or monomers from raw, feed or packaging materials are present. Foodstuff as an organic material tend to form breakdown or conversion products from bacteriological, thermal, atmospheric (oxygen) or light induced processes which can lead to a sensory degradation or even a food spoilage. These effects can lead to a bad quality (smell, taste, texture, appearance, security, health) of the product and hence to a bad consumer acceptance as well as a bad reputation of the product and the manufacturing company. Additionally, it causes an enormous waste of resources, manpower and this creates a substantial financial loss. Keeping in mind that sensors and sensor technology is a growing field with a strong penetration in nearly all application areas such as consumer goods up to food industry and their potentials, it is only logical to apply this type of technology in this field in order to allow the establishment of a cost effective and time efficient food quality control system to solve such difficulties and guarantee consumer safety.

OBJECTIVES
The objectives of this project are:
• to develop application driven sensor systems and sampling instruments
• to integrate them in a new instrumentation allowing to make on-line measurements
• to monitor the quality of packaging materials by measuring the amount of outgassing analytes

These novel applications have a direct industrial interest since the real-life tests can only be performed at the production sites. ESCAPE assures a quick transformation of the obtained prototypes into the manufacturing process. Moreover, classical and time-consuming quality evaluation methods like human sensory panels or analytical investigations by means of gas chromatography/mass spectrometry can be reduced to a minimum.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Milestone (MS) 1, month (M) 4: technology roadmap for the packaging application.
• MS2, M8: 1st laboratory test database.
• MS3, M17: pre-prototype instrument.
• MS4, M21: 2nd laboratory test database.
• MS5, M28: exploitation and technology implementation plan.
• MS6, M34: 3rd real life test database.

This will lead to a novel on-and/or at-line quality control system based on integrated chemical sensor arrays, application driven sampling, and specific data evaluation algorithms.
The EQCS (ESCAPE Quality Control System) will give the European packaging industry a rapid monitoring tool. The ultimate goal is to establish an on-line test which will replace spot checks. Thus, the processes in the food chain can be controlled at an early stage to save time, manpower and resources.
A Concerted Action for the development of a framework for the
effective implementation of traceability of products throughout the
food supply chain

FOODTRACE

Contract number: QLK1-2001-02202
Contract type: Concerted Action
Total cost: € 738,474
EC contribution: € 738,474
Starting date: not yet determined
Duration: 30 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr Ian Smith
Automatic Identification Manufacturers (Europe) Ltd
The Old Vicarage, Haley Hill
HX3 6DR Halifax
United Kingdom
Tel.: +44 1422 368368
Fax: +441422355604
E-mail: ian@aimglobal.org

Prof. Tidmarsh, David
University of Central England
Faculty of Engineering & Computer Technology
Franchise Street
Perry Bara, PO Box B42 254
B42 2SU Birmingham
United Kingdom
Tel.: +44-1213-315 575
Fax: +44-1213-316317
E-mail: david.tidmarsh@uce.ac.uk

Dr Russel, J Ian T
Codeway Ltd
Telford Way
CO4 4QG Colchester
United Kingdom
Tel.: +441206751300
Fax: +441206751286
E-mail: ian.russell@codeway.com

Mr Schade, Jürgen
Centrale für Coorganisation
Maarweg 133
51149 Köln
Germany
Tel.: +49-221-94 71 42 00
Fax: +49-221-94 71 42 70
E-mail: schade@ccg.de

Mr Purslow, Philip
Cimmedia Ltd
Shelfield Lodge
B49 6JN Shelfield, Warwickshire
United Kingdom
Tel.: +441789488950
Fax: +441789488950
E-mail: cimmedia@msn.com

Dr Kernan, Brendan
EAN Ireland
84/86 Lower Baggot Street
Dublin 2
Ireland
Tel.: +353-1-60 51 536
Fax: +353-1-638 15 35
E-mail: info@ean.ie

PARTNERS

Dr Angué, Thérèse
Groupement d’Etude et de Normalisation de la Codification
2, Rue Maurice Hartmann
92137 Issy-les-Moulineaux
France
Tel.: +330140955419
Fax: +330140955449
E-mail: tangue@gencod-ean.fr

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A Concerted Action for the development of a framework for the effective implementation of traceability of products throughout the food supply chain

BACKGROUND
FoodTrace is a thirty month Concerted Action to develop a traceability framework for the whole food chain from farm to table. It will enable the industry to meet the needs of consumers and other stakeholders. FoodTrace addresses key points in the Food Safety White Paper and the Quality of Life programme. It will have a stakeholder group to define socio-economic and political needs, seventeen plus nodes for national and sector interests, three Special Interest Groups to look at data carriers and data capture, information retrieval and eBusiness methods, supply chain models and traceability standards. FoodTrace will be open to all stakeholders through its website, e-news and e-discussion groups. There will be two working conferences, and net meetings throughout. FoodTrace will present its final report at a conference open to everyone involved in European and international food chains. It will post the report on its website.

OBJECTIVES
• To establish a generic framework for traceability in European and global food chains.
• To determine the needs of all stakeholders, especially producers and consumers.
• To involve member states and trading partners.
• To develop traceability concepts.
• To add traceability to supply chain models.
• To support safety and quality of a diversity of food products.
• To propose standards for item identification.
• To provide a roadmap for the industry to implement item-attendant data carrier and data capture technologies.
• To investigate the use of eBusiness technologies for a traceability system with hundreds of thousands of participants in many countries.
• To recommend schema for product information and technology for information retrieval.
• To propose innovative ways of presenting information to consumers and other stakeholders.
• To deal with data access, security and confidentiality.
• To identify areas for future RTD.
• To publish an authoritative report.
• To recommend an action plan at an open Conference.

EXPECTED RESULTS AND ACHIEVEMENTS
• MS1 Pan European announcement.
• MS2 Network structure, recruitment, planning completed; reference model, work plans published; group meeting, month 6.
• MS3 Stakeholder requirements and state of art reviewed, month 12.
• MS4 Working group proposals ready to present to network/stakeholders, month 18.
• MS5 Framework reviewed/recommendations drafted, month 24.
• MS6 Report, road maps, recommended RTD, standards, proposed action plan published; dissemination material ready, website revamped, month 30.
Iwicka, Ewa
Institute of Logistics and Warehousing
EAN Poland
Estkowskiego 6
61-755 Poznan
Poland
Tel.: +48618527681
Fax: +48618526376
E-mail: ewa_iwicka@ilim.poznan.pl

Mr Solatie, Hugo Toivo Heimo
Oy Maxicon Ab
Riilahdentie 5.F.27
02360 Espoo
Finland
Tel.: +35898024518
Fax: +35898024518
E-mail: info@aimfinland.fi

Mr Avory, Graham
Association for Standards & Practices
in Electronic Trade
EAN UK Ltd
Marketing & Communications
10 Maltravers Street
WC2R 3BX London
United Kingdom
Tel.: +4402076559037
Fax: +4402076812293
E-mail: graham.avory@e-centre.org.uk

Mr Rask, Arne
AIM Denmark Co Logisys A/S
Skagensgade 35
2630 Tåstrup
Denmark
Tel.: +4543526711
Fax: +4543526132
E-mail: ar@logisys.dk

Mr Slusarenko, Grigory
Automatic Identification Association
Uniscan
EAN Russia
Prospekt Vernadskogo, 53
PO Box 4
117415 Moscow
Russia
Tel.: +70954327612
Fax: +70954329565
E-mail: info@ean.ru

Mr Vermelis, Carl
AIM Nederlands
Leembaan 60A
PO Box 180
5750 AD Deurne
The Netherlands
Tel.: +31493351867
Fax: +31493351162
E-mail: info@aim-ned.nl

Dr Vieider, Günther
AIM Italy
Italy
Tel.: +39-029-218 121
Fax: +39-029-210 05 38
E-mail: info@icsitalia.it

Ms Zeth, Kristina
AIM Sweden Ekonomist Forening
Neglinge Center
133 33 Saltsjübaden
Sweden
Tel.: +46087176148
Fax: +46087176098
E-mail: kansliet@aim.sweden.se

Ms Iosep, Marcela
National Association for International Artists
Numbering EAN Romania
Logistic Dpt.
Mexic St.13
71206 Bucharest
Romania
Tel.: +4012301302
Fax: +401230??
E-mail: ean@ean.ro

Dr Sehorz, Eugen
EAN-Austria Gesellschaft für kooperative Logistik GmbH
EAN Identification Systems
Mayerhofgasse 1/15
1040 Vienna
Austria
Tel.: +431505860152
Fax: +431505860122
E-mail: e.sehorz@ean.co.at
Mr Bårdseth, Rolf
AIM Norway Pe Norsk
Emballasieforening
Norway
Tel.: +4767911719
Fax: +4767911711
E-mail: ROLF.BAARDSETH@INTERMEC.COM

Dr Nador, György
AIM Magyarorszag Eghesueles
Becsi Ut 120
1034 Budapest
Hungary
Tel.: +3613889595
Fax: +3612501504
E-mail: 

Mr Kroener, Henrik H.
Euro Commerce Asbl
Rue Froissart 123-133
1040 Brussels
Belgium
Tel.: +3222305874
Fax: +3222300078
E-mail: Kroner@euro.commerce.be

Mr Slith, Ian
Automatic Identification Manufacturers
UK
The Old Vicarage, Haley Hill
HX3 6DR Halifax
United Kingdom
Tel.: +441422368368
Fax: +441422355604
E-mail: iansmith@aim-europe.org

Mr Schade, Jürgen
Centrale für Coorganisation GmbH
Maarweg 133
51149 Köln
Germany
Tel.: +49-221-94 71 42 00
Fax: +49-221-94 71 42 90
E-mail: SCHADE@CCG.DE

Ms Angué, Thérèse
Groupement d’Etude et de Normalisation de la Codification
2, Rue Maurice Hartmann
92137 Issy-les-Moulineaux
France
Tel.: +330140955419
Fax: +330140955449
E-mail: tangue@gencod-ean.fr

Mr Simeonov, Tsvetan
Bulgarian Chamber of Commerce and Industry
National EAN Bureau
42 P. Parchevich Straße
1000 Sofia
Bulgaria
Tel.: +35929877826
Fax: +35929883209
E-mail: eanbg@bcci.bg
Novel cross-linking enzymes and their consumer acceptance for structure engineering of foods
CROSSENZ

Contract number: QLRT-2001-02208
Contract type: Shared Cost Project
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Rosanna d’Amario
Project website: not yet available
Coordinator: Dr Johanna Buchert

VTT Biotechnology
P.O. Box 1500
02044 VTT Finland
Tel.: +358-9-4565146
Fax: +358-9-4552103
E-mail: Johanna.Buchert@vtt.fi

Dr Marcel Asther
INRA

Unité Mixte de Recherche de Biotechnologie des Champignons Filamenteux
Av. de Lumyni 163
13288 Marseille Cedex 09
France
Tel.: +33491828600
Fax: +33491828601
E-mail: marcel.asther@esil.univ-mrs.fr

Prof. Dr David O’Beirne
University of Limerick
Department of Life Sciences
Limerick
Ireland
Tel.: +35361202845
Fax: +35361330316
E-mail: david.obeirne@ul.ie

Dr Henrik Andersen
Danish Institute of Agricultural Sciences
Animal Product Quality
Blüchers Allé
8830 Tjele
Denmark
Tel.: +4589991241
Fax: +4889991564
E-mail: Henrik.andersen@agrsce.dk

PARTNERS

Prof. Dr Klaus G. Grunert
The Aarhus School of Business
The MAPP Centre
Haslegaardsvej 10
8210 Aarhus V
Denmark
Tel.: +4589486439
Fax: +4586150177
E-mail: klg@asb.dk

Peter E. Degn
Danisco A/S
Edwin Rahrs Vej 38
8220 Brabrand
Denmark
Tel.: +4589435449
Fax: +4586251077
E-mail: g8hsp@danisco.com

Dr Chris De Wilde
Cropdesign N.V.
Technologiepark 3
9052 Zwijnaarde
Belgium
Tel.: +3292415080
Fax: +3292415089
E-mail: Chris.DeWilde@cropdesign.com
Novel cross-linking enzymes and their consumer acceptance for structure engineering of foods

BACKGROUND
Sensory properties, such as texture play a major role in food product quality. Food structure is especially important in baking, in dairy and products. The significance of textural properties has further increased with the trend towards low-fat, low calorie and low additive content products. Traditionally, food structure has been improved by using food ingredients such as emulgators or thickeners (e.g. monoglycerides, gelatine or carbohydrate-based polymers). Especially the use of gelatine is currently regarded negatively by the consumers and attempts to create food processing technologies without the need for it are currently searched. By the use of the enzymes, it will be possible to transform inherently available food components into functional ingredients during food processing and manufacturing. The enzymatic cross-linking can occur via proteins or certain carbohydrates either directly or indirectly. The type of cross-link depends on the type of enzyme used and different covalent linkages may be generated with different enzymes.

Today, despite of the huge potential, only transglutaminases are being used for food structure engineering. There is clearly a need to develop new enzyme-based methods and in-depth understanding of the correlation between cross-linking reactions and food structural and sensory properties. There is also need for novel types of enzyme activities, which would be functional in food processing conditions. Efficient production of these novel cross-linking enzymes in large quantities is also a prerequisite for industrial application development.

Previous research has shown that European consumers are sceptical with regard to the use of GMOs in food production and that this also applies to the use of enzymes which are produced using GMOs, even though no GMO material is present in the final food product. However, the way in which these sceptical attitudes enter the formation of intentions to buy products produced using enzymes produced in different ways, and especially the possible trade-off of a negative attitude towards the production method with additional sensory benefits, is presently not well-understood, even though preliminary research indicates that such trade-offs play a major role for consumer acceptance of novel food products.

OBJECTIVES
The generic objective of the project is to develop novel enzymatic technologies for structure engineering of foods. The developed enzymatic tools can be exploited in dairy, meat and baking applications for production of novel types of products. The objective is also to assess consumer acceptance of the use of these differently produced enzymatic structure engineering tools in food processing. Scientifically, the challenging objective is to discover novel cross-linking enzymes and to generate knowledge on enzymatic reaction mechanisms on molecular level. In addition, correlation between these molecular changes and macromolecular rheological and functional properties will be generated. The technological objective is to assess the practical applicability of the novel cross-linking enzymes in dairy, bakery and meat processing.
(EXPECTED) RESULTS AND ACHIEVEMENTS
• Development of new enzyme-based cross-linking enzymes and different routes (GMO, non-GMO and plant) for their production;
• Elucidation of reaction mechanisms for cross-linking enzymes;
• Development of improved sensory properties to food by combining novel enzyme technologies to high level food processing science;
• Practical evaluation of the potential of new enzyme-based systems in process applications;
• Evaluation of consumers’ attitudes to the novel enzymatic technologies.
Using electronic identification (EID) and molecular markers (DNA) for improving the traceability of meat

EID + DNA Tracing

Contract number: QLK1-2001-02229
Contract type: Shared Cost Project
Total cost: € 2.257.671
EC contribution: € 1.583.380
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr Gerardo Caja
Universitat Autonoma de Barcelona
Ciencia Animal i dels Aliments
Campus de Bellaterra, Edifici V
08193 Cerdanyola Del Vallès
Spain
Tel.: +34935811442
Fax: +34935812006
E-mail: gerardo.caja@uab.es

PARTNERS

Dr Wilkinson, David
Joint Research Centre - European Commission Institute for Systems Informatics and Safety
Via Enrico Fermi, Joint Research Centre.Ispra, T.P. 361
21020 Ispra Varese
Italy
Tel.: +390332789947
Fax: +390332789923
E-mail: david.wilkinson@jrc.it

Dr Lengelé, Luc
Services Vétérinaires
Ministère de l’Agriculture et des Classes Moyennes
DG5 - SVD
WTC III
Boulevard Simon Bolivar 30
1000 Bruxelles
Belgium
Tel.: +32-2-208 36 88
Fax: +32-2-208 36 57
E-mail: luc.lengele@cmlag.fgov.be

Mr Fernandez-Galvan, Manuel
Instituto Canario de Investigaciones Agrarias
Unidad de Producción Animal
Pastos y Forrajes
PO Box 60
38200 La Laguna, Tenerife
Spain
Tel.: +34922476302
Fax: ++34922476307
E-mail: mfgalvan@icia.rcanaria.es

Dr Vilaseca i Vintro, Joan Francesc
Gesimpex Comercial S.L.
Pau Claris, 165 5 C-D
08037 Barcelona
Spain
Tel.: +34934878599
Fax: +34932153808
E-mail: jfvilasecat@gesimpex.com

Prof. Dr Schön, Hans
Bayerische Landesanstalt für Landtechnik
Technische Universität München
Vöttinger Straße 36
85350 Freising
Germany
Tel.: +490816134403566
Fax: +4908161714048
E-mail: wendl@tec.agrar.tu.muenchen.de
Using electronic identification (EID) and molecular markers (DNA) for improving the traceability of meat

BACKGROUND
Traceability is sensitive point for consumers. Despite this, methods for tracing meat are poorly developed. With this aim, a double system based on electronic identification (BID) and DNA profiling for tracing animals and meat, according to EC regulations, is proposed. Improving knowledge of EID and overcoming limiting factors in the use of bolus (ruminants) and injectable (pig) transponders, will be attempted. We will develop and test a competitive new reader, and automatic data transfer (animal to meat) and recovery of transponders in the abattoir will also be studied. For DNA profiling, selection of markers and comparison of sampling methods will be performed. Finally the evaluation of the implementation for tracing and quality monitoring of beef and pork meats, including the management of a data base and a cost-benefit analysis, will be made.

OBJECTIVES
Primary objective: the development of a reliable system for the traceability of livestock and meat based on the joint use of electronic identification (EID) and molecular markers (DNA). The BID will provide a real time tagging and tracing-back methodology for on farm use and administrative purposes until slaughtering; the DNA profile will be used as an unchangeable method to audit the tracing-back of the identity of animals, carcasses and meat cuts in the whole meat industry process, at reasonable cost and response time. Further objective: the implementation and evaluation of the double system (EID+DNA) for the tracing and quality monitoring of beef (‘red’ and ‘pink’ meat) and pork (‘white pig’ fresh meat and ‘black pig’ fresh and cured ham) from farm to consumer under EU conditions, including the Data Base management and a cost-benefit analysis.

(Expected) RESULTS AND ACHIEVEMENTS
• M1: Retention law and prototype of small bolus for ruminants;
• M2: Body site for transponder injection in pigs;
• M3: Improved reader and automatic transponder retriever;
• M4: Flexible label transponders for identity transfer;
• M5: Laboratory test of devices and equipment;
• M6: DNA sampling and analysis for animal, carcass and meat;
• M7: Database and software for EID+DNA tracing-back;
• M8: Validation of the system in beef cattle and pigs;
• M9: Cost and cost-benefit analysis of the traceability system.
Dr Sydney Weber, Richard
Shearwell Data Limited
Putham Farm
Wheddon Cross, Minehead
TA24 7AS
United Kingdom
Tel.: +441643841552
Fax: +441643841628
E-mail: richard@shearwell.co.uk

Dr Verticelli, Lucio
Istituto Zooprofilattico Sperimentale
dell’Abruzzo e del Molise “G.
Caporale”
Reparto Genetica e Biologia
Molecolare
Laboratorio Centro Elaborazione Dati
Via Campo Boario
64100 Teramo
Italy
Tel.: +398613321
Fax: +39861332251
E-mail: 1.verticelli@izs.it

Dr Palacios Gómez, Javier
Instituto Nacional de Investigación y
Tecnología Agraria y Alimentaria
Mejora Genética y Biotecnología
Carretera de La Coruña Km. 7.5
PO Box 8111
28040 Madrid
Spain
Tel.: +34913473750
Fax: +34913471472
E-mail: palacios@inia.es

Mr Meghen, Ciaran
Identigen Limited
Smurfit Institute of Genetics
Dublin 2
Ireland
Tel.: +353-1-60 82 300
Fax: +353-1-679 85 58
E-mail: cmeghen@tcd.ie

Prof. Lathrop, Mark
Centre National de Génotypage
2 Rue Gaston Cremieux
PO Box 5721
91057 Evry Cedex
France
Tel.: +33-1-60 87 84 03
Fax: +33-1-60 87 84 84
E-mail: mark.lathrop@cng.fr
Low temperature-pressure processing of foods: Safety and quality aspects, process parameters and consumer acceptance

SAFE ICE

Contract number: QLRT-2001-02230
Contract type: Shared Cost Project
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Dyanne Bennink
Project website: not yet available

Coordinator:
Prof. Dr Dietrich Knorr
Technische Universität Berlin
Lebensmittelbiotechnologie und -prozesstechnik
Königin Luise-Str. 22
14195 Berlin
Germany
Tel.: +49-30-31471250
Fax: +49-30-8327663

PARTNERS

E-mail: dietrich.knorr@tu-berlin.de
Dr Karin Autio
VTT Biotechnology
Tietotie 2
02044 VTT Espoo
Finland
Tel.: +35894565160
Fax: +3589455203
E-mail: karin.autio@vtt.fi

Dr Pedro D. Sanz
Instituto del Frio
Consejo Superior de Investigaciones Científicas (CSIC-IF)
Calle José Antonio Novais 10
Ciudad Universitaria 28040
Spain
Tel.: +34915492300
Fax: +34915493627
E-mail: psanz@if.csic.es

Pr Dr Alain Le Bail
Ecole Nationale d’Ingenieurs des Techniques
des Industries Agricoles et Alimentaires
La Geraudière
44322 Nantes
France
Tel.: +33251785454
Fax: +33251785455
E-mail: lebail@enitiaa-nantes.fr

Prof. Dr Stanley Brul
Unilever Nederland BV
Unilever Research & Development
Vlaardingen
Olivier van Noortlaan 120
3133 AT Vlaardingen
The Netherlands
Tel.: +31104606142
Fax: +31104606238
E-mail: stanley.brul@unilever.com

Prof. Dr ir. Marc Hendrickx
Katholieke Universiteit Leuven
Department of Food and Microbial Technology
Laboratory of Food Technology
Kasteelpark Arenberg 22
3001 Leuven
Belgium
Tel.: +3216324063
Fax: +3216324198
E-mail: Marc.Hendrickx@agr.kuleuven.ac.be

MSc. Jacek Arabas
Polish Academy of Sciences
High Pressure Research Center
Sokolowska 29/37
01-142 Warsaw
Poland
Tel.: +48226325010
Fax: +48226324218
E-mail: equipment@unipress.waw.pl
Low temperature-pressure processing of foods: Safety and quality aspects, process parameters and consumer acceptance

BACKGROUND
The aim of this project is to address and overcome specific scientific and technological hurdles which is necessary to make an informed judgement of the relevance of food related effects of pressure in the low temperature domain as to realise and deliver their full benefits to the end users.

OBJECTIVES
To comply with this goal the project is organised into three objectives:

• to accumulate systematic data regarding thermophysical properties, safety, quality and stability aspects of pressure freezing and thawing of foods;
• to develop models for SAFE ICE processes related to safety, quality and stability aspects as well as consumer acceptability of foods;
• to use the knowledge generated for product evaluation and optimisation, for process control and process concept development and for educated judgments on consumer aspects aiding the identification of critical process parameters.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Expected achievements include the accumulation of unique data sets based on the interaction of European scientists from various fields including freezing technology, food microbiology, food biotechnology, food engineering and material science. Such data will aid the identification of critical process parameters and provide quantitative information on product safety aspects essential for product optimisation or new product or process developments.

Furthermore, it is expected to establish a sound scientific database regarding product safety and product stability criteria and to acquire data on a pilot plant scale. It is the ultimate goal of this project to initiate new technologies and new products based on SAFE ICE technologies.
A new process using membrane reactor technology to improve the healthcare aspects of hydrogenated edible oils

CAMERTOIL

Contract number: QLRT-2001-02234
Contract type: Shared Cost Project
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Rosanna d’Amario
Project website: not yet available

Coordinator:
Dr Maria Carmen Villaran
Fundación Leia
Centro de Desarrollo Tecnológico Research and Development of Environmental Technologies
Leonardo da Vinci 11
01510 Minano Mayor (Alava)
Spain
Tel.: +34-945 298 144
Fax: +34-945 298 217
E-mail: mcarmenv.leia@sea.es

PARTNERS

Prof. Dr Stuart Hampshire
University of Limerick
Materials and Surface Science Institute
Plassey Technological Park
Limerick
Ireland
Tel.: +35361202686
Fax: +35361202912
E-mail: stuart.hampshire@ul.ie

Dr Christian Scherf
GKSS Forschungszentrum Geesthacht GmbH
Institut für Chemie
Max-Planck-Straße
21502 Geesthacht
Germany
Tel.: +494151871669
Fax: +494152871618
E-mail: christian.scherf@gkss.de

Federico Lopez
De Smet España
Calle Colombia, 64, 7°
28016 Madrid
Spain
Tel.: +34913599205
Fax: +34913599210
E-mail: pperez@desmetesp.com

Mr Dimitar Jankov
Bisser Oliva S.A.
Industrial Zone
6000 Stara Zagora
Bulgaria
Tel.: +35942600365
Fax: +3594239678
E-mail: olivast@stz.orbitel.bg

Mr Maximo Ramo
Helados Miko, S.A.
R&D Department
Zona Industrial de Araia
01250 Araia
Spain
Tel.: +34945010800
Fax: +34945276095
E-mail: Fjavier.Echarri@miko.es

Mr Francisco Soler
Lipidos Santiga, S.A.
Research and Development Department
Ctra. Ripollet a Santigo, km 4.3. 08130 Sta. Perpetua de Mogoda (Barcelona)
Spain
Tel.: +34935443397
Fax: +34935743296
E-mail: francisco.soler@lipidossantiga.com
A new process using membrane reactor technology to improve the healthcare aspects of hydrogenated edible oils

BACKGROUND

Edible oil hydrogenation is an operation carried out in order to optimise some oil properties. The health concern related with the high production of trans-fatty acid in these processes is leading the sector of edible fat manufacturers to develop new and expensive technologies or to modify the hydrogenation process.

OBJECTIVES

The main objective of CAMERTOIL is to develop and validate a new hydrogenation system based on the catalytic membrane reactor technology that will allow to reduce the content of trans-fatty acids in the final hydrogenated products below 1%. With this system, the hydrogenation process will be simplified: the catalyst membrane is supported and there is no mixture of reactants and catalyst, making the filtration phase unnecessary and avoiding the losses of catalyst. This will allow using a more selective catalyst to avoid trans-fatty acid production.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Dr Mariyana Perifanova-Nemska  
Higher Institute for Food and Flavour Industry  
Production and Processing of Vegetable Oils  
Maritza 26  
4002 Plovdiv  
Bulgaria  
Tel.: +35932236465  
Fax: +35932440102  
E-mail: maryperifanova@myrealbox.com
QLRT-2001-02234: A new process using membrane reactor technology to improve the healthcare aspects of hydrogenated edible oils
Optimised processes for preparing healthy and added value food ingredients from lupin kernels, the European protein-rich grain legume

HEALTHY-PROFOOD

Contract number: QLRT-2001-02235
Contract type: Shared Cost Project
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Alkmini Katsada
Project website: not yet available

Coordinator:
Prof. Dr. Anna Arnoldi
Università degli Studi di Milano
Dipartimento di Scienze Molecolari e Agroalimentari
via Celoria 2
20133 Milano
Italy
Tel.: +39-02-50316806
Fax: +39-02-50316801
E-mail: Anna.Arnoldi@unimi.it

PARTNERS

Prof. Cesare Sirtori
Università degli Studi di Milano
Dipartimento di Scienze Farmacologiche
Via Balzaretti 9
20133 Milano
Italy
Tel.: +390250318311
Fax: +390250318394
E-mail: cesare.sirtori@unimi.it

Prof. Georgios Doxastakis
Aristotle University of Thessaloniki
School of Chemistry
University Campus
54006 Thessaloniki
Greece
Tel.: +30310997774
Fax: +30310997779
E-mail: doxasta@chem.auth.gr

Prof. Marek Naruszewicz
National Food and Nutrition Institute
WHO Collaborating Centre for Food Contamination Monitoring
Powińska 61/63
02-903 Warsaw
Poland
Tel.: +48(22)55-09677
Fax: +48228421103
E-mail: mmarusz@izz.waw.pl

Prof. Hilmer Sørensen
The Royal Veterinary and Agricultural University
Chemistry Department
Thorvaldsensvej 40
1871 Frederiksberg C
Denmark
Tel.: +4535282432
Fax: +4535282398
E-mail: hils@kvl.dk

Prof. Anne Frøkiær
Technical University of Denmark
Biocentrum-DTU
Solvtofts Plads, Bld.224
2800 Kgs. Lyngby
Denmark
Tel.: +4545252753
Fax: +4545886307
E-mail: hf@biocentrum.dtu.dk

Dr Riita Korpela
Valio Ltd, R&D
Meijeritie 6
P.O Box 30 0039 Helsinki
Finland
Tel.: +358103813019
Fax: +358503840197
E-mail: riita.korpela@valio.fi
Optimised processes for preparing healthy and added value food ingredients from lupin kernels, the European protein-rich grain legume

BACKGROUND

Proteins are an essential ingredient for the preparation of foods. The European ingredient market is approaching maturity, but experiencing a period of unrest due to the demands of food manufactures: in particular, as a result of the BSE crisis, they plan to use as much as possible plant proteins instead of animal proteins.

Lupin is an ancient European protein-rich grain legume typical of the Mediterranean region and produces seeds with a protein content that is both qualitatively and quantitatively similar to soybean. Its protein content, varying from species to species, is around 35 to 40% in *Lupinus albus*. Lupin seed has a very low content of antinutritional compounds, such as hydrolase inhibitors, lectins, saponins, oligosaccharides of the raffinose family. All these factors indicate that lupin has all the potentialities to become an excellent source of added-value food protein ingredients.

This project will develop protocols for preparing lupin ingredients and food items therefrom that may be well accepted by EU consumers for their sensory and nutritional characteristics. It will evaluate nutritional characteristics and assess potential health benefits. It will assure traceability of lupin-based ingredients in food items and assess allergenic potential. Model foods will be sensory evaluated in collaboration with EU consumer associations. It will produce a survey with statistical data on protein ingredients in EU and trends of consumers and industrialists on novel products. Finally, it will promote lupin-based ingredients and food items in Europe through involvement of consumer associations.

OBJECTIVES

• To optimise economically competitive and environmentally sustainable processes for the preparation of food ingredients with optimal technological, sensory, and nutritional characteristics, based on lupin kernels, that may also be potentially beneficial for health.

• To obtain protocols for the preparation of food items based on lupin proteins that may be very well accepted by the European consumers for their sensory and nutritional characteristics.

• To promote lupin based ingredients and food items in Europe through the involvement of consumer associations.

(EXPECTED) RESULTS AND ACHIEVEMENTS

• A survey gathering statistical data on protein ingredients for food industry in EU, as well as trends of consumers and industrialists regarding novel products;

• Optimisation of economically competitive and environmentally sustainable processes for preparing lupin protein ingredients with improved technological, sensory and nutritional characteristics, which may be beneficial for health;

• Economical assessment on the place of lupin ingredients in the ingredient market;

• Protocols for the preparation of lupin protein based food items with optimal sensory and nutritional characteristics;
• Assessment of the potential health benefits of these food ingredients/items in hypercholesterolemia, hypertension, and diabetes;
• Assessment of the consumer acceptance of these food items;
• Promotion of lupin based ingredients and food items by active participation of consumer associations.
Recommendations for improved procedures for securing consumer oriented food safety and quality of certified organic foods from plough to plate

ORGANIC HACCP

Contract number: QLRT-2001-02245
Contract type: Concerted Action
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 24 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr Kirsten Brandt
Danish Institute of Horticultural Sciences
Department of Horticulture
Kirstinebjergvej 10
5792 Aarslev
Denmark
Tel.: +45-63-904244
Fax: +45-63-904395
E-mail: kirsten.brandt@agrsci.dk

Dr Lucius Tamm
Research Institute of Organic Agriculture
Division of Crop Protection
Ackerstrasse
5070 Frick
Switzerland
Tel.: +41628657238
Fax: +41628657273
E-mail: lucius.tamm@fibl.ch

Dr Katherine O’Doherty Jensen
Royal Veterinary and Agricultural University
Research Department of Human Nutrition
Rolighedvej 30
1958 Frederiksberg C
Denmark
Tel.: +4535282488
Fax: +4535282483
E-mail: koj@kvl.dk

Dr Paolo Bergamo
Consiglio Nazionale Delle Ricerche
Institute of Food Science and Technology
Via Roma 52
83100 Avellino
Italy
Tel.: +390825299161
Fax: +390825299105
E-mail: p.bergamo@isa.av.cnr.it

Dr Iain Ogden
The University of Aberdeen
Department of Medical Microbiology
Polwarth Building, Forsterhill
AB25 2ZD Aberdeen
United Kingdom
Tel.: +441224551132
Fax: +441224685604
E-mail: i.ogden@abdn.ac.uk

Dr Alberta Velimirov
Ludwig Boltzmann Institute for Biological Agriculture
Rinnböckstr. 15
1110 Wien
Austria
Tel.: +4317951497946
Fax: +431795149997940
E-mail: albiveli@yahoo.com

Prof. Dr Eduardo Rosa
Universidade de Tras-os-Montes e Alto Douro
Department of Plant Sciences and Agricultural Engineering
Quinta de Prados
5001-911 Vila Real
Portugal
Tel.: +351259350451
Fax: +351259350327
E-mail: Erosa@utad.pt

PARTNERS
Recommendations for improved procedures for securing consumer oriented food safety and quality of certified organic foods from plough to plate

BACKGROUND
The proposal aims to provide an overview of consumer concerns in terms of organic food in different European regions, and a conceptual framework for setting future research in perspective. It will establish a database of existing procedures and relevant control points for selected organic food production chains, prepared for extension with additional commodity groups and updated procedures, and provide a systematic assessment of the Critical Control Points of the chains and the possibilities for improvements. It will produce and disseminate information material with recommendations for improvements of procedures and control, to the stakeholders involved (consumers, regulating bodies, sales outlets, distributors, producers and safety authorities), and define the most important areas where additional research is needed.

OBJECTIVES
• To provide an overview of consumer concerns in terms of organic food in different European regions, and a conceptual framework for setting future research in perspective;
• To establish a database of existing procedures and relevant control points for selected organic food production chains, prepared for extension with additional commodity groups and updated procedures;
• To provide a systematic assessment of the Critical Control Points of the chains and the possibility of improvements;
• To produce and disseminate information material with recommendations for improvements of procedures and control, to the stakeholders involved;
• To define the most important research needs on subjects where current knowledge does not yield a sufficiently firm basis for practical recommendations, and disseminate this information to researchers and research policy makers.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• A review of consumer concerns and criteria as regards organic agriculture;
• A data set describing the chains of production and distribution for organic products for 9 commodities in 5 to 10 regions;
• Assessment of Critical Control Points for 7 types of consumer criteria;
• Assembly of recommendations based on these assessments and dissemination to producers, consumers, authorities, researchers and other stakeholders.
QLRT-2001-02245: Recommendations for improved procedures for securing consumer oriented food safety and quality of certified organic foods from plough to plate
**Integrated carcass, meat primers and associated products identification, tracking, tracing and record generation system**

**INTELLITRACKER**

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<td>Scientific Officer:</td>
<td>Antonio di Giulio</td>
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<td>not yet available</td>
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**Coordinator:**

Mr David Mills  
Bradman-Lake Ltd  
Yelverton Road  
Brislington  
Bristol  
BS4 5HP  
United Kingdom  
Tel.: +44 1179 715228  
Fax: +44 1179 775514  
E-mail: david.mills@bradmanlake.co.uk

**Coordinator:**

Mr Herbert Feyerabend  
Allgäu Fleisch GmbH  
Bleicherstraße 18  
87437 Kempten  
Germany  
Tel.: +49 831 7035 0  
Fax: +49 831 7035 29  
E-mail: feyerabend@allgaeu-fleisch.de

**PARTNERS**

Dr Rembert Pieper  
NWK-Binär Soft- und Hardwareentwicklungs-GmbH  
Am Wiesengrund 1  
86932 Pürgen  
Germany  
Tel.: +49 8196 9300 0  
Fax: +49 8199 9300 90  
E-mail: nwk@nwk.de

Mr Popy Abergel  
RVSI (Europe) Ltd  
New Barnes Mill, Cottonmill Lane  
St Albans  
Hertfordshire  
AL1 2HA  
United Kingdom  
Tel.: +44 1727 734690  
Fax: +44 1727 965935  
E-mail: apopy@aol.com

Mr R Berghammer  
Rudolf Berghammer GmbH  
Kühbachstraße 4  
4724 Neukirchen am Walde  
Austria  
Tel.: +43 7278 3362 0  
Fax: +43 7278 3362 20  
E-mail: not yet available

Mr Richard Maunder  
Lloyd Maunder Ltd  
Lloyd Maunder Road  
Willand  
Callompton  
Devon  
EX15 2PJ  
United Kingdom  
Tel.: +44 1884 820534  
Fax: +44 1884 820826  
E-mail: richard.maunder@lloydmaunder.co.uk
Integrated carcass, meat primers and associated products identification, tracking, tracing and record generation system

BACKGROUND
Recent animal and food contamination issues have highlighted the immediate need for better materials tracking and tracing. A relatively simple, flexible, low cost approach has been identified for carcasses from pig, lamb and poultry capable of integrating animal ID data with grading and production data and seamlessly carrying that data with the associated products.

Any technology developed must be simple to use and cost effective but be available in formats to suit small producers and large processors alike. It must also be relatively unobtrusive and satisfy current food regulations.

The end point is the demonstration of an integrated, non-contact system for marking and identifying animal carcasses, their primals and subsequent products with a robust 2D Matrix code that remains with the meat during break-up and processing, using a combination of separate technologies already proven in other industries.

OBJECTIVES
• To produce a flexible system capable of marking carcasses, primals and their associated products with a unique robust mark at several anatomical locations in a single operation;
• To ensure the solution (individual components and the integrated system) are rugged;
• To make it simple to use;
• To minimise the need for any specialist skills to accomplish its required function;
• To be as automated and/or integrated as possible without introducing unnecessary complication but to also be made available in a manual format for smaller producers or low volume operations;
• To make the solution affordable relative to the application;
• To ensure that any sensitive data/information generated is safe but securely accessible through the developed technology;
• To ensure data record is complete yet tamper proof so it can be used for validation purposes;
• To be flexible in its applications - proposed for pork, poultry and lamb.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• A working demonstrator system for generating a machine readable mark/code/ID suitable for application to meat carcasses, primals and products in a write once/read many (WORM) approach;
• A reliable and reproducible method of applying that mark to carcasses;
• A method of reading that mark ‘on demand’;
• A method of generating a record including a method of incorporating previous live animal information, grading, yield and production data;
• The necessary individual hardware and software components to accomplish these objectives;
• Simple to use within a harsh working environment;
• Configurable and affordable to the needs of both small and large processors.
Production of CLA-enriched dairy products by natural means

**BIOCLA**

**Contract number:** QLRT-2001-02362  
**Contract type:** Shared Cost Project  
**Total cost:** Under negotiation  
**EC contribution:** Under negotiation  
**Starting date:** not yet determined  
**Duration:** 36 Months  
**Scientific Officer:** Jürgen Lucas  
**Project website:** not yet available

**Coordinator:**  
Dr Catherine Stanton  
Teagasc  
Dairy Products Research Center  
Moorepark  
Fermoy, Co. Cork  
Ireland  
Tel.: +353-2-542442  
Fax: +353-2-542340  
E-mail: cstanton@moorepark.teagasc.ie

**PARTNERS**

Dr Giovanni Piredda  
Istituto Zootecnico e Caseario per la Sardegna  
Località Bonassai  
07040 Olmedo  
Italy  
Tel.: +39-079-38 94 44  
Fax: +39-079-38 94 50  
E-mail: IZCSCAS@TIN.IT

Dr Nick Offer  
Scottish Agricultural College  
Food Systems Division  
Auchincruive  
KA6 5HW Ayr  
United Kingdom  
Tel.: +44-1292-52 51 61  
Fax: +44-1292-52 50 71  
E-mail: n.offer@au.sac.ac.uk

Prof. Dr Sebastiano Banni  
Università degli Studi di Cagliari  
Dipartimento di Biologia Sperimentale  
Sezione di Patologia Sperimentale  
Cittadella Universitaria  
09042 Monserrato (Cagliari)  
Italy  
Tel.: +39-070-675 41 28  
Fax: +39-070-675 40 32  
E-mail: banni@vaxa1.unica.it

Dr Yves Chilliard  
INRA Theix  
Herbivore Research Unit  
63122 St Genès-Champanelle  
France  
Tel.: +33-473 62 41 14  
Fax: +33-473 62 45 19  
E-mail: chilliar@clermont.inra.fr

Dr Jean-Pierre Tillon  
Union Invivo  
BP 19  
02402 Chateau-Thierry Cedex  
France  
Tel.: +33-323 84 80 00  
Fax: +33-323 83 39 27  
E-mail: jptillon@ucaab.com

Dr Pekka Huhtanen  
MTT Agrifood Research Finland  
Animal Production Research  
31600 Jokioinen  
Finland  
Tel.: +358-3-41 88 36 94  
Fax: +358-3-41 88 36 61  
E-mail: pekka.huhtanen@mtt.fi
Production of CLA-enriched dairy products by natural means

BACKGROUND

Conjugated linoleic acid (CLA), a natural component of milkfat exhibits several health promoting attributes, including protection against cancer, heart disease and obesity, diet-related diseases that contribute significantly to EU health-care costs. To confer the potential health benefits of CLA to humans, foods rich in CLA should be consumed. This project aims to develop dairy-based functional foods enriched in CLA, and evaluate their efficacy in humans. CLA enriched foods will be manufactured at pilot and commercial scales from CLA-enriched milk, to be obtained following the identification of animal feeding and management strategies suitable for bovine, ovine and caprine species, and secondly, following the development of dairy-fermentation based processes using selected CLA-producing food-grade strains. This project will have a positive impact on health of EU consumers, EU milk producers and the EU functional foods industry.

OBJECTIVES

The objective of the project is to derive natural, consumer-acceptable strategies and processing systems to produce CLA-enhanced dairy foods of proven safety and quality. This will be achieved by co-ordinated metabolic, nutritional and technological studies involving milk production in the bovine, ovine and caprine species and through exploitation of CLA producing food-grade cultures. Both detailed and large-scale animal experiments will be conducted with lactating dairy cows, goats and sheep, leading to the identification of animal feeding and management strategies appropriate to a range of geographical regions and dairy systems throughout the EU. High quality dairy-based functional foods enriched in CLA, manufactured from the resulting milk and using bioactive cultures with CLA-biosynthetic capabilities, will be evaluated in studies with animals and healthy humans to establish their safety and efficacy. Effects of consumption of the CLA-enriched functional foods on CLA status and lipid metabolism in healthy humans will be established. Consumption of CLA-rich foods is likely to confer health benefits on humans, given the health promoting properties attributed to dietary CLA, including reduction in cancers, such as skin, stomach and breast cancer, and reduction of the risk of heart disease and obesity.

The scientific objectives are:

• To elucidate the biological mechanisms of CLA production in lactating ruminants and in bacteria;
• To evaluate the contribution of added intestinal microbes to mammalian CLA status;
• To assess the impact of CLA-enriched fats on stability and quality in dairy food systems;
• To assess the impact of consuming CLA-enriched dairy products on human health parameters.

The technological objectives are

• To enrich CLA in milk products, by identification of animal feeding and management strategies for production of CLA-enriched milk appropriate to a range of geographical regions and dairy systems, and through exploitation of CLA producing cultures;
• To develop stable CLA-enriched food products of acceptable sensory properties;
• To assess safety and potential efficacy of naturally produced CLA-enriched dairy products in humans - demonstration of improvement of the raw material and product.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Elucidation of mechanisms of CLA biosynthesis in lactating ruminants and in microbes;
• Effective animal feeding and management strategies for sustainable production of CLA-enriched milk appropriate to a range of geographical regions and dairy systems;
• Stable CLA-enriched dairy products with good sensory attributes produced;
• Identification of the contribution of added intestinal CLA producing bioactive cultures to mammalian CLA status;
• Effects on human health parameters of the CLA-enriched dairy products described;
• Safety and potential efficacy of naturally produced CLA-enriched dairy products in humans assessed;
• Quantification of effective CLA intakes in humans and measurement of the consequences of consumption of CLA-enriched foods for human blood lipid profiles and the definition of relationships between intake and tissue levels of CLA and its metabolites in man.

PARTNERS
Dr Richard Dewhurst
Institute of Grassland and Environmental Research
Plas Gogerddan
SY23 3EB Aberystwyth, Ceredigion
United Kingdom
Tel.: +44-1970-82 82 55
Fax: +44-1970-82 83 57
E-mail: richard.dewhurst@bbsrc.ac.uk

Dr Donald Muir
Hannah Research Institute
Hannah Research Park
KA6 5HL Ayr
United Kingdom
Tel.: +44-1292-670 170
Fax: +44-1292-670 180
Email: charis@charisfoods.co.uk
Production of CLA-enriched dairy products by natural means
Novel enzyme-aided extraction technologies for maximised yield and functionality of bioactive components in consumer products and ingredients from by-products

MAXFUN

Contract number: QLRT-2001-02364
Contract type: Shared Cost Project
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Dyanne Bennink
Project website: not yet available

Coordinator:
Prof. Dr Kaisa Poutanen
VTT Biotechnology
Tietotie 2
02044 VTT Espoo
Finland
Tel.: +358 9 456 5192
Fax: +358 9 455 2103
E-mail: Kaisa.Poutanen@vtt.fi

PARTNERS

Prof. Dr F.A. Tomás-Barberán
Consejo Superior Investigaciones Científicas (CSIC)
Murcia
CEBAS, P.O. Box 4195
Murcia 30080
Spain
Tel.: +34 968 39 6334
Fax: +34 968 39 6213
E-mail: fatomas@cebas.csic.es

Dr H.A. Schols
Laboratory of Food Chemistry
Department of Agrotechnology and Food Science
Wageningen University
Bomenweg 2
6703 GD Wageningen
The Netherlands
Tel.: +31 317 48 2239
Fax: +31 317 48 4893
E-mail: henk.schols@chem.fdsci.wag-ur.nl

Dr Véronique Cheynier
Joint Research Unit Sciences for Enology (INRA-SPO)
2, Place Viala
34060 Montpellier cedex
France
Tel.: +33 499 61 2298
Fax: +33 499 61 2683
E-mail: cheynier@ensam.inra.fr

Dr Riitta Törrönen
University of Kuopio
P.O. Box 1627
70211 Kuopio
Finland
Tel.: +358 17 16 3109
Fax: +358 17 16 3322
E-mail: riitta.torronen@uku.fi

Dr Pedro Abellán
Hero España, S.A.
Departamento de Calidad y Desarrollo
Avda. de Murcia, 1
30820 Alcantarilla (Murcia)
Spain
Tel.: +34 968 898 900
Fax: +34 968 898 952
E-mail: pedro.abellan@hero.es

Dr David Ageron
La Societé Française de Distilleries
BP 47
07150 Vallon Pont d’Arc
France
Tel.: +33 475 880 218
Fax: +33 475 881 017
E-mail: d-ageron@france-distilleries.com
Novel enzyme-aided extraction technologies for maximised yield and functionality of bioactive components in consumer products and ingredients from by-products

BACKGROUND
MAXFUN will develop novel enzyme-aided processing technologies for grape and berry applications with special emphasis on increasing the yield and enhancing the quality of the final consumer products, i.e. juice or wine. Enzymatic treatments will be combined to selected novel physical/physicochemical and mechanical treatments. The same technologies will also be applied for extraction of valuable food ingredients from the current process by-products. The potential health-promoting value of consumer products or novel ingredients will be elucidated by bioactivity assays and in vitro models. The sensory quality of the improved products will also be studied. Finally, the consumer attitudes and acceptance of products manufactured with the new technologies will be assessed together with an economical and process technical feasibility analysis.

OBJECTIVES
The general objective of MAXFUN is to develop novel enzyme-aided processing technologies for grape and berry processing industry resulting in maximised exploitation of the quality and healthiness of the raw materials with concomitant improvement in the processability and minimisation of the waste formation. The research will focus on grapes (wine grapes, white grapes) and berries (black currants and bilberries) and their process residues, but the developed technologies are easily applicable to other types of raw materials. The objective is also to isolate novel, potentially bioactive components from non-utilised process residues and thus create opportunities for waste upgrading to valuable food ingredients. The goal is to elucidate the health-promoting potential of the improved consumer products and isolated food ingredients with various bioassays and in vitro models. Finally, the aim is to investigate the role of the developed technologies on the consumer attitudes towards novel products.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Novel enzymes for fruit and berry processing produced;
• Suitability of novel unit operations for grape and berry processing evaluated;
• Enzyme-aided extraction technologies developed;
• Novel techniques for grape and berry by-product valorisation developed;
• Bioactivity of the improved consumer products and ingredients determined;
• Consumer acceptance to the novel technologies elucidated;
• Economical and technical feasibility of the enzyme-aided extraction technologies estimated.
Mr Vernu Vasunta
Kiantama Oy
Marjatie 1
89601 Suomussalmi
Finland
Tel.: +3588712670
Fax: +3588712671
E-mail: vernu.vasunta@kiantama.fi

Dr Steen Skjold-Jørgensen
Novozymes A/S
Beverage R&D
Krogshøjvej 36
2880 Bagsværd
Denmark
Tel.: +4588249999
Fax: +4544980610
E-mail: ssj@novozymes.dk
QLRT-2001-02364: Novel enzyme-aided extraction technologies for maximised yield and functionality of bioactive components in consumer products and ingredients from by-products
Development of quantitative and qualitative molecular biological methods to identify plant and animal species in foods

COORDINATOR:
Dr. Jutta Zagon
Federal Institute for Health Protection of Consumers and Veterinary Medicine
FG 213
Thielallee 88-92
14195 Berlin
Germany
Tel.: +49-30-84123876
Fax: +49-30-84123876
E-mail: j.zagon@bgvv.de

PARTNERS

Dr. Fredi Schwägele
Bundesanstalt für Fleischforschung
Institut für Chemie und Physik
E.-C.-Baumann-Straße 20
95326 Kulmbach
Germany
Tel.: +49-9221 803216
Fax: +49-9221 803303
E-mail: c-schwaegele@baff-kulmbach.de

Dr. J.A. Lenstra
Utrecht University
Faculty of Veterinary Medicine
Institute of Infectious Diseases and Immunology
Yalelaan 1
PO Box 80165
3508 TD Utrecht
The Netherlands
Tel.: +31-30 2534992
Fax: +31-30 2540784
E-mail: J.A.Lenstra@vet.uu.nl

Dr. Pardigol, Andreas
Dr. Pöpping, Bert
Eurofins Scientific Ltd
Rue Pierre Adolphe Bobierre
PO Box 42301
44323 Nantes Cedex 3
France
Tel.: +33-2 51832107
Fax: ++33-2 51832110
E-mail: AndreasPardigol@eurofins.com
BertPopping@eurofins.com

Dr. Tomáš Kuchtá
Food Research Institute Vyskumný
Ustav Potravinarsky
Priemyselska 4
PO Box 25
82475 Bratislava
Slovakia
Tel.: +421-7 50237158
Fax: +421-7 55571417
E-mail: kuchta@vup.sk

Ing. Jiří Kucera
Food Research Institute Prague
Department of Microbial Products
Radiova 7
10231 Prague 10 - Hostivar
Czech Republic
Tel.: +420-2 96791364
Fax: +420-2 72701983
E-mail: j.kucera@vup.cz
Development of quantitative and qualitative molecular biological methods to identify plant and animal species in foods

BACKGROUND
Recent investigations demonstrated that fraudulent replacement of food components as well as adverse reaction to unexpected food ingredients are quite common problems. Up to now official methods for the detection of plant and animal species in foods are mainly based on protein analysis. The project aims to develop DNA-analytical methods for qualitative and quantitative identification of plant and animal species in foods to monitor product safety and traceability. The project includes the comparison of nucleic acid-based methods with protein-based ones. A research aspect will be enhancing throughput by introducing multiplex-PCR, PCR-ELISA and chip technology. Four methods for several species will be validated in interlaboratory studies. Furthermore a public database will be established containing information about methods to identify plant and animal species in foods.

OBJECTIVES
Main objectives of the project will be the development of methods suited for the monitoring of potential allergenic compounds, fraud and to ensure correct labelling. Thus a panel of species in foodstuffs will be investigated which might play a role in this regard. The project includes two aspects: development of qualitative methods which are useful to identify a broad variety of different species including exotic species, species of regional interest and hidden potential allergenic compounds. Quantitative methods will be developed with respect to threshold values for supporting the surveillance of legal requirements. Research will be performed on the following aspects: enhancing sample throughput and applicability and comparison of DNA with protein analytical methods. Four methods will be validated in interlaboratory studies. In addition a database will be developed including all information to identify species in foodstuffs.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Recommendations on sample preparation suited also for quantitative analysis.
• Development of qualitative DNA- and protein- based methods as well as quantitative methods.
• Development of methods enhancing throughput in food analysis.
• Comparison between protein- and DNA-based methods.
• Evaluation of four methods in interlaboratory studies.
• Establishing a database, containing these methods.
Dr. Geir Dahle  
Institute of Marine Research  
Department of Aquaculture  
Nordnes Gt 50  
PO Box 1870  
5817 Bergen  
Norway  
Tel.: +47-55 236349  
Fax: +47-55 236379  
E-mail: geir.dahle@imr.no  

Dr. Fernando Ponz  
Instituto Nacional de Investigación y  
Tecnología Agraria y Alimentaria  
Departamento de Mejora Genética y  
Biotecnología  
Ctra la Coruña, Km 7.5  
28040 Madrid  
Spain  
Tel.: +34 913476887  
Fax: +34 913573107  
E-mail: fponz@inia.es  

Dr. Claudia Harms  
Hanse Analytik GmbH  
Fahrenheitstraße 1  
28359 Bremen  
Germany  
Tel.: +49-421 202466  
Fax: +49-421 2024689  
E-mail: cl.harms@hanse-analytik.de  

Dr. Peter Remler  
Graz University of Technology  
Institute of Bio- and Food Chemistry  
Department of Food Chemistry and  
Technology  
Petersgas 12/II  
8010 Graz  
Austria  
Tel.: +43-316 8736499  
Fax: +43-316 8736971  
E-mail: peter.remler@tugraz.at  

Dr. Käppeli, Othmar  
Agency for Biosafety Research and  
Assessment of Technology Impacts of  
the SPP  
Clarastrasse 13  
4058 Basel  
Switzerland  
Tel.: +41-61 6909310  
Fax: +41-61 6909315  
E-mail: kaepel@bats.ch  

Dr. Rolf Meyer  
Nestec S.A.  
Avenue Nestlé 55  
1800 Vevey  
Switzerland  
Tel.: +41-21 7858808  
Fax: +41-21 7858553  
E-mail: rolf.meyer@rdls.nestle.com
QLK1-2001-02373: Development of quantitative and qualitative molecular biological methods to identify plant and animal species in foods
Traceability of origin and authenticity of olive oil by combined genomic and metabolomic approaches

OLIV-TRACK

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Scientific Officer: Barend Verachtert
Project website: not yet available

Coordinator:
Prof. Dr Nelson Marmiroli
Università degli Studi di Parma
Dipartimento di Scienze Ambientali
Sezione Genetica e Biotecnologie Ambientali
Parco Area delle Scienze 11/A
43100 Parma
Italy
Tel.: +39-052-1905606
Fax: +39-052-1905665
E-mail: nelson.marmiroli@unipr.it

Dr Paolo Donini
NIAB
Huntingdon Road
CB3 0LE Cambridge
United Kingdom
Tel.: +441223276381
Fax: +441223277602
E-mail: paolo.donini@niab.com

Dr Gianluca De Bellis
Consiglio Nazionale delle Ricerche
Istituto di Tecnologie Biomediche
Via Fratelli Cervi 93
20090 Segréate (Milano)
Italy
Tel.: +390226422762
Fax: +390226422770
E-mail: debellis@itba.mi.cnr.it

Prof. Dr Corrado Fogher
Plantechno Srl
Via Staffolo 60
26040 Vicenzoano (Cremona)
Italy
Tel.: +390375201366
Fax: +390375200678
E-mail: info@plantechno.com

Dr Antonio Martin
CSIC
Instituto de Agricultura Sostenible
Finca Alameda del Obispo S/N
14080 Córdoba
Spain
Tel.: +34957499299
Fax: +34957499252
E-mail: ge1mamua@uco.es

Dr Artur da Camara Machado
University of Azores
Department of Agricultural Sciences
Terra-Cha
9701-851 Angra do Heroismo
Portugal
Tel.: +351295402235
Fax: +351295402205
E-mail: amachado@angra.uac.pt

Prof. Dr Henrique Guedes-Pinto
University of Tras-os-Montes e Alto Douro
Department of Genetic and Biotechnology
Apdo 202
5000-911 Vila Real
Portugal
Tel.: +351259350543
Fax: +351259350629
E-mail: amf@utad.pt

PARTNERS
Traceability of origin and authenticity of olive oil by combined genomic and metabolomic approaches

BACKGROUND

The project concerns the traceability of origin and authenticity of olive oil by genomic and metabolomic approaches. Starting from commercially available cultivars, databases will be constructed including all relevant information for science, commerce, marketing and processing in the EU. After an initial feasibility study on DNA extraction from olive oil, the project applies established DNA analytical methods based on PCR and metabolic profiling to develop molecular markers for application in advanced high-throughput platforms. Mass spectrometry, LightCycler and microarrays, will allow for a precise discrimination and quantification of different cultivar composition in olive oil of different origin and technological processing. Methods will be validated for their application to forensic tests on olive oils, enabling to understand their composition, also in quantitative terms, and the presence of frauds. Results will be disseminated to a network of stakeholders.

OBJECTIVES

• To establish through a feasibility study the applicability of available DNA extraction/purification methods to olive oils collected at different stages of the production chain (crude and refined), and to evaluate whether the DNA collected is quantitatively (amount) and qualitatively (length or size of the fragments) applicable for a genomic analysis through quantitative PCR, molecular markers analysis, microarray analysis. This will be done on few cultivars chosen randomly among those included in this project.
• To collect information regarding olive cultivation and olive oil production, commerce, marketing and processing in the European Union.
• To collect information and to assess the use of molecular markers for variety identification and discrimination in order to define a set of markers that can be used together (multiplexed) in the commonly used high throughput genotyping platforms.
• To obtain and deliver the information available on the genetic makeup and distribution of alleles across cultivars in European regions to help in designing a set of molecular markers that can be used throughout the project for olive oil analysis.
• To assess the presence of DNA fragments by qualitative and quantitative methods in oil samples obtained from commercial lines or from oils reconstructed in laboratory, starting from pure genetic stocks including some low quality cultivars that are utilised for commercial frauds.
• To compare the data set obtained with genomic information and metabolic profiling to assess and quantify cultivar composition of oil in a diagnostic test that will be made available as tool kit for SME food companies, Quality Assessing Institutes and Consumers Associations.
• To establish the procedure for obtaining a “molecular identity card” (M-ID) for each olive oil, based on genomic and metabolomic data, in order to prepare a label for the products which can be visible and readable by consumers (bar code).
• To develop a network of all the interested parties including growers, companies and consumers to discuss the relevance of molecular methodologies in traceability across the food chain and in particular across the production of olive oil.
(EXPECTED) RESULTS AND ACHIEVEMENTS

• Methods for extracting DNA from olive oils in quantity and size compatible with their application to genomic analysis
• A database of the olive cultivars grown in the EU and utilised for the olive oil production
• A database of genetic information and allele distribution in cultivars and across populations
• Diagnostic molecular markers for olive
• Methods for metabolites analysis and quantification in olive oils preparations (metabolic profiling)
• A strategy for processing metabolic profiling data obtained from olive oils of different origin, either of single or mixed cultivars
• Methods for quantification of cultivar composition in olive oil by LightCycler technology, DNA and PNA microarray technology
• A number of toolkits and methodologies to be used in forensic testing including fraud detection
• A “molecular identity card” (M-ID) for labelling oils
• A network of information and communication involving all participants and stakeholders
QLRT-2001-02386: Traceability of origin and authenticity of olive oil by combined genomic and metabolomic approaches
Fermentation of food products: optimised lactic acid bacteria strains with reduced potential to accumulate biogenic amines

DECARBOXYLATE

Contract number: QLRT-2001-02388
Contract type: Shared Cost Project
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Duration: 36 Months
Scientific Officer: Dyanne Bennink
Project website: not yet available

Coordinator:
Dr Paloma López
Consejo Superior de Investigaciones Científicas
Estructura y Función de Proteínas
Centro de Investigaciones Biológicas
Velázquez 144
28006 Madrid
Spain
Tel.: +34-915 611 800
Fax: +34-915 627 518
E-mail: plg@cib.csic.es

Dr Julius Lolkema
University of Groningen
Department of Microbiology
Kerklaan 30
9751 NN Haren
The Netherlands
Tel.: +31503632150
Fax: +31503632154
E-mail: j.s.lolkema@biol.rug.nl

Prof. Aline Lonvaud
Université Victor Segalen Bordeaux 2
Biotechnology and Applied Microbiology
Faculty of Enology
351, Cours de la Libération
33405 Talence
France
Tel.: +33557571300
Fax: +33557571794
E-mail: Aline.lonvaud@oenologie.u-bordeaux2.fr

Dr Dominique Garmyn
Université de Bourgogne
Ecole Nationale Supérieure de Biologie Appliquée à la Nutrition et à l’Alimentation
Laboratoire de Microbiologie
Esplanade Erasme, 1
21000 Dijon
France
Tel.: +33-380 39 66 77
Fax: +33-380 39 66 40
E-mail: garmyn@u-bourgogne.fr

Dr Fergal Patrick Rattray
Chr. Hansen A/S
Department of Genomics and Strain Development.
Bøge Alle 10-12
2970 Hørsholm
Denmark
Tel.: +4545747474
Fax: +4545748994
E-mail: fergalpatrick.rattray@dk.chr-hansen.com
Fermentation of food products: optimised lactic acid bacteria strains with reduced potential to accumulate biogenic amines

BACKGROUND

Lactic acid bacteria (LAB) play an important role in the production of fermented food by dairy and wine industries. Decarboxylation of di- and tricarboxylic acids by LAB is a desirable step resulting in the production of compounds that enhance the organoleptic properties and/or the stability of the finished products. However, decarboxylation of amino acids (e.g. histidine, tyrosine) leads to the production of biogenic amines (BA) (e.g. histamine, tyramine), which have undesirable toxic properties. The goal of the present proposal is to acquire an in-depth understanding of the individual acid, and amino acid decarboxylation pathways, to obtain strains unable to produce BA and to generate aroma producer strains resistant to acid stress. We aim to develop strains and systems for the food industries to avoid health risks of BA by controlling their production and, in parallel, to improve the beneficial citrate/malate decarboxylating pathways.

OBJECTIVES

Decarboxylation of metabolites is extremely important for the quality of the fermentation products both in a positive and negative manner, which is dependent on the particular substrate and fermentation process. Metabolism of carboxylic acids generates aroma compounds and lactic acid, which increase organoleptic properties and hygienic quality (impeding growth of pathogenic strains) of the fermentation products, whereas BA production results in food poisoning. The overall objective of the project is to exploit decarboxylation pathways in LAB to develop safe and optimised food technologies. The main goals are:

• to control and/or eliminate the production of BA in fermented food and beverages by utilisation of new LAB strains and/or systems during the fermentation processes. The evaluation and validation of the strains and methods developed in this project will allow the industrial partner to establish a well defined system for the elimination of the health risk associated with the production of BA with the final aim of producing food with safe levels of BA;

• to improve quality of food and beverages by utilisation of new LAB strains, which are acid-resistant and better producers of aroma. The citric and malic acids fermentations result in the production of lactic acid and aroma compounds such as diacetyl, which improve, respectively, the hygienic quality (e.g., impeding the growth of pathogenic strains) and the organoleptic properties of dairy and wine. The validation of the new food-grade LAB strains will allow the industrial partner to obtain bacterial cultures for the production of high quality food and beverages.

The specific objectives of this project are

• to improve screening methods for the detection of LAB producing unwanted BA substances during milk fermentation and wine production;

• to use different LAB as model organisms to develop methods for minimisation of BA production in fermented dairy products and wine;

• to develop tools to construct food-grade null mutant alleles and to develop food quality integration systems;
• to construct novel food-grade strains capable of improving and/or modifying the organoleptic properties of dairy products and wine;
• to engineer strains with altered decarboxylating pathways useful for the dairy and wine industries as starter strains;
• to develop new LAB strains resistant to lactate and acidic conditions.

(EXPECTED) RESULTS AND ACHIEVEMENTS

We aim to construct modified strains and to develop systems to minimise the health risk associated with the production of BA in fermented dairy products and wine, and to construct novel strains capable to improve and/or modify the organoleptic properties of cheese and wine. The specific expected achievements are:

• to develop tools to obtain specific mutant genes,
• to genetically and biochemically characterise the constructed mutant strains, and
• to increase controlled gene expression with the aim of optimising LAB as cell factories with reduced occurrence of hazards.

We will engineer the decarboxylating pathways to reduce the accumulation of poisoning BA, in order to obtain healthful and high quality food products in accordance with one of the most important European society requests. The full exploitation derived from such analyses will be of direct relevance to the competitiveness of biotechnological companies in the European Union.
Prof. Dr Helena Santos
Instituto de Biologia Experimental e
Technologica
Apartado 12
2781-901 Oeiras
Portugal
Tel.: +351214427787
Fax: +351214421161
E-mail: santos@itqb.unl.pt

Prof. Dr Diego de Mendoza
Universidad Nacional de Rosario
Instituto de Biología Molecular y
Celular de Rosario
Suipacha 531
2000 Rosario
Argentina
Tel.: +543414350661
Fax: +543414390465
E-mail: carrill@arnet.com.ar

Dr Miguel Álvarez
CSIC
Instituto de Productos Lacteos de
Asturias
Carretera de Infiezo S/N
33300 Madrid
Spain
Tel.: +34985892131
Fax: +34985892233
E-mail: maag@ipla.csic.es
Seaweed antioxidants as novel ingredients for better health and food quality

SEAHEALTH

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Duration: 36 Months
Scientific Officer: Sigurdur Bogason
Project website: not yet available

Coordinator:
Dr Patricia Burtin
Centre d’Etude et de Valorisation des Algues
Presqu’Ile de Pen Lan
22610 Pleubian
France
Tel.: +33-2-96229350
Fax: +33-2-96228438
E-mail: algue@ceva.fr

Prof. Dr Karl-Werner Glombitza
Rheinische Friedrich-Wilhelms-Universität Bonn
Institut für Pharmazeutische Biologie
Nussallee 6
53115 Bonn
Germany
Tel.: +49228733252
Fax: +492287360193
E-mail: K.W.Glombitza@uni-bonn.de

Dr Clarissa Gerhauser
Deutsches Krebsforschungszentrum
Abteilung Toxikologie und Krebsrisikofaktoren
Im Neuenheimer Feld 280
69120 Heidelberg
Germany
Tel.: +496221423306
Fax: +496221433359
E-mail: c.gerhauser@dkfz-heidelberg.de

Dr Paolo Simonetti
Università degli Studi di Milano
Dipartimento di Scienze e Tecnologie Alimentari e Microbiologiche
Sezione Nutrizione
Via Celoria, 2
20133 Milano
Italy
Tel.: +39258356647
Fax: +39258356600
E-mail: Paolo.Simonetti@unimi.it

Dr Maria-Teresa Mitjavila
Universitat de Barcelona
Departament de Fisiologia Facultat de Biologia
Av. Diagonal, 645
08028 Barcelona
Spain
Tel.: +349340212330
Fax: +34934110358
E-mail: tmitja@bio.ub.es

Dr Harry Wichers
Agrotechnical Research Institute
Bormsesteeg 59
6700 AA Wageningen
The Netherlands
Tel.: +31317475228
Fax: +31317475347
E-mail: h.j.wichers@ato.wag-ur.nl

Dr Klaus Menrad
Fraunhofer-Institut für Systemtechnik und Innovationsforschung
Breslauer Str. 48
76139 Karlsruhe
Germany
Tel.: +497216809330
Fax: +497216809476
E-mail: me@isi.fhg.de

PARTNERS
Seaweed antioxidants as novel ingredients for better health and food quality

BACKGROUND
The main objectives of the SEAHEALTH project are to develop a new generation of algae antioxidant ingredient and functional foods and to demonstrate benefits for human health in prevention of atherosclerosis and cancer. Analyse consumer appreciation and sensory perception of these novel functional foods linked to the marketing investigation constitute important tasks of the project as socio-economic aspect and relevant gender specifications. It is intended to develop communication strategies in order to inform consumers about the health effects and specific benefits of algal ingredient products.

OBJECTIVES
The SEAHEALTH project aims at studying the role of algal antioxidant substances as novel food ingredient 1) for cancer and atherosclerosis prevention, 2) for food quality enhancement. The objective is to develop optimised procedure at lab and pilot scale for extraction and isolation of antioxidant substances, to demonstrate the antioxidant potential of the extracts by in vitro and in vivo tests, to evaluate their role in cancer and atherosclerosis prevention as well as novel ingredient for food quality preservation. This project also aims at developing new food product and at setting up a strategy to improve acceptability of consumer for such extracts or food products

(EXPECTED) RESULTS AND ACHIEVEMENTS
• To provide an optimised manufacturing protocol of antioxidant substances (carotenoids, polyphenols, tocopherols) contained in selected brown algae at both laboratory and pilot scale (details on algae pre-treatment, extraction/purification processing, packaging conditions to warranting antioxidant potential).
• To characterise the antioxidant substances in terms of structure, content, in order to improve knowledge about the diversity of antioxidant substances extracted from brown algae.
• To provide a detailed report on the in vitro antioxidant potential of the seaweed extracts
• To provide a detailed report on the extracts antioxidant activity by estimating safe and effective use levels (in vivo study on rats) and bioavailability (in vivo studies on animals and humans)
• To provide a documented report on the potential role of these antioxidant substances in preventing cancer and atherosclerosis diseases (in vitro and in vivo studies on animals) in order to get a better understanding of the structure/function relationships and identification of the principal components responsible for health beneficial effects.
• To evaluated usefulness of the extracts as antioxidant in food industry, by formulation of some functional foods (beverages, milk products and snacks).
• To study the effects of processing conditions, matrix composition and storage conditions on antioxidants availability and stability
• To improve consumer acceptance and preference for these novel functional foods by defining the best formulations in some beverages, milk products as yoghurts and snacks
• To provide details on the seaweed ingredients: features, potential applications, storage conditions, consumers’ perception of comparative advantages over functional ingredients from other sources in order to speed up their acceptance by scientists, manufacturers and consumers and favour a rapid commercial exploitation of the results.

• To provide points to consider for an efficient exploitation and dissemination plan to facilitate communication between researchers from various background (nutrition technology, behavioural sciences e.g. psychology, sociology and marketing sciences), food industry, consumers and food distributors.

• To provide a strategic plan to promote employment and relationships between research world and industry with regard to the project results and the enormous potential of growing use of algal antioxidant additives in consumption of foods.

• To assure an efficient technical and financial coordination during the whole duration of the project in order to secure a successful outcome, while promoting the role of women scientists in European researches as coordinator or task leader.

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PARTNERS

Mr David Gaudout
Diana Vegetal
La Gare
35560 Antrain
France
Tel.: +33299984077
Fax: +33299984539
E-mail: gaudout@diana-vegetal.com

Prof. Dr Hariolf Grupp
Karlsruhe Technical University
Institut für Wirtschaftspolitik und -forschung
Kaiserstraße
76128 Karlsruhe
Germany
Tel.: +497216087932
Fax: +497216088429
E-mail: grupp@iww.uni-karlsruhe.de
Seaweed antioxidants as novel ingredients for better health and food quality
Constructing tailor-made surface starter cultures for safe production of red-smear cheeses

SMEAR

Contract number: QLRT-2001-02461
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Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Barend Verachttert
Project website: not yet available

Coordinator:
Dr Wouter Noordman
NIZO Flavour and Natural Ingredients
Kernhemseweg 2
6710 BA Ede
The Netherlands
Tel.: +31-31-8659511
Fax: +31-31-8650400
E-mail: wnoordman@nizo.nl

PARTNERS

Dr Wilco Meijer
CSK Food Enrichment
Department of R&D
Pallasweg 1
8901 BA Leeuwarden
The Netherlands
Tel.: +310582844242
Fax: +310582844299
E-mail: meijer@cskfood.nl

Dr Søren Lillevang
Arla Foods Amba
Rordrumvej 2
8220 Erabrand
Denmark
Tel.: +4587466710
Fax: +4587466688
E-mail: soren.k.lillevang@arlafoods.com

Ir. Mewis Hettinga
Leerdamer Company
Steenhovenweg 4
4145 KK Schoonrexoerd
The Netherlands
Tel.: +31345648470
Fax: +31345648490
E-mail: m.hettinga@leerdammer.com

Dr Wilhelm Bockelmann
Bundesanstalt für Milchforschung
Herman Weigmann-Straße 1
24103 Kiel
Germany
Tel.: +494316092438
Fax: +494316092306
E-mail: Bockelmann@bafm.de

Dr Jean Banks
Hannah Research Institute
KA 65HL Ayr
United Kingdom
Tel.: +441292674114
Fax: +441292674004
E-mail: Banksj@hri.sari.ac.uk
Constructing tailor-made surface starter cultures for safe production of red-smear cheeses

BACKGROUND
Surface-ripened cheeses have typical tastes and colours, caused by a complex mixture of microorganisms on their surfaces. These microorganisms are transferred from one batch of cheese to another during the ripening period of several weeks (old-young smearing). This procedure carries the inherent risk of contamination of the new cheeses with undesired microorganisms (*Listeria monocytogenes*, moulds). The risk of *Listeria* infections could be reduced significantly by using defined surface starter cultures instead of smear cultures. However, complex defined surface starter cultures are not yet commercially available for any red-smear cheese.

In a previous EU RTD project (CT98-4220), in which the majority of the members of the present consortium participated, the feasibility of developing defined surface starter cultures for red-smear cheeses has been investigated. In that project, the surface flora of a particular red-brown smear cheese has been identified and intensively characterised, in particular with respect to the microbiology, flavour compounds, and colour development. Based on these studies, defined starter cultures, resembling as much as possible the original flora were developed. By using these starter cultures in pilot scale cheese production, it was shown for the first time that defined starter cultures can dominate the micro-flora on cheeses ripened in pilot-scale cheese production. All technical methods were developed that are necessary to construct a defined surface starter. However, the starter cultures were not yet of commercial interest because the colour and taste were still different from that of the original smear cheese. Moreover, the growth of the defined starter red-smear cultures was too slow and therefore, moulds could still colonise the cheeses. Dairy and starter culture companies will not change to the use of defined surface starters because the development time of the surface starter was too long and the quality of the final product was not equal to the existing products. As a result, the safety of surface ripened cheeses will not improve, even though evidence has been provided that defined surface starters can be constructed. This makes clear that this new technology can not be commercialised directly and it has to be demonstrated that high quality surface starters can be developed.

OBJECTIVES
To enable dairy and starter culture companies to change to the use of defined surface starters, the development time of the surface starter must be shortened and the quality of the final product must be equal to the existing products. Therefore, in this project it will be demonstrated that such defined starters can be constructed time – and cost-effectively by following a routine procedure: Tailor-made starter cultures for two different red-smear cheese varieties will be developed, evaluated in pilot-scale cheese production, and validated (production technology, cheese characteristics, consumers acceptation). Thereby, this project will bridge the gap between proof of principle, as established in the previous project, and a commercially tangible technology. Deliverables will be: 1) safer cheeses; 2) new market for starter companies; 3) better controlled cheese making processes, less losses, more income for cheese companies.
(EXPECTED) RESULTS AND ACHIEVEMENTS

The project will deliver a time- and cost effective standard method with which industrial surface starter cultures for red-smear cheeses can be constructed. The use of industrial surface starter cultures will result in:

- Improved safety of the cheeses;
- A completely new market for starter culture companies. So far, tailor-made starter cultures for red-smear cheeses are not available, because they cannot be constructed time- and cost effectively.
- Better controlled processes for the preparation of red-smear cheeses by industrial companies and decreased losses of batches of cheese, contaminated with *Listeria* or other undesired micro-organisms. This will result in increased profits for industrial cheese companies. It is envisaged that at the end of the project, each of the two industrial cheese companies involved in this project will have a defined surface starter culture for their specific cheese. These cheeses have been validated with respect to production technology, flavour, colour and consumer acceptation.
Development and application of a TTI based safety monitoring and assurance system (SMAS) for chilled meat products

**TTI-MEAT SAFETY SYSTEM SMAS**

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**Contract type:** Shared Cost Project  
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**EC contribution:** Under negotiation  
**Starting date:** not yet determined  
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**Scientific Officer:** Alkmini Katsada  
**Project website:** not yet available  

**Coordinator:**  
Prof. Dr Petros Taoukis  
National Technical University of Athens  
Chemical Engineering Division of Process and Product Development  
Lab Food Chemistry & Technology  
5 Iroon Polytechniou  
15780 Athens  
Greece  
Tel.: +30-1-07723171  
Fax: +30-1-07723163  
E-mail: taoukis@chemeng.ntua.gr

**PARTNERS**

Dr Elisabeth Borch  
SIK - Institutet för Livsmedel och Bioteknik AB  
The Swedish Institute for Food and Biotechnology, Microbiology and Product Safety Department  
P.B. 5401  
40229 Göteborg  
Sweden  
Tel.: +46313355600  
Fax: +4631833782  
E-mail: eb@sik.se

Prof. George John Nychas  
Agricultural University of Athens  
Lab. of Microbiology & Biotechnology of Foods  
Iera Odos 75  
11855 Athens  
Greece  
Tel.: +30-10-5294693  
Fax: +30-10-5294693  
E-mail: gjn@auadec.aua.gr

Dr James Sheridan  
Teagasc, The National Food Centre  
Food Safety Department  
Dunsinea, Castlenock  
15 Dublin  
Ireland  
Tel.: +35318059539  
Fax: +35318059550  
E-mail: jsheridan@nfc.teagasc.ie

Dr.ir. Serve’ Notermans  
TNO  
Nutrition and Food Research  
Utrechtseweg 48  
3700 AJ Zeist  
The Netherlands  
Tel.: +31306944943  
Fax: +31306944901  
E-mail: notermans@voeding.tno.nl
Development and application of a TTI based safety monitoring and assurance system (SMAS) for chilled meat products

BACKGROUND
A Safety Monitoring and Assurance System (SMAS) for meat products will be developed. SMAS integrates kinetic models for dominant meat pathogens and spoilage bacteria, risk assessment techniques and the capacity to monitor single product temperature history with Time Temperature Integrators (TTI), into an effective chill chain decision and management tool. TTI of high accuracy and suitable design for safety monitoring will be developed and optimised. Models will be refined for reliable prediction of meat safety and spoilage. SMAS will be validated in real conditions and provide the meat sector the ability to control its weak link, the chill chain, and deliver to the consumer’s table safe meat products of high hygienic quality. It will satisfy the consumer that state-of-the-art methods and technology can guarantee him low risk-high quality meat products and thus help restore the image and increase competitiveness of the EU meat sector.

OBJECTIVES
The overall objective of the development of SMAS, an effective safety assurance and quality optimisation management system of meat products, extending from production to the consumer, comprises the following objectives:
• Modelling the effect of food structure, microbial interactions and dynamic storage conditions on meat pathogens and spoilage bacteria;
• Combination of validated pathogen growth models with data on prevalence/concentration, dose response and chill chain conditions for risk assessment with and without SMAS application;
• Development, modelling and optimisation of TTI with accuracy to monitor microbiological safety of meat products;
• Development of SMAS into a user-friendly computer software;
• Evaluation of the applicability and effectiveness of SMAS in real conditions of meat distribution;
• Assessment of the industry acceptance of the TTI and the concept of chill chain management;
• Evaluation of EU consumer attitude on use of TTI.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The main milestones in this project are:
• Successful development of refined predictive models accurate for safety and spoilage prediction of meat products in actual dynamic conditions;
• Design and development of optimised TTI with accurate response kinetics, suitable for safety monitoring;
• Availability in software of the intelligent management Safety Monitoring and Assurance System (SMAS);
• Effective application of SMAS in the real meat chill chain.
Dr József Baranyi  
Institute of Food Research  
Food Safety Science Division  
Norwich Research Park, Colney  
NR4 7UA Norwich  
United Kingdom  
Tel: +441603 255121;  
Fax: +441603507723  
E-mail: dunlopj@main.hri.sari.ac.uk

Dr Constantin Genigeorgis  
Creta Farm SA Production of Meat  
15th mm Rethymnou-Herakliou N&T Road  
74100 Rethymnon  
Greece  
Tel.: +30831086700  
Fax: +30831058035  
E-mail: cretafarm@otenet.gr

Dr Peter Rönnow  
Vitsab Sweden AB  
Stenyxegatan 21  
213 76 Malmö  
Sweden  
Tel.: +4540215020  
Fax: +4640212420  
E-mail: peter.ronnow@vitsab.se
Enhancement and indication of food quality by combinations of oxygen scavenger and quality indicator systems for polymer packagings

ACOSIC

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Contract type: Shared Cost Project
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Achim Boenke
Project website: not yet available

Coordinator:
Dr Horst-Christian Langowski
Fraunhofer-Institut für Verfahrenstechnik und Verpackung
Giggenhauser Str. 35
85354 Freising
Germany
Tel.: +49-81-61491500
Fax: +49-81-61491555
E-mail: langowski@ivv.fraunhofer.de

PARTNERS

Dr Michela Bonora
CIBA Speciality Chemicals S.P.A.
Head of Knowledge Center Application Research
Via Pila 6/3
40044 Sasso Marconi (Bo)
Italy
Tel.: +39 051 6786228
Fax: +39 051 845799
E-mail: michaela.bonora@cibasc.com

Dr Herbert Nagorski
Amcor Flexibles Helio Folien GmbH
Gladbacher Straße 189
41747 Viersen
Germany
Tel.: +4902162937265
Fax: +49021629377283
E-mail: herbert.nagorski@amcor-flexibles-europe.com

Dr Rainer Brandt
Wipak Walsrode GmbH & Co. KG
P.B. 1661
29656 Walsrode
Germany
Tel.: +495161442353
Fax: +49516144142353
E-mail: rainer.brandt.rb@wipak.de

Dr Juris Walter
Alcan Packaging Services Ltd.
Research & Development
Bad. Bahnhofstr. 16
8212 Neuhausen
Switzerland
Tel.: +41526749336
Fax: +41526749220
E-mail: juris.walter@alcan.com
Enhancement and indication of food quality by combinations of oxygen scavenger and quality indicator systems for polymer packagings

BACKGROUND
The quality and shelf-life of foods is in the most cases reduced by oxygen influence. A wide range of food shows oxidative damage to flavour and colour. The main objectives of the project are the development of combined systems for indication of food quality and packaging integrity, and at the same time for enhancement of product quality and shelf life via oxygen scavenging (“indicator-scavenger-systems”). These systems are to be integrated into packaging film materials. The benefits of such an innovative packaging system are:

• To reduce the internal oxygen level as low as possible just directly after packing of the product;
• To increase the shelf life and the nutritional and sensory quality of food;
• To allow for verification of proper functionality of the oxygen scavenger and of product quality and for detection of damages or tampering, throughout the whole logistic chain up to the point of consumption.

OBJECTIVES
The main objectives of the project are the development of combined systems- for indication of food quality and packaging integrity, and at the same time,- for enhancement of product quality and shelf life via oxygen scavenging(“indicator-scavenger-system”). The goal of this project is to develop new materials and conversion techniques up to prototypes of active indicator/oxygen scavenger packagings for oxygen sensitive foods. The innovations are the development of systems with combined indicator and scavenger functions, the integration of the systems into packaging films and the verification the proper functionality of oxygen scavenger and for detection of damages or tampering of the packagings, throughout the whole logistic chain up to the point of consumption. In the project a broad attention will be addressed to the consumer and customer acceptance of these new innovative type of packaging.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The project will deliver combinations of indicator substances and oxygen scavengers in various configurations (combined in polymer blends; linked via chemical bonds, either directly or via a matrix system). Selected combined oxygen indicator/scavenger systems will be integrated into packaging film materials. Depending on the actual indicator/scavenger combination, different techniques (extrusion in form of mono-layer and multi-layer film, incorporation into lamination adhesives, coating via lacquering/printing, vacuum deposition onto substrate films) will be used for their incorporation into packaging film laminates. Their application will be tested for a series of oxygen sensitive products in pouches and thermoformed packages. For this new type of packagings, the acceptance of consumers, retail trade and of packing companies is essential. Therefore, a related consumer acceptance analysis will be included into the project for different European markets at an early stage of the technical development. Later in the project, more advanced prototypes resulting from the work will be subjected to the same evaluation procedures. Consumer acceptance will be assessed and supervised via a consumer organisation, contributing to the project. Films and com-
Complete packages will be tested via packaging experiments on an automated packaging line. They will be assessed for their mechanical and physical properties and, especially, with emphasis to their improvement of food quality and safety. For a broad implementation of these innovative packaging types into the market, a code of practice with performance know-how and test methods for the assessment of these oxygen indicator/scavenger packagings will be developed and a multitude of dissemination and exploitation activities will be scheduled according to the progress in the project.
QLRT-2001-02601: Enhancement and indication of food quality by combinations of oxygen scavenger and quality indicator systems for polymer packagings
Reduced allergenicity of processed foods (containing animal allergens)

REDALL

Contract number: QLRT-2001-02687
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Total cost: Under negotiation
EC contribution: Under negotiation
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Duration: 36 Months
Scientific Officer: Barend Verachtert
Project website: not yet available

Coordinator:
Dr Angelika Paschke
Department of Food Chemistry
Grindelallee 117
20146 Hamburg
Germany
Tel.: +49-40-428384353
Fax: +49-40-428384342
E-mail: fc6z038@public.uni-hamburg.de

Dr Dr Günther Hammer
Bundesanstalt für Fleischforschung
Institute for Technology
E.-C.- Baumannstraße 20
95326 Kulmbach
Germany
Tel.: +0499221803280
Fax: +0499221803343
E-mail: T-Hammer@baff-kulmbach.de

Dr Günther Bretschneider
Hipp-Werk Georg Hipp
Georg-Hipp-Str. 7
85276 Pfaffenhofen
Germany
Tel.: +08441757261
Fax: +08441757300
E-mail: günther.bretschneider@hipp.de

Dr Rodolphe Fritsché
Nestlé Research Center, Nestec Ltd
Vers-chez-les-Blanc
1026 Lausanne
Switzerland
Tel.: +41217858683
Fax: +41217858549
E-mail: Rodolphe.fritsche@rdls.nestle.com

PARTNERS

Prof. Dr Wolfgang Lindner
University of Vienna
Institute of Analytical Chemistry
Währinger Straße 38
1090 Wien
Austria
Tel.: +00431427752300
Fax: +004313151862
E-mail: wolfgang.lindner@univie.ac.at

Dr Matthias Besler
Lefo Institut für Lebensmittel- und Umweltforschung Dr Gerhard Wichmann GmbH
Waldemar-Bonsels-Weg 170
22926 Ahrensburg
Germany
Tel.: +49410255471
Fax: +49410250806
E-mail: info@lefo.de

Prof. Dr Mike Morgan
University of Leeds
Procter Department of Food Science
Woodhouse Lane
LS2 9JT Leeds
United Kingdom
Tel.: +441132332966
Fax: +441132332982
E-mail:m.morgan@food.leeds.ac.uk
Reduced allergenicity of processed foods (containing animal allergens)

BACKGROUND
Food allergy concerns consumers, health care professionals, and food manufacturers all over Europe. It is estimated that up to 8% of children and 2% of adults are affected. The project aims at the technological development of less allergenic food products containing animal allergens that are highly potent and stable and at improving food safety by strategies to prevent allergen contamination. The approach includes development of sensitive and reliable allergen detection methods, determination of threshold levels for minimal allergen intake inducing allergic symptoms, and allergenic assessment of foods containing cow’s milk, egg, and/or meat. Comparable data on prevalence of food allergies and the occurrence of severe reactions are targeted on a pan-European level. Based on the project results, a priority list of allergenic foods is aimed.

OBJECTIVES
Methods for allergen determination (milk, egg, meat) in foods will be developed. These will detect allergen traces, be quick, cost-effective, and reliable. Food products containing animal allergens with significance to allergic individuals will be identified and less allergenic products will be developed applying various processing parameters. Educational material will be developed to prevent allergen contamination during food processing. Products will be evaluated by in-vitro and in-vivo tests. The threshold levels inducing allergic symptoms in allergic individuals will be determined with native and selected processed foods. An alternative in-vitro test should be established. Knowledge of i) food allergy prevalence in the general population, ii) the occurrence of severe allergic reactions to food allergens, and iii) consumer attitudes with respect to foods containing allergens is targeted on a pan-European level. A major conclusion will be an allergen priority list.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Evaluated methods to determine allergens in foods, less allergenic food additives and products, threshold levels for minimal allergen intake inducing symptoms, educational material for prevention of allergen contamination, and data on prevalence of food allergies and frequency of severe reactions as well as related consumer attitudes are expected. Moreover, pan-European networks of consumer and clinical institutions and a priority list of allergenic food products will be achieved.
Reduced allergenicity of processed foods (containing animal allergens)
AREA 2.
Development of tests to detect and processes to eliminate infectious and toxic agents throughout the food chain
Food safety screening: Synthetic glucocorticoids

GLUCOCORTICOIDS ANALYSIS

Contract number: QLK1-1999-00122
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Starting date: 1/02/2000
Duration: 36 Months
Scientific Officer: Rosanna d’Amario
Project website: not yet available

Coordinator:
Dr Carlos Van Peteghem
Faculty of Pharmaceutical Sciences
Laboratory of Food Analysis
Harelbekestraat 72
9000 Gent
Belgium
Tel.: +32-9-2648115
Fax: +32-9-2648199
E-mail: carlos.vanpeteghem@rug.ac.be

PARTNERS

Dr de Groene, Els
TNO Nutrition and Food Research Institute
Department of Pharmacology
Utrechtseweg 48
PO Box 360
3700 AJ Zeist
The Netherlands
Tel.: +31-30 6944748
Fax: +31-30 6944742
E-mail: degroene@voeding.tno.nl

Dr Reuvers, Thea
Instituto de Salud Carlos III
Unidad de Residuos Zoosanitarios
Carretera de Majadahonda -Pozuelo, Km.2
28220 Majadahonda Madrid
Spain
Tel.: +34-91-5097900
Fax: +34-91-5097913
E-mail: treuvers@isciii.es

Dr Salden Martin
Euro-Diagnostica B.V.
Beijerinckweg 18
PO Box 5005
6802 EA Arnhem
The Netherlands
Tel.: +31-26 3630364
Fax: +31-26 3645111
E-mail: m.salden@eurodiagnostica.nl

Dr Naegeli, Hanspeter
University of Zürich
Institute of Veterinary Pharmacology and Toxicology
August Forel-Straße 1
8008 Zürich
Switzerland
Tel.: +41-1-635 87 63
Fax: +41-1-635 89 10
E-mail: naegelih@vetpharm.unizh.ch

Dr Elliott, Christopher
The Queen’s University of Belfast
Department of Veterinary Sciences
Stoney Road, Stormont
BT4 3SD Belfast
United Kingdom
Tel.: +44-1232525679
Fax: +44-1232525750
E-mail: chris.elliott@dani.gov.uk

Dr Hellenäs, Karl-Erik
Statsens Livsmedelsverk
Chemistry Division 3
PO Box 622
751 26 Uppsala
Sweden
Tel.: +46 18 175708
Fax: +46 18 105848
E-mail: kahe@slv.se
**Food safety screening: Synthetic glucocorticoids**

**BACKGROUND**

Synthetic glucocorticoids are structural analogues of hydrocortisone that display extremely potent hormonal activities. Despite their broad illicit use in livestock intended for human consumption, monitoring programmes for residues of synthetic glucocorticoids have not been implemented. Maximal residue limits in milk and meat as well as various withdrawal times for veterinary preparations containing synthetic glucocorticoids have been proposed, but analytical methods to control the enforcement of such regulations are entirely missing. In consequence, the goal of this project is to establish and disseminate innovative methods for the detection of synthetic glucocorticoids in fluids or tissues of food producing animals. These methods will provide the analytical basis for surveillance programmes that support the Community policies concerned with food safety and human health.

**OBJECTIVES**

The goal of this project is to develop and disseminate innovative methods for the detection of synthetic glucocorticoids in animal fluids and tissues. Synthetic glucocorticoids are extremely potent analogues of the endogenous hormone hydrocortisone. Despite their broad use in livestock intended for human consumption, monitoring programmes for residues of these compounds have not been implemented in the European Union. On the contrary, the lack of detection methods for glucocorticoids stimulates their illicit use to increase animal weight, to pass ante-mortem inspections or to mask injections of antibiotic/hormone cocktails. Maximal residue limits and withdrawal times for veterinary preparations containing synthetic glucocorticoids have been proposed, but analytical methods to control the enforcement of such regulations are entirely missing. Thus, the project will promote food safety and consumer health as well as the harmonisation of surveillance procedures.

**(EXPECTED) RESULTS AND ACHIEVEMENTS**

In view of their potent hormonal effects, synthetic glucocorticoids constitute a serious health hazard. This project will yield screening (immunoassay, reporter gene and proteome analysis) and confirmatory methods (LC-MS) that provide the analytical basis for control programmes in support of Community policies concerned with food safety and human health. In a broader perspective, these methods will prevent trade barriers and increase consumer confidence, thereby enhancing the competitiveness of European food production.

Applications:

- a rapid, sensitive and high-throughput chemiluminescence immunoassay;
- confirmatory and identification methods based on liquid chromatography coupled to mass spectrometry;
- a reporter gene-based bioassay to replace animal testing for measuring the pharmacological potency of glucocorticoids and their metabolites or derivatives;
- a proteome analysis assay to detect expression of endogenous glucocorticoid-responsive genes in liver or other tissues and identify markers for glucocorticoid exposure.
QLK1-1999-00122: Food safety screening: Synthetic glucocorticoids
Bound residues and nitrofuran detection
FOODBRAND

Contract number: QLK1-1999-00142
Contract type: Shared Cost Project
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Duration: 42 Months
Scientific Officer: Achim Boenke
Project website: http://www.afsni.ac.uk/foodbrand

Coordinator:
Dr David Glenn Kennedy
The Queen’s University of Belfast
Veterinary Science
Stoney Road, Stormont
BT4 3SD Belfast
United Kingdom
Tel.: +44-28-905 256 51
Fax: +44-28-905 256 26
E-mail: glenn.kennedy@dardni.gov.uk

PARTNERS
Dr Hans van Rhijn
State Institute For Quality Control of Agricultural Products
Natural Constituants, Residues and Contaminants
Bornesteeg 45
PO Box 230
6708 PD Wageningen
The Netherlands
Tel.: +31-31 7475597
Fax: +31-31 7417717
E-mail: j.a.vanrhijn@rikilt.dlo.nl

Dr Schmitt, Karl
R-Biopharm GmbH
Dolivostraße 10
64293 Darmstadt
Germany
Tel.: +49-6151 81 02 13
Fax: +49-6151 81 02 20
E-mail: K.Schmitt@r-biopharm.de

Dr DeBeuckelaere Wim
Verbruikers Unie Test-Aankoop S.V.
Hollandstraat 13
1060 Brussel
Belgium
Tel.: +32-2 5423204
Fax: +32-2 5423250
E-mail: wdebeuckelaere@test-aankoop.be

Dr Kovacsics Lorena
National Food Investigation Institute
Food Residue Toxicology Department
Mester Utca 81
PO Box 1740
1465 Budapest
Hungary
Tel.: +36-1 215-6193
Fax: +36-1 215-6858
E-mail: lola@oai.hu

Dr Franek Milan
Veterinary Research Institute
Department of Biotechnology
Hudcova 70
621 32 Brno
Czech Republic
Tel.: +42 4132 1241
Fax: +42 4121 1229
E-mail: franek@vri.cz

Dr O’Keeffe Michel
Teagasc
Food Safety Department
Dunsinea, Castleknock
Dublin 15
Ireland
Tel.: +353-1 8059500
Fax: +353-1 8059550
E-mail: m.okeeffe@nfc.teagasc.ie
Bound residues and nitrofuran detection

BACKGROUND
The nitrofuran drugs furaltadone, nitrofurantoin and nitrofurazone were banned from use in food animal production in the EU in 1993, and the use of furazolidone was similarly prohibited in 1995, because of concerns about their carcinogenicity and mutagenicity. There is evidence of illegal abuse of these compounds within the EU, since a nitrofuran preparation, intended for illegal use in animal production, was seized in a Member State and bound residues of AOZ have been detected in a minor food species (rabbit) in the same country. In a recent survey, EU National Reference Laboratories (NRLs) expressed the view that testing for bound residues of the nitrofurans was superior to testing for parent drugs (92%); stated that they had inadequate information on the best matrix to test (83%); expressed a need for internal standards (85%); expressed a need for analytical calibrants (92%); and stated that the organisation of a workshop was a high priority (92%). The analytical capability of NRLs to monitor compliance with the EU ban on nitrofurans is poor. While a significant proportion of EU NRLs have screening and confirmatory tests for the parent drugs (57 and 29%, respectively) only 7% of NRLs can screen for bound residues of the nitrofurans. No broad-spectrum screening tests (immunochemical or chemical) or Reference Methods exist.

OBJECTIVES
The nitrofurans are banned from use in food animal production in the EU. Monitoring compliance with the ban by measuring residues of the parent drug is of limited value because of their short biological half-life and marked in vitro instability. The project is using novel and innovative approaches to result in effective control by developing well-validated tests in accredited laboratories to measure tissue-bound residues that persist in tissues for up to 6 weeks after cessation of illegal treatment. The consortium includes 4 NRLs with GLP/EN45000 accreditation, one SME, one research laboratory and consumer representation. Some EU NRLs prefer to screen using in-house chemical methods and others prefer to use commercially available immunochemical screening methods. The project will enable NRL end users to choose a screening method according to their preferences, and will also develop validated Reference Methods for the confirmation of these drugs.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Delays in the recruitment of staff in some Partner laboratories have meant that progress during the first year has been more limited than anticipated. However, FoodBRAND has been able to deliver a supply of reference standards for the moieties released from tissue-bound residues of the nitrofurans. These compounds are not commercially available. Problems were encountered in the identification of a suitable derivatising reagent that was needed for the experimental approach to antibody production adopted by Partner 1. Reagents, originally scheduled to be used as derivatising agents, proved to have very low reactivity with the target analytes. However, these difficulties were overcome when 5-hydroxy-o-nitrobenzaldehyde was examined. This compound proved to be reactive with the nitrofuran moieties and possessed a reactive hydroxyl group to permit the subsequent conjugation of the HNBA-nitrofuran derivative to carrier proteins for immunisation into animals. Partners 1 and 2-2 have adopted different strategies to raise the desired antisera. A large number of animals (108) are currently undergoing immu-
nisation in an attempt to produce the desired antibodies. Early results suggest that Partner 2-2 has produced the required antibodies, but these do not appear to show any displacement. Further work is necessary. No data are currently available on the animals immunised by Partner 1. Partner 2-3 has concentrated initially on possible clean-up methods for the nitrofuran moieties. Although some difficulties were encountered, there are many alternative approaches that must be explored. Partner 2-1, working on the development of an HPLC-UV screening test for the nitrofuran drugs has been able to detect peaks corresponding to 3 out of the 4 target compounds. To date they have been unable to detect NPAMOZ (derived from furaltadone). Investigations continue, in collaboration with Partner 1, to ensure detection of all compounds. FoodBRAND has delivered deuterated internal standards, necessary for accurate quantification in the Reference Method, based on LC-MS-MS, being developed by Partner 2. Working on 3 out of the 4 target compounds, Partner 2 has made good progress in obtaining chromatographic resolution of the target analytes. Partner 2 has shown that an adequate number of fragments can be produced for NPAMOZ and NPSEM using electrospray LC-MS-MS to permit unambiguous identification of these compounds. Initial experiments have shown that recovery of NPAOZ and NPAMOZ from spiked liver samples should be satisfactory. Dissemination of the work of the project has occurred at several conferences, through the establishment of the project web site and at a NRL-and a Consumer workshop.
Development, validation and application of stochastic modelling of human exposure to food chemicals and nutrients

MONTECARLO

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Duration: 36 Months
Scientific Officer: Achim Boenke
Project website: http://www.iefs.org/montecarlo

Coordinator:
Prof. Dr Michael Gibney
Institute of European Food Studies
Trinity College
2 Dublin
Ireland
Tel.: +353-1-6709175
Fax: +353-1-6709176
E-mail: iefs@iefs.ie

Dr Brussaard, Tineke
TNO Nutrition and Food Research Institute
Department of Consumer Research and Epidemiology
Utrechtseweg 48
P.O. Box 360
3700 AJ Zeist
The Netherlands
Tel.: +31-30 6944759
Fax: +31-30 6957952
E-mail: Brussaard@voeding.tno.nl

Dr Margetts, Barrie
University of Southampton
Institute of Human Nutrition
Level B 805
South Academic Block
Southampton General Hospital
SO16 6YD Southampton
United Kingdom
Tel.: +442380 794776
Fax: +442380 796529
E-mail: bmm@soton.ac.uk

Dr Van Klaveren, Jacob
RIKILT
State Institute for Quality Control of Agriculture
P.O. Box 230
6700 EV Wageningen
The Netherlands
Tel.: +31317475465
Fax: +31317417717
E-mail: j.d.vanklaveren@rikilt.wag-ur.nl

Dr Sexton, James
Trinity College
Dept. of Mathematics
Dublin 2
Ireland
Tel.: +353 1 608 2285
Fax: +353 1 608 2282
E-mail: sexton@maths.tcd.ie

Dr Ocio, Jesus Angel
Gobierno Vasco
DireccionSubdireccion de Salud Publica
Galle Santiago 11
01002 Vitoria-Gasteiz
Spain
Tel.: +34-945 017181
Fax: +34-945 017179
E-mail: sanamb2vi@ej-gv.es
Development, validation and application of stochastic modelling of human exposure to food chemicals and nutrients

BACKGROUND

There is a growing demand for guarantees of the safety of the food supply for the purposes of protecting consumer health and facilitating international trade. It is therefore extremely important that risk assessors and regulatory authorities have data and tools that allow insight into all aspects related to the safety of the food supply, including consumer exposure to food chemicals such as food additives, pesticide residues, micronutrients, mycotoxins and so forth.

OBJECTIVES

Many of the current methods for estimating exposure to food chemicals are limited by the fact that they do not take account of variability and uncertainty in food chemical occurrence and concentrations.

Therefore, the objectives of this project are:

• To develop a comprehensive set of mathematical algorithms, purpose built to take account of all the necessary components for stochastic modelling of a variety of food chemicals and to develop appropriate computer software.
• To conduct a multi-centre study, using existing national data, to explore the influence of input distributions on model output for the key components of a stochastic model of food chemical intake (i.e. food intake, chemical occurrence, chemical concentration, market share, brand loyalty, correlated foods).
• To generate databases of true intakes of (i) food additives, based on brand level food consumption and ingredient composition, (ii) pesticide residues, based on duplicate diets and (iii) nutrients, based on biomarker studies.
• To assess the validity of the developed stochastic modelling software against true intakes, to conduct a comprehensive sensitivity analysis of validated models, and to compare these intakes against those derived using current approaches to exposure assessment.
• To provide a comprehensive set of practical guidelines for the appropriate use of stochastic modelling of food chemical intake and to provide guidelines on the correct interpretation of the output of stochastic modelling.
• To actively communicate all research findings to national authorities and scientific bodies as well as standardisation bodies involved in food chemical exposure assessment at regular stages through the project and, furthermore, to incorporate their feedback in the development of the software and guidelines.

(EXPECTED) RESULTS AND ACHIEVEMENTS

Following acquisition of staff, the protocols for the various workpackages were finalised at the first plenary meeting. At this first meeting there was also a training workshop on the use of @RISK and BestFit (two commercially available software packages used for fitting distributions and modelling of data). By month 3 of the project, a website providing information on the objectives and participants involved in the project, had been established. Workpackage 2, comprising a series of numerical experiments to explore how mode of inputting data can influence the output of stochastic models was still in progress by the end of the first reporting period. While 6 out of the 7 partners...
were engaged in this task involving the influence of input components on model output, they were also involved in workpackage 3. This workpackage entails the collection of primary data (Partners 5, 6 & 7) and the collection of ancillary data (Partners 1, 3 & 4) necessary to furnish existing food intake databases in order that each partner can engage in the validation studies. The validation of stochastic modelling of exposure to food additives, pesticides or micronutrients against true intakes based on brand level databases (Partners 1, 4 & 6), duplicate diets (Partners 5 & 7) or biomarkers (Partner 3) will comprise the work of workpackage 4 commencing at month 18. A primary set of algorithms for modelling food chemical intakes has been developed by Partner 2. These algorithms were then incorporated into a software programme which through the course of the first reporting period has been developed and advanced based on feedback from the partners and their results arising from the work undertaken in workpackage 2. An extensive list of relevant end-users have been identified and contacted with respect to the Monte Carlo project.

During the second reporting period for this project, the following outcomes have been achieved:

• Based on feedback from the partners, the software has been advanced to (I) facilitate upload of all databases, of varying structures, identified as being necessary for modelling and (ii) incorporate the algorithms necessary for running the models.

• Research into the selection of input data and distributions and identification of correlations and dependencies for probabilistic modelling of food chemical exposure was completed. The results of this research were compiled as a report and posted on the project website (www.iefs.org/montecarlo). Interested parties and potential end-users were contacted by e-mail to make them aware of the report.

• Partners completed the work of generating detailed databases of exposure (P1 and P4 fully recoded existing national food consumption databases to brand level and assessed the presence and concentration of selected additives in these brands. P3 compiled information about the major food sources of selected nutrients, variability in content and factors influencing bioavailability for an existing survey of 444 Dutch adults; P5 and P7 completed duplicate diet studies of approximately 250 Dutch and Spanish infants respectively that were then analysed for selected pesticide residues; P6 completed a survey of sweetener intakes in 337 Italian teenagers over 3 periods of 4 consecutive days of recoding)

• Partners designed validation protocols for WP4 and commenced work on the validation studies.

PARTNERS

Dr Leclercq, Catherine
Instituto Nazionale di Ricerca per gli Alimenti e la Nutrizione
Via Andeatina 546
00178 Rome
Italy
Tel.: +39065032412
Fax: +39065031592
E-mail: leclercq@inran.it
Food safety in Europe: Risk assessment of chemicals in food and diet

FOSIE

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Starting date: 1/01/2000
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Scientific Officer: Achim Boenke
Project website: http://www.ils.org/europe/fosie

Coordinator: Dr Berry Danse
International Life Sciences Institute
European Branch
Avenue E. Mounier 93 Box 6
1200 Brussels
Belgium
Tel.: +31-2-7710014
Fax: +31-2-7620044
E-mail: juliane@ilsieurope.be

PARTNERS

Prof. Dr Eisenbrand, Gerhard
University of Kaiserslautern
Food Chemistry / Environmental Toxicology
Erwin-Schrödinger Straße
PO Box 3049
67663 Kaiserslautern
Germany
Tel.: +49-631 205 29 74
Fax: +49-631 205 30 85
E-mail: eisenbra@rrhr.uni-kl.de

Prof. Dr Kroes, Robert
Research Institute for Toxicology
Yalelaan 2
PO Box 80176
3508 TD Utrecht
The Netherlands
Tel.: +31 302 535 373
Fax: +31 302 535 077
E-mail: rmkroes@worldonline.nl

Dr Kuiper, Harm
RIKILT-DLO
Department of Food Safety and Health
Bornsesteeg 45
PO Box 230
6708 PD Wageningen
The Netherlands
Tel.: +31 317 475 463
Fax: +31 317 417 717
E-mail: h.a.kuiper@rikilt.dlo.nl

Dr Müller, Detlef
Procter & Gamble European Service GmbH
Industriestraße 32-34
65760 Eschborn/Ts.
Germany
Tel.: +49 6196 89 43 98
Fax: +49 6196 89 66 48
E-mail: muller.d@pg.com

Dr Smith, Maurice
Unilever Research Laboratory
Vlaardingen
Olivier van Noortlaan, 120
3133 AT Vlaardingen
The Netherlands
Tel.: +31 10 460 6492
Fax: +31 10 460 5867
E-mail: maurice.smith@unilever.com

Dr Angelika Tritscher
Nestlé Research Centre
P.O.Box 44
Vers-chez-les-Blanc
1000 Lausanne 26
Switzerland
Tel.: +41-21-785-80-41
Fax: +41-21-785-85-53
E-mail: angelika.tritscher@rdls.nestle.com
Food safety in Europe: Risk assessment of chemicals in food and diet

BACKGROUND

The safety of our food supply is a shared responsibility, from farm to fork, of the food producing industry, regulatory authorities and consumers. As part of this safety assurance it is essential to assess the potential risks posed by food and food ingredients. Consequently, the risk assessment process has to be based on sound scientific data and performed at internationally agreed standards in a transparent manner. The traditional risk assessment process applied successfully to food additives relies on toxicology testing in animals at intake levels many times higher than is likely in humans. Extrapolation of the data to determine the safe level for man is performed by employing safety (or uncertainty) factors. Such an approach does not assess quantitatively the relationship between exposure and adverse health effects and cannot effectively deal with novel foods and macro-ingredients with high levels of intake in the human diet. Therefore, new and harmonised approaches are needed which can also take account of the latest scientific advances and to generate suitable possible solutions also to the various ongoing current activities in different international working groups and scientific committees such as the EC, Scientific Steering of the European Commission in the Consumer Protection Directorate General.

OBJECTIVES

The project will focus on the following objectives:

- To carry out a detailed state-of-the-art appraisal of all stages involved in risk assessment and seek to integrate these in the most relevant manner for assessing risk using a matrix approach;
- to explore means of improving the principles applied to, and scientific basis of, risk assessment with respect to natural toxicants, food additives and contaminants in the food chain, including possible interactions between individual chemicals and effects of the food matrix;
- to identify gaps in knowledge that might lead to differences in interpretation of toxicological and exposure data, and the research need to reduce these;
- to determine the nature and level of testing needed for safety evaluation relevant to the nature of the chemical, level of use/occurrence in the diet and human exposure (including novel foods and processes, nutritional supplements);
- to add a European contribution to international initiatives to harmonise principles, terminology and methodology for risk assessment;
- to contribute towards a consensus on risk assessment issues that is scientifically transparent and justifiable;
- to assist risk managers in developing appropriate, defensible food standards that adequately protect the safety of the consumer whilst allowing for innovation in food production and processing.

(EXPECTED) RESULTS AND ACHIEVEMENTS

Early 2000, the Project Steering Committee established the First Plenary Meeting programme. In April 2000, the first Plenary Meeting was held to gather all participants in the project to set up a European multidisciplinary network. The project is addressed by Individual Theme Groups (ITGs) on ‘In-vitro Toxicology’ (A), ‘Animal based Toxi-
cology’ (B), ‘Mathematical Modelling’ (C), ‘Biologically based modelling’ (D), ‘In-
take Assessment’ (E) and ‘Epidemiology’ (F). The main objectives of the first Plenary
meeting were (i) to review and agree on a proposed work programme, including sci-
entific issues to be addressed, (ii) agree on the terms of reference and responsibilities
of the ITGs and (iii) agree on the final composition of the ITGs including respective
chairmen. From July 2000 to January 2001, ITG A-F had 2 to 3 meetings to draft ITG
reports. These reports will be reviewed by the Project Steering committee before being
reviewed by the Second Plenary meeting in June 2001.
Prof. Ronald, Walker  
University of Surrey  
School of Biological Sciences  
Guildford  
GU2 5XH Surrey  
United Kingdom  
Tel.: +44 1483 25 97 37  
Fax: +44 1483 57 69 78  
E-mail: r.walker@surrey.ac.uk  

Dr Knowles, Michael E.  
Coca-Cola West Europe  
1424 Chaussée de Mons  
1070 Brussels  
Belgium  
Tel.: +32 2 559 27 10  
Fax: +32 2 559 23 78  
E-mail: mknowles@eur.ko.com

Dr Kozianowski Gunhild  
Südzucker AG  
Zentralabteilung Forschung,  
Entwicklung und Services  
Wormser Straße 11  
PO Box 1127  
67283 Obrigheim  
Germany  
Tel.: +49 6359 803 126  
Fax: +49 6359 803 331  
E-mail: gunhild_kozianowski@suedzucker.de

Prof. Dr Pfannkuch, Friedlieb  
Hoffmann-La Roche Ltd.  
Human Nutrition and Health, Safety,  
Toxicology  
Building 72/049A  
4070 Basel  
Switzerland  
Tel.: +41 61 687 07 99  
Fax: +41 61 688 68 19  
E-mail: friedlieb.pfannkuch@roche.com

Dr O’Brien, John  
Danone Vitapole  
Centre Internationale Recherche  
“Daniel Carasso”  
15 Avenue Galilée  
92350 Le Plessis-Robinson  
France  
Tel.: +33 1 4107 8400  
Fax: +33 1 4107 4775  
E-mail: jobrien@danone.com

Dr Barlow, Susan  
Dr Susan Barlow  
8 Harrington Road - Brighton  
BN1 6RE East Sussex  
United Kingdom  
Tel.: +44 1 273 55 38 45  
Fax: +44 1 273 500 723  
E-mail: suebarlow@talk21.com

Ms Kettlitz, Beate  
Bureau Européen des Unions de  
Consommateurs  
Avenue de Tervuren 36, bte 4  
1040 Brussels  
Belgium  
Tel.: +32-2-743-15-90  
Fax: +32-2-735-74-55  
E-mail: beate.kettlitz@beuc.org

Dr Slorach, Stuart  
Statens Livsmedelsverk  
National Food Administration  
Toxicology Division  
PO Box 622  
75126 Uppsala  
Sweden  
Tel.: +46 18 17 55 94  
Fax: +46 18 10 58 48  
E-mail: stuart.slorach@slv.se

Dr Doe, John  
Astrazeneca Plc  
Central Toxicology Laboratory  
Alderley Park  
SK10 4TJ Macclesfield Cheshire  
United Kingdom  
Tel.: +44 16 25 514 556  
Fax: +44 16 25 585 715  
E-mail: john.doe@ctl.zeneca.com

Dr Dourson, Michael  
Toxicology Excellence for Risk  
Assessment  
1757 Chase Avenue  
45223 Cincinnati, Ohio  
United States  
Tel.: +1 513 542 7475  
Fax: +1 513 542 74 81  
E-mail: dourson@tera.org
Validation and standardization of diagnostic Polymerase Chain Reaction for detection of food-borne pathogens

FOOD-PCR

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Starting date: 1/04/2000
Duration: 36 Months
Scientific Officer: Alkmini Katsada
Project website: not yet available

Coordinator:
Dr Jeffrey Hoorfar
Danish Veterinary Laboratory
Department of Microbiology
27, Bülowsvej
1790 Copenhagen
Denmark
Tel.: +45-35300251
Fax: +45-35300120
E-mail: www.pcr.dk

Dr Raadstrom, Peter
Lund University
Department of Applied Microbiology
Getingevägen 60
PO Box 124
221 00 Lund
Sweden
Tel.: +46-46 2223412
Fax: +46 46 2224203
E-mail: peter.raadstrom@tmb.lth.se

Dr Cook, Nigel
Central Science Laboratory
Food Microbiology Group
Sand Hutton
Y041 1LZ York
United Kingdom
Tel.: +44 01904 462623
Fax: +44 01904642111
E-mail: n.cook@cs1.gov.uk

Dr Wagner, Martin
University of Veterinary Science
Institut of Milk Hygiene, Milk Technology and Food Science
Veterinärplatz 1
1210 Wien
Austria
Tel.: +43 1 25077 3520
Fax: +43 1 25077 3590
E-mail: martin.wagner@vu-wien.ac.at

Dr Schiemmel, Heinz
Institute for Reference Materials and Measurements
Retieseweg
2440 Geel
Belgium
Tel.: +3214571220
Fax: +3214590406
E-mail: heinz.chimmel@jrc.org

Dr Helmuth, Reiner
Federal Institute for Health Protection of Consumers and Veterinary Medicine
Division Diagnosis and Epidemiology
Diedersdorfer Weg 1
12277 Berlin
Germany
Tel.: +49 30 8412 2233
Fax: +49 30 8412 2953
E-mail: r.helmuth@bgvv.de

Dr Kuhn, Matthias
Congen Biotechnologie GmbH
Robert-Rössel Straße 10
13125 Berlin
Germany
Tel.: +49 30 94893500
Fax: +49 30 94893510
E-mail: mkuhn@congen.de
Validation and standardization of diagnostic Polymerase Chain Reaction for detection of food-borne pathogens

BACKGROUND
Sensitive and cost-effective molecular methods, such as PCR, are receiving increasing attention for testing the microbiological safety of food. However, lack of international validation, standard protocols, reagents and equipment has hampered its implementation in routine diagnostic. The overall objective of the proposed project is to facilitate implementation of diagnostic PCR for detection of food-borne pathogens. This will be achieved through construction of DNA sample library and primer databank, validation of thermocyclers, ring-trials, automation and guidelines. The project will involve 12 expert and 22 end-user laboratories from 20 EU and applicant countries. The work is planned in 2 phases, including 6 WP and 20 tasks, which will focus on 5 major pathogens (Salmonella, Campylobacter, enterohemorrhagic E. coli (EHEC), L. monocytogenes and Y. enterocolitica) and 4 sample types (poultry carcass-rinse, pig carcass swab, meat and milk).

OBJECTIVES
Recognising that sensitive and more cost-effective methods are needed for detecting food-borne pathogens, we are launching a project seeking to validate and standardise use of the polymerase chain reaction (PCR) for this purpose. Although a powerful research tool, the application of PCR for detecting food-borne pathogens is hampered from lack of validation, standard protocols, reagents, and equipment. Additional specific project objectives include validating a simple method for purifying DNA from bacterial cultures, establishing a central collection of certified DNA sample materials, establishing a databank containing key food-pathogen DNA sequence, listing strains for specificity testing, developing standardised reagents, and validating pre-PCR sample treatment methods

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Validation of a simple and reproducible method for purification of DNA from bacterial cultures
• DNA-sample bank, consisting of defined DNA material
• DNA databank for registration of food pathogen-specific genes primers and probes
• Sets of criteria for validation of thermocyclers
• User-friendly, pre-PCR sample preparation techniques for the sample types included in this study
• Assessment of specificity, sensitivity and reproducibility of known PCR analyses through comparative studies and ring-trials
• Validated automated, closed-tube PCR for detection of Campylobacter spp.
• Guidelines for first-time implementation of PCR by end-users
• Proposals for European standardisation (CEN/TC 275) of PCR testing
• Organisation of two workshops for technology transfer
Dr Legakis, Nicholas J.
University of Athens
Microbiology
M. Asias 75
11527 Athens
Greece
Tel.: +30-1-7785638
Fax: +30-1-7709180
E-mail: nlegakis@cc.uoa.gr

Dr Vladimir Kmet
Institute of Animal Physiology
Slovak Academy of Sciences
Soltesovej 4
040 01 Kosice
Slovakia
Tel.: +421-95762162
Fax: +421-95762162
E-mail: kemtv@saske.sk

Dr Bülte, Michael
Justus-Liebig-Universität Gießen
Institute of Veterinarian Food Science
Frankfurter Straße 92
35392 Giessen
Germany
Tel.: +0641 99-38250
Fax: +49 641 99 38259
E-mail: michael.buelte@vetmed.uni.giessen.de

Dr Fach, Patrick
Agence Française de Sécurité Sanitaire des Aliments
43, Rue de Dantzig
75015 Paris
France
Tel.: +33-149772752
Fax: +33-149772695
E-mail:

Dr Vazquez, José
Universidad Complutense de Madrid
Dept. Patología Animal
Unidad de Microbiología
28040 Madrid
Spain
Tel.: +34 91 394 37 04
Fax: +34 91 394 39 08
E-mail: vazquez@eucmax.sim.ucm.es

Dr Sørensen, Rie
Danish Meat Research Institute
Process Technology and Hygiene
Magleårdsvæj 2
4000 Roskilde
Denmark
Tel.: +45 46 30 30 30
Fax: +45 46 30 31 32
E-mail: rs@dnri.dk

Dr Karpiskova, Renata
National Institute of Public Health
Centre for Food Chain Hygiene
Palackeho 1-3
612 42 Brno
Czech Republic
Tel.: +420 5 755745
Fax: +420 5 41211764
E-mail: niph@chpr.anet.cz

Dr Kuchta, Thomas
Vyskumný Ústav Potravinarnský
Food Research Institute
Priemyselna 4
82475 Bratislava
Slovakia
Tel.: +421-75023 7158
Fax: +421-755571417
E-mail: kuchta@vup.sk

Dr Demnerova, Katerina
Institute of Chemical Technology
Prague
Department of Biochemistry and Microbiology
Technická 1903/3
166 28 Prague
Czech Republic
Tel.: +420 2 24355172
Fax: +420 2 3119990
E-mail: katerina.demnerova@vscht.cz

Dr Hugas, Marta
Meat Technology Center
Granja Camps I Armet, S/N
17121 Monells
Spain
Tel.: +34 72 63 00 52
Fax: +34 72 63 03 73
E-mail: marta.hugas@irta.es
Dr da Cruz, Vicente
National Institute for Engineering and Industrial Technology
Departamento de Tecnología das Indústrias Alimentares
Estrada do Paco do Lumiar
Edificio S
1649-038 Lisboa
Portugal
Tel.: +351 1 7127132
Fax: +351-1-7127162
E-mail: uma@mail.ineti.pt

Dr Barbanera, Martino
Coop Italia
Via Del Lavoro 6/8
40033 Casalecchio di Bologna
Italy
Tel.: +051/ 596173
Fax: +051/596145
E-mail: coopitalia.ut15@inter.business.it

Dr Toti, Laura
Instituto Superiore di Sanità
Reparto Igiene delle Tecnologie Alimentari
Lab Alimenti
V. Le Regina Elena N. 299
00166 Roma
Italy
Tel.: +390 6 4990 2779
Fax: +
E-mail:

Dr Ikonomopoulos, John
Medicanalysis Ltd.
Fleming 18, Maroysi
15126 Athens
Greece
Tel.: +30-166855490
Fax: +30-16855492
E-mail: histoclub@ath.forthnet.gr

Dr Joosten, Han
Nestlé Research Center
Department Quality & Safety
PO Box 44
1000 Lausanne
Switzerland
Tel.: +41 21 785 82 29
Fax: +41 21 785 85 53
E-mail: han.joosten@Grdls.nestle.com

Dr Nikopensius, Tiit
Estonian Agrobiocentre
Laboratory of Mycobacterioses and Tuberculin
Roomu Tee 10
51013 Tartu
Estonia
Tel.: +372 7 33 97 17
Fax: +372 7 33 97 17
E-mail: eabc@pb.uninet.ee

Dr Knut, Rudi
Norwegian Food Research Institute
Matforsk
Osloveien 1
1430 Ås
Norway
Tel.: +47-64970266
Fax: +47-64970333
E-mail: knut.rudi@matforsk.no

Prof. Dr Borch, Elisabeth
Swedish Meats R&D Ab
V. Langgatan 20
PO Box P.O.Box 504
244 24 Kävlingen
Sweden
Tel.: +46-46722400
Fax: +46-46736137
E-mail: elisabeth.borch@smrd.com

Dr Thisted Lambertz, Susanne
National Food Agency
Biology Division
Hammesplanaden 5
PO Box 622
751 26 Uppsala
Sweden
Tel.: +46-18175562
Fax: +46-18171494
E-mail: sula@slv.se
Validation and standardization of diagnostic Polymerase Chain Reaction for detection of food-borne pathogens
Multi-residue screening for coccidiostatic compounds used in poultry production

POULTRY-CHECK

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Scientific Officer: Achim Boenke
Project website: http://www.utu.fi/research/residues

Coordinator:
Prof. Dr Timo Lövgren
Dept. of Biotechnology
Biocity 6A
20520 Turku
Finland
Tel.: +358-2-3338051
Fax: +358-2-3338050
E-mail: timo.lovgren@utu.fi

PARTNERS

Dr Takalo, Harri
Innotrac Diagnostics Oy
Kalevantie 25
20520 Turku
Finland
Tel.: +358-2 2784021
Fax: +358-2 2410024
E-mail: harri.takalo@innotrac.fi

Dr Elliot, Chris
The Queen’s University of Belfast
Department of Veterinary Sciences
Stoney Road, Stormont
BT4 3SD Belfast
United Kingdom
Tel.: +44-1232 525625
Fax: +44-1232 525840
E-mail: chris.elliot@dardni.gov.uk

Dr Delahaut, Philippe
Centre d’Economie Rurale
Laboratoire d’Hormonologie
Rue du Point du Jour 8
6900 Marloie
Belgium
Tel.: +32 84 220 230
Fax: +32 84 31 61 08
E-mail: delahaut.erdha@skynet.be

Dr Van Rhijn, Hans
RIKILT-DLO
Natural Constituants, Residues and Contaminants
Bornsesteeg 45
PO Box 230
6708 PD Wageningen
The Netherlands
Tel.: +31 317 475400
Fax: +31 317 417 717
E-mail: J.A.vanrhijn@rikilt.dlo.nl

Dr Alfredsson, Gunnel
Stats Livsmedelsverk
Chemistry Division 3
Hannesplanaden 5
PO Box 622
751 26 Uppsala
Sweden
Tel.: +46 18 175594
Fax: +46 18 105848
E-mail: livsmedelsverket@slv.se
Multi-residue screening for coccidiostatic compounds used in poultry production

BACKGROUND
EU legislation demands that residues of xenobiotics used in poultry production to prevent and treat disease are monitored. However, there is strong evidence that some coccidiostat residues may be present in meat and the consumer is not being given adequate protection. Vast quantities of such drugs are used to treat and prevent disease in poultry production. Some coccidiostats have been banned from use in the EU due to their carcinogenic properties of (nitroimidazoles). Some coccidiostats are authorised and have been (or are being) assigned Maximum Residue Levels (MRLs). There is strong evidence that both authorised and unauthorised coccidiostats are being abused in the EU. Despite widespread use of these drugs, and the potential for adverse effects, few National Reference Laboratories (NRLs) have the ability to test for their presence in food. A recent survey showed that more than 75% of labs felt that existing methods for coccidiostats required improvement. Only one third of labs were able to measure residues of all the banned nitroimidazole drugs. More than 2/3rds of the labs believe that there is a need to develop methods for more coccidiostats.

OBJECTIVES
The central aim of this project is to address the above issues. Nitroimidazoles, halofuginone, toltrazuril, and nicarbazin have, therefore, been selected as priorities for the analysis method development. High-throughput, multi-residue and user-friendly tests will be developed and validated. The system can be applied for rapid detection of toxic agents throughout the food chain and subsequently also other residues can be measured with the same system. Chemical methods are also going to be developed to confirm the findings of the screening assays. The present consortium comprises 3 NRLs with GLP/EN45000 accreditation, 2 innovative SMEs and a research centre.

(EXPECTED) RESULTS AND ACHIEVEMENTS
During the first year of the project the following results and milestones have been achieved: A high number of different immunogens have been designed and antibodies have been generated in the project using high volume polyclonal production techniques. The resulting antibodies have been characterised by enzyme immunoassays (ELISAs) and selected antibodies have been further evaluated in a time-resolved fluorimunoassay (TR-FIA) system. Working antibodies have so far been produced for all except one of the coccidiostatic compounds included in the project. The development of prototype test kits (TR-FIA) has been started for each compound when a promising antibody has already been generated and the respective hapten structure is thus identified. For two of the coccidiostats the microtitre plate tests have been adapted for all-in-one (AIO) dry chemistry principle by using the optimised conditions already obtained. The development of sample preparation methods has been started ahead of planned schedule. The confirmatory methods, based on LC-MS/MS-techniques, have already been optimised for all compounds included in the project as planned. A dedicated web-site has been established for the project according to plan and the methods will be disseminated to end-users in Technology Transfer events.

During the second year of the project, the following results and milestones have been achieved. Antibodies have been developed for all of the analytes and the antibody production is now complete. The development of analyte-specific TR-FIA labels and TR-
FIA prototype test kits has also been completed. The adaptation of the tests into dry chemistry all-in-one concept is in progress and it has already been completed for two of the assays. The confirmatory methods have been validated and the standard operating procedures prepared. Two methods have been also tested by another partner laboratory.
Construction of miniaturised free flow electrophoresis (mFFE) incorporating dedicated sensors for real-time analysis of food contaminants

MICROSENSOR

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Contract type: Shared Cost Project
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Starting date: 1/02/2000
Duration: 36 Months
Scientific Officer: Achim Boenke
Project website: http://www.lfra.co.uk/candr/resweb4.htm

Coordinator:
Dr Pradip Patel
Leatherhead International Ltd
Consultancy and Research
Randalls Road
KT22 7RY Leatherhead
United Kingdom
Tel.: +44-1372-376 761
Fax: +44-1372-386228
E-mail: ppatel@lfra.co.uk

Prof. Manz, Andreas
Imperial College of Science, Medicine and Technology
Dept. of Chemistry
Imperial College Road
SW7 2AZ London
United Kingdom
Tel.: +44-171 594 5838
Fax: +44-171 594 5833
E-mail: a.manz@ic.ac.uk

Dr Tiefenthaler, Kurt
Artificial Sensing Instruments ASI AG
Schaffhauserstraße 580
PO Box 120
8052 Zürich
Switzerland
Tel.: +41 1 3013710
Fax: +41 1 3013719
E-mail: asi@swissonline.ch

Dr Weber, Gerhard
Dr Weber GmbH
Klausnerring 17
85551 Kirchheim
Germany
Tel.: +49 89 90480813
Fax: +49 89 90480814
E-mail: FFEWeber aol.com

PARTNERS
Construction of miniaturised free flow electrophoresis (mFFE) incorporating dedicated sensors for real-time analysis of food contaminants

BACKGROUND

Food safety and quality are fundamental obligations towards the European consumer as clearly identified in the proposal “Agenda 2000” towards of the Common Agricultural Policy. The consumer and authorities are concerned about the problem of food safety (e.g. microbiological and chemical contamination), and environmental issues (e.g. animal welfare). The European Commission has proposed to adopt harmonised rules at Community level for matters relating to public health, the protection of the consumers, fairness to trade and environmental protection. There are several relevant directives which include microbiological criteria (e.g. Council Directives 92/46/EEC, 94/65/EC, 89/437/EEC, 91/493/EEC and 80/777/EEC) for food safety control taking also into account that food-borne illnesses leading to consumer’s health damage need to be avoided such as these ones reported in 1990, where an average of 120 cases of food-borne illness per 100,000 population from 11 European Countries occurred. Many of the modern techniques (e.g. ELISA, PCR and HPLC) for the analysis of food contaminants are not wholly reliable, robust, real-time or suited to line sample measurement. This is largely due to two significant problems, i.e. the interference of components from bulk food matrix and potential cross-reactions with closely related species. To address these problems, generic techniques are required that reproducibly separate analytes from potential interference in real-time prior to detection and estimation.

OBJECTIVES

The major objective of MICROSENSOR project is to develop and demonstrate the practical feasibility of miniaturised free flow electrophoresis (mFFE) -based optical biosensor techniques for real-time measurement of analytes (e.g. markers of rBST hormone and Listeria), as a generic tool to address the problem of food safety. If successful, the new analytical technology will enhance: (i) food safety by providing efficient tools to cope with modern food production, and (ii) efficiency of European Food Control laboratories. Consequently, it is the strategic objective of this project to test the practical feasibility of mFFE systems with downstream dedicated sensors for the real-time measurement of three selected analytes (e.g. mycotoxin, markers for recombinant bovine somatotrophin, rBST, and Listeria) as a tool to address selected problems of food safety. The proposed research aims to deliver such techniques by using a multidisciplinary approach integrating the novel generic mFFE separation techniques, a solid state optical biosensor system and associated software for the measurement of the selected food contaminants in comparison with the conventional techniques.

EXPECTED RESULTS AND ACHIEVEMENTS

The literature reviews on the applications of FFE and biosensors in the agrifood industry have been published as LFRA reports. Further external publication of the biosensor paper has been secured in the Trends in Analytical Chemistry (TRAC) Journal.

Work has continued on the development of miniaturised FFE systems. Standard procedures for microfabrication of polydimethylsiloxane (PDMS) chip devices have been established, permitting the rapid and cost-effective production of multiple copies. The
first-design prototype of a microchip, with media flow regulated by a vacuum pump, has been fabricated for use with a linear array UV detector. The integrity and functionality of the structure has been successfully demonstrated by resolving the fluorescent compounds, fluorescein and rhodamine. The microchip magnet design concept has been patented.

Work has also continued on the development of prototype mini-FFE chambers for the separation of Listeria and IGF-1. Continuous isotachophoresis was used to resolve Listeria and Micrococcus from a mixed suspension. Sample capacity was increased using simultaneous manifold separations. The robustness of the mini-chambers was improved by developing a new supporting frame to equalise the pressure across the chambers. Following successful reliability trials, the mini-FFE instrument was technology transferred to the food laboratory for the development of practical protocols. Free flow zone electrophoresis and isotachophoresis have since been used to determine the characteristic profiles of Listeria, Micrococcus and E.coli using the mini-FFE instrument.

Work has continued on the development of suitable detection systems for use with the mini-FFE. Work was instigated on development of SPR sensor based assay procedures for Listeria. Selective binding profiles of antibody and bacterial cells have been demonstrated using gold-coated glass slides of a commercial optical biosensor. The ASI biosensor has been tested for stability, and recently transferred to the food laboratory for protocol development.
QLK1-1999-00343: Construction of miniaturised free flow electrophoresis (mFFE) incorporating dedicated sensors for real-time analysis of food contaminants
Prevention of ochratoxin a in cereals

OTA PREV

Contract number: QLK1-1999-00433
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Duration: 42 Months
Scientific Officer: Achim Boenke

Coordinator:
Dr Monica Olsen
National Food Administration
Biology Division
751 26 Uppsala
Sweden
Tel.: +46-18-175598
Fax: +46-18-105848
E-mail: moool@slv.se

PARTNERS

Dr Jonsson, Nils
Swedish Institute of Agricultural and Environmental Engineering
PO Box 7033
750 07 Uppsala
Sweden
Tel.: +46-18-303 300
Fax: +46-18-300 956
E-mail: nils.jonsson@jti.slu.se

Prof. Magan, Naresh
Cranfield Biotechnology Centre
Cranfield University
Barton road, Silsoe, Beds
MK454DT
United Kingdom
Tel.: +44 1234 754339
Fax: +44 1234 7507
E-mail: n.magan@cranfield.ac.uk

Dr Banks, John
Central Science Laboratory
Sand Hutton
York Y041 1LZ
United Kingdom
Tel.: +44 1904 462335
Fax: +44 1904 462111
E-mail: j.banks@csl.gov.uk

Prof. Fanelli, Corrado
VegetaleLaboratorio di Micologia
Università di Roma “La Sapienza”
Largo Cristina de Svezia 24
00165 Roma
Italy
Tel.: +39 06 6833878
Fax: +39 06 4463865
E-mail: cfanelli@axrma.uniroma1.it

Dr Rizzo, Aldo
National Veterinary and Food Research Institute
Department of Chemistry
PO Box 368
00231 Helsinki
Finland
Tel.: +358 9 3931 909
Fax: +358 9 3931 920
E-mail: aldo.rizzo@eela.fi

Dr Haikara, Auli
VTT Biotechnology and Food Research
PO Box 1500
02044 Espoo
Finland
Tel.: +358-94565130
Fax: +358-94552103
E-mail: auli.haikara@vtt.fi
Prevention of ochratoxin A in cereals

BACKGROUND

The EU is the second largest agricultural exporter with trade based on cereals, in particular wheat, and other agricultural products as identified in a study published by the European Commission in relation to the EC Agricultural Policy for the 21st Century. About 25% of the world’s food crops are affected by mycotoxins every year. The presence of ochratoxin A in edible tissue and particularly in pig kidneys, as a result of consumption of contaminated feed, has been demonstrated in Denmark and Sweden by Krogh and Rutquist already in 1977, respectively. As a consequence prevention strategies and early detection systems of mycotoxin-contaminated raw materials form an essential need. Consequently, monitoring and surveillance programmes have been set-up. Ochratoxin A (OTA) is a mycotoxin of considerable concern for human health and is classified as a possible human carcinogen. The EC, Scientific Committee for Food (SCF) has concluded that the intake of OTA should be reduced as far as possible, e.g. below 5 ng/kg body weight/day. Cereals normally correspond to 50-80% of average consumer intake. Consequently, prevention of OTA formation by specific moulds in cereals would have a significant impact on levels of human exposure.

OBJECTIVES

The over-all objective for this project is the protection of the consumer’s health by decreasing the amount of ochratoxin A in cereals produced in Europe. This will be achieved by identifying the key elements in an effective HACCP programme for ochratoxin A for cereals, and by providing tools for preventive and corrective actions. The project includes the whole food chain from primary production to the final processed food product. The objectives and expected achievements are divided into 4 different tasks, all important steps in a HACCP managing programme for ochratoxin A in cereals: identification of the critical control points; establishment of critical limits for the critical control points; developing rapid monitoring methods, and establishment of corrective actions in the event of deviation of a critical limit. The outcome from all tasks, which consist of 11 workpackages, will serve as a pool of knowledge for HACCP-based ochratoxin management programmes, which will increase food safety and support the EU cereal industry.

(EXPECTED) RESULTS AND ACHIEVEMENTS

During the second reporting period of Task 1, the examination of ochratoxin positive cereal samples has continued. The number of countries, in which Penicillium verrucosum has been identified as the toxin producer, has increased considerable during 2001. Now, P. verrucosum has not only been found in cereals in Denmark, Sweden, Norway, United Kingdom, Germany and Austria, but also in Italy, Spain, France and Portugal. Still P. verrucosum is the only ochratoxin producer found. More than 100 isolates of P. verrucosum from these environments have been fingerprinted phenotypically and examined for production of ochratoxin A, and many different clones have been found. Replies on the questionnaire, aiming to compile a detailed summary of the different farming methods used across the Community have been received from 12 countries. The data is currently being tabulated and assessed.

Task 2 is providing new knowledge concerning the microbial ecology of the ochratoxin A-producing fungi. The results indicate that niche occupation and niche overlap be-
between *P. verrucosum* and other species varies considerably with water availability and temperature. *A. ochraceus* occupied the same niche as *P. verrucosum* at high water activity \( (a_w=0.995) \), but was more competitive under drier conditions. Studies on the effect of gas composition on germination showed that *A. ochraceus* is more sensitive to high concentrations of CO\(_2\) than *P. verrucosum*. Overall, *P. verrucosum* is very tolerant up to 50% CO\(_2\). The storage experiments with winter wheat, harvested in August 2000, have been completed. The experiments were supplemented with tests using irradiated grain. The results indicate that an increase in respiration rate occurred just before or at the same time as growth of *P. verrucosum* or of other moulds could be demonstrated. At water activities above 0.85, an obvious increase of ochratoxin A usually could be detected at the same time or just after *P. verrucosum* started to grow. Irradiation of grain caused faster growth of moulds and higher production of ochratoxin A. The first year’s collection of data from out-door silos, which will be used to describe the heat and moisture transfer in critical parts of a silo, showed that, independent of silo type, there was often a gradual moistening from 13 to 15% moisture content of the upper surface of the grain during the storage period. Detailed screening of anti-oxidants, essential oils and antimicrobial extracts from mushrooms have been completed and the best candidates have been tested on irradiated and natural wheat and maize. A few candidates give more than 90% inhibition on the growth of fungi and of the ochratoxin production. In addition, the results from miniscale storage experiments with irradiated barley contaminated with toxigenic moulds and inoculated with lactic acid bacteria (LAB) suspensions, showed that certain LAB restrict efficiently the growth of *Penicillium verrucosum*.

In Task 3 rapid monitoring methods are being developed. A new set of molecular imprinted polymers (MIPs) has been produced. The MIPs showed excellent affinity to ochratoxin A, and do not bind towards other tested chemical as the initial material did. An extraction procedure for removal of ochratoxin A from grain samples has been developed. Currently, a protocol for detection of ochratoxin A in spiked and real samples is being tested. Very sensitive prototype ELISAs have been produced and are being evaluated. The assay is well within the range of the recent established EU legislation of 3-5 (g/kg). To establish a molecular detection system for the ochratoxin producing fungi, the strategy is now targeted at using suppression subtractive hybridisation-PCR to target the genes that are up-regulated by cells producing ochratoxin A. Preliminary results indicate that this approach is partially successful.

Task 4 deals with the establishment of corrective actions during milling and cereal processing and during malting and brewing. Two 100-kg batches of wheat were inoculated with *P. verrucosum* to produce samples with a concentration of ochratoxin A at 5 and 50 (g/kg). The results showed that cleaning and scouring of wheat only resulted in a small loss of ochratoxin A. However, the bran and offal fraction contained much higher concentrations of ochratoxin A, so that this resulted in significantly reduced toxin levels in the white flour by about 50%. There was only a small additional loss during baking. Extrusion appeared to produce a small reduction that appeared to be related to temperature rather than moisture content or screw speed. Malting experiments have been carried out using barley with natural contamination and barley artificially contaminated with *P. verrucosum*. The growth of *P. verrucosum* during malting was negligible and only minor amounts of OTA were found. However, high amounts of OTA were produced during germination and in most cases also during kilning (drying), when artificially contaminated samples were malted. The process temperature during malting had a pronounced effect on the growth of *P. verrucosum* and the formation of ochratoxin A.
A HACCP-BASED APPROACH TO THE PREVENTION OF OCHRATOXIN A IN CEREALS

QLK1-1999-00433: Prevention of ochratoxin a in cereals
Safety evaluation of horizontal gene transfer from genetically modified organisms to the microflora of the food chain and human gut

GMOBILITY

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Duration: 36 Months
Scientific Officer: Barend Verachtert
Project website: http://www.entransfood.com

Coordinator:
Dr Jos van der Vossen
Nutrition and Food Research Institute (TNO)
Food Microbiology Department
Utrechtseweg 48
3700 AJ Zeist
The Netherlands
Tel.: +31 30 6944720
Fax: +33 30 6944901
E-mail: vanderVossen@voeding.tno.nl

PARTNERS

Dr Bogers, Robert, J.
RIKILT-DLO
Food Health and Food Safety
Department
Bornsesteeg
PO Box 230
6700 AE Wageningen
The Netherlands
Tel.: +31 17 475400
Fax: +31 317 417717
E-mail: r.j.bogers@rikilt.dlo.nl

Dr Ende, Ingrid
University of Hohenheim
Food Microbiology 1
Garbenstraße 28
70599 Stuttgart
Germany
Tel.: +49-711 459-0
Fax: +49-711 459-3289
E-mail: ende@verwaltung.uni.hohenheim.de

Mr Walker, Joe
Bibra International Molecular Biology
Department
Woodmansterne Road
PO Box Carshalton
SM5 4DS Surrey
United Kingdom
Tel.: +44-1816521000
Fax: +44-1816617029
E-mail: jwalker@bibra.co.uk

Mrs Courtois, Sylvie
INRA
Centre de Recherche de Jouy-en-Josas
Domaine de Vilvert Bâtiment 440
78352 Jouy-en-Josas
France
Tel.: +33-01 34652079
Fax: +33-01 34652088
E-mail: courtois@jouy.inra.fr

Dr Schlundt, Joergen
Danish Veterinary and Food Administration
Institute of Food Safety and Toxicology
19 Mørkhøj Bygade
2860 Søborg
Denmark
Tel.: +45 33956180
Fax: +45 33956698
E-mail: js.vfd.dk

Prof. Dr Lubitz, Werner
University of Vienna
Institute of Microbiology and Genetics
Dr Bohrgasse 9
1030 Vienna
Austria
Tel.: +43 1 3191484203
Fax: +43 1 3191484234
E-mail: oldfox@gem.univie.ac.at
Safety evaluation of horizontal gene transfer from genetically modified organisms to the microflora of the food chain and human gut

BACKGROUND
This project addresses the assessment of possible gene transfer from genetically modified organisms (GMO-plants and microorganisms) to the microflora of the food chain. For appropriate implementation of national and EU regulations, there is still a lack of knowledge concerning the transfer of non-equivalent DNA. The risk of horizontal gene transfer will be addressed based on the outcome of the exploitation of several donor-recipient combinations in different environments. Therefore we will use food models, models which mimic the ecological habitat in the rumen and human gastro-intestinal tract. In this coordinated project we will study all parameters involved in horizontal gene transfer. All data resulting from the different tests in the variety of model systems will yield validated model systems for studying HGT.

OBJECTIVES
The principal aims of the project proposed here, is to provide a risk evaluation based on scientific knowledge and evidence concerning the frequencies and consequences of horizontal gene transfer (HGT) of marker genes to bacteria present in the food chain and human microflora as a basis for the safety evaluation of transgenic crops and microorganisms in food. Apart from analysis of transfer frequencies, hazards will be identified, exposure data will be collected and the impact will be addressed to quantify the risk of HGT and to be conclusive. Therefore, data on transfer frequencies will be related to the nature of the transgenic food, the stability of DNA in the food matrix, and the gastrointestinal tract, the daily intake of a transgenic food, the frequency of a particular gene in nature, and the relevance of a particular marker gene in terms of selective pressure. In addition, the project will also focus on standardisation of methods and systems used for the safety evaluation of transgenic food with respect to HGT.

(EXPECTED) RESULTS AND ACHIEVEMENTS
QLK1-1999-00527: Safety evaluation of horizontal gene transfer from genetically modified organisms to the microflora of the food chain and human gut
Rapid detection of transnational foodborne viral infections and elucidation of transmission routes through molecular tracing and development of a common database

FOODBORNE VIRUSES IN EUROPE

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Starting date: 1/02/2000
Duration: 36 Months
Scientific Officer: Alkmini Katsada
Project website: www.rivm.nl/eufoodborneviruses.htm

Coordinator:
Dr Marion Koopmans
National Institute of Public Health and Environment
Research Laboratory for Infectious Diseases
Antonie Van Leeuwenhoeklaan 9
3720BA Bilthoven
The Netherlands
Tel.: +31-30-2743945
Fax: +31-30-2744449
E-mail: marion.koopmans@rivm.nl

PARTNERS

Prof. Dr C-H. von Bonsdorff
University of Helsinki
Haartman Institute
Department of Virology
Haartmaninkatu 3
PO Box 21
00014 University of Helsinki
Finland
Tel.: +358-91911
Fax: +358-919123077
E-mail: Carl.Henrik.vanBonsdorff@helsinki.fi
Dr B. Böttiger
Statens Serum Institut
Dept. of Virology
Artillerivej 5
2300 Copenhagen
Denmark
Tel.: +45 32683268
Fax: +45 32683868
E-mail: bbo@ssi.dk

Dr L. Svensson
Swedish Institute for Infectious Disease Control
Department of Virology
Doktorsringen 25
171 82 Solna
Sweden
Tel.: +46-8-457 2310
Fax: +46-8 32 83 30
E-mail: lensve@mbox.ki.se

Dr Brown, David
Public Health Laboratory Service
Central Public Health Laboratory
Enteric and Respiratory Virus Laboratory
61 Colindale Av.
NW9 5HT London
United Kingdom
Tel.: +44 181 200 4400
Fax: +44 181 200 1569
E-mail: dbrown@cphl.demon.co.uk

Dr E. Schreier
Robert Koch-Institut
Molekulare Epidemiologie Viraler Erreger
Nordufer 20
13353 Berlin
Germany
Tel.: +49-30-45 47 23 56
Fax: +49-30-45 47 26 02
E-mail: schreire@rki.de
Rapid detection of transnational foodborne viral infections and elucidation of transmission routes through molecular tracing and development of a common database

BACKGROUND
Foodborne and waterborne viral infections are increasingly recognised as causes of illness in humans. The most commonly implicated pathogens (calicivirus, Hepatitis A virus) can not be readily be cultured, but recent advances in molecular virology have enabled the development of the sensitive methods that are needed for their detection and typing. The lack of international standardisation, however has precluded full use of the molecular information for tracking of outbreaks across borders, and for elucidation of the major transmission routes. In this proposal we aim to allow more rapid and internationally standardised assessment of the spread of foodborne viruses, including elucidation of the mechanisms of emergence of novel variants, by standardisation of methods, the use of a common database, and epidemiological follow-up of international foodborne viral infections.

OBJECTIVES
The project team has set the following overall objectives:

• To study the importance of enteric viruses as causes of illness across Europe, with a special focus on multinational outbreaks of infection with Norwalk-like viruses and hepatitis A virus.
• To develop novel, standardised, rapid methods for virus detection and typing to be used in all participating laboratories.
• To establish the framework for a rapid, prepublication exchange of epidemiological, virological and molecular diagnostic data.
• To determine which are the high-risk foods and major transmission routes of foodborne viral infections in the different countries and between countries.
• To describe the pattern of diversity within and between countries, and identify potential pandemic strains at the onset.
• To investigate the mechanisms of emergence of these strains, including the possibility of spill-over from animal reservoirs.

(EXPECTED) RESULTS AND ACHIEVEMENTS
A. Dr Sanchez  
Instituto de Salud Carlos III  
Centro Nacional de Microbiologia  
Ctra./Majadahonda-Pozuelo Km 2  
28220 Majadahonda, Madrid  
Spain  
Tel.: +34-91-38 77 834  
Fax: +34-91-38 77 832  
E-mail: asanchez@isciii.es

Prof. Dr A. Bosch  
Universitat de Barcelona  
Departament de Microbiologia  
Facultat de Biologia  
Avinguda Diagonal, 645  
08028 Barcelona  
Spain  
Tel.: +34-934035380  
Fax: +34-934035387  
E-mail: albert@bio.ub.es

Dr F. LeGuyader  
Institut Francais de Recherche Pour l’Exploitation de la Mer  
Laboratoire de Microbiologie  
Rue de l’Île d’Yeu  
PO Box 21105  
44311 Nantes Cedex 03  
France  
Tel.: +33-146482150  
Fax: +33-146482277  
E-mail: sleguyad@ifremer.fr

Dr L. Toti  
Istituto Superiore di Sanità  
Reparto di Igiene delle Tecnologie Alimentari  
Laboratorio di Alimenti  
Viale Regina Elena 299  
00161 Rome  
Italy  
Tel.: +39 06 49902693  
Fax: +39 06 44869440  
E-mail: tot@iss.it

Dr P. Pothier  
Centre Hospitalier Universitaire de Dijon  
Laboratoire de Virologie  
1 Bd. Jeanne d’Arc  
21034 Dijon  
France  
Tel.: +33-380 29 35 75  
Fax: +33-380 29 34 21  
E-mail: pierre.pothier@u-bourgogne.fr
QLK1-1999-00594: Rapid detection of transnational foodborne viral infections and elucidation of transmission routes through molecular tracing and development of a common database
Virus safe seafood
VS SEAFOOD

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Contract type: Shared Cost Project
Total cost: € 2.170.225
EC contribution: € 1.145.958
Starting date: 1/02/2000
Duration: 36 Months
Scientific Officer: Sigurdur Bogason
Project website: www.ifremer.fr/vsseafood

Coordinator:
Dr Monique Pommepuy
IFREMER
Laboratoire de Microbiologie
29280 Plouzane
France
Tel.: +33 298224339
Fax: +33 298224594
E-mail: pommepuy@ifremer.fr

Dr Albert Bosch
Universitat de Barcelona
Departament de Microbiologia
Avinguda Diagonal, 645
08028 Barcelona
Spain
Tel.: +34 934021485
Fax: +34 934010592
E-mail: albert@porthos.bio.ub.es

Dr Hilde Van Pelt-Heerschap
DLO-Netherlands Institute for Fisheries Research
Haringkade
PO Box 68
1970 AB IJmuiden
The Netherlands
Tel.: +31 255 564479
Fax: +31 302743425
E-mail: hilde@rivo.dlo.nl

Dr Lennart Svensson
Swedish Institute for Infectious Disease Control
Department of Virology
Doktorsringen 25
171 82 Solna
Sweden
Tel.: +46 8 457 22696
Fax: +46 8 337272
E-mail: lensve@mbox.ki.se

Dr Atmar, Robert
Baylor College of Medicine
Division of Molecular Urology
1 Baylor Plaza
77030 Houston, Texas
United States
Tel.: +1 713 798 6849
Fax: +1 713 790 0681
E-mail: ratmar@bcm.tmc.edu

Dr Brest, Goulven
Comité National de la Conchyliculture
55, Rue des Petits Champs
75001 Paris
France
Tel.: +33 142974844
Fax: +33 142860824
E-mail:

Dr Jean Cohen
INRA Jouy-en-Josas
Virologie et Immunologie Moléculaire
Domaine de Vilvert
78352 Jouy-en-Josas
France
Tel.: +33-134632604
Fax: +33-134632621
E-mail: cohen@biotech.jouy.inra.fr

PARTNERS
Virus safe seafood

BACKGROUND

The overall objective of this project is to provide useful tools for the evaluation of human viral contamination in shellfish and innovative technology for their quality control and depuration. Shellfish viral contamination is currently under diagnosed, although significant epidemiological studies have linked viral illnesses to the consumption of contaminated shellfish. To answer this problem molecular typing and study of the resistance of major human enteric viruses will be investigated. Moreover, the quality of harvesting areas and shellfish depuration process will be assessed. These information will help evaluating various tools: routing methodologies, “Warning system” to prevent the contamination of harvesting areas, “Good Depuration Practices” to secure the shellfish depuration process. The project results will provide the elements for a sustainable development of European shellfish production.

OBJECTIVES

The overall objective of the “Virus-Safe Seafood” project is to provide, along the food chain, useful and rapid tools for the evaluation of human viral contamination of shellfish and innovative technology for their quality control and depuration. The final objective is to assure the safety of the food supply.

The problem of shellfish contamination is currently under diagnosed and under managed, although significant epidemiological studies have linked viral illnesses to the consumption of contaminated shellfish meeting bacterial standards. Protecting the consumer will imply preventing action based on seafood specificity. Shellfish are a unique foodstuff, because of the characteristics of the animal (filter-feeder) and the way they are eaten (slightly cooked, and even raw for oysters). These animals are grown in seawater, and hydric environment is the main source of contamination. They accumulate contaminants, among them human enteric viruses, which are able to persist for a long time in the animal. If viral hydric contamination occurs in harvesting areas, shellfish could be contaminated. As bacterial indicators have now been proved not to be correlated with viral presence, regulation set up to protect consumers is inefficient. Even if EU rules recommend depuration for bacterial polluted shellfish, the efficiency of depuration process to remove viruses still needs to be demonstrated. Efficient consumer protection must take into consideration the viral contamination of growing areas (sewage input and harvesting water quality) and the viral elimination during the depuration process. The food chain is here “harvesting and depuration”. All these factors are taken into account to construct and organise the project “Virus-Safe Seafood”.

A co-operative research between multidisciplinary partners is settled to procure the competence necessary to achieve the project. Expertise from fundamental research, R&D and shellfish producers, are complementary to address the following objectives:

1. Determination of viral input and shellfish contamination: the main human enteric viruses implicated in diseases linked to shellfish consumption chosen for this study will be: astrovirus (AV), calicivirus (CV), enterovirus (EV), Hepatitis A virus (HAV), rotavirus (RV). They will be searched to appreciate the role of the environment as a reservoir. The following techniques will be used:
   - Extraction /concentration of viral particles and purification of nucleic acids;
   - Commercial kits validation and evaluation for routine detection;
1. Detection by RT-PCR, hybridisation; quantification and standardisation of the protocols;  
Molecular typing to determine the strains persisting in the environment.  
These techniques will be applied to assess viral contamination of waste waters, rivers,  
seawater and shellfish samples. Shellfish imported or sampled from harvesting areas  
will be analysed. The concentration of actual and potential indicators (Escherichia coli  
and F+RNA specific phages) will be compared to the presence of human enteric viruses  
and evaluated to propose a more valuable approach for shellfish safety.  

2. Evaluation of the persistence of enteric viruses in the environment: Virus-like Particles (VLPs) of astrovirus, calicivirus and rotavirus will be constructed. This new technology issued from molecular research will be used to:  
- simulate and compare their behaviour in seawater;  
- follow viral capsid degradation and thus, obtain information on infectivity;  
- evaluate the role of physical (temperature, salinity) and biological (bacterial flora) parameters on viral fate.  

3. Optimisation of shellfish depuration: to assess the efficiency of depuration process on viral contamination:  
- VLPs-artificially contaminated shellfish will first be used;  
- Different parameters will be evaluated to enhance depuration processes;  
- After VLPs assays optimisation, the same depuration processes will be applied to naturally contaminated shellfish;  
- Efficiency of depuration enteric viruses and indicators will be then evaluated.  

(EXPECTED) RESULTS AND ACHIEVEMENTS  
These information will define various tools to evaluate the accuracy of EC standards,  
reducing the risk caused by seafood consumption and providing a sustainable development of shellfish production:  
- Understanding of pathogen distribution and designing “viral risk months”;  
- Providing valuable information about viral risk for countries involved in shellfish trade; improving shellfish safety by defining “Good Depuration Practices” and a “warning system” in harvesting areas.
New methods for the safety testing of transgenic food
SAFOTEST

Contract number: QLK1-1999-00651
Contract type: Shared Cost Project
Total cost: € 1.801.662
EC contribution: € 1.549.785
Starting date: 1/02/2000
Duration: 48 Months
Scientific Officer: Barend Verachtert
Project website: http://www.entransfood.com

Coordinator:
Dr Ib Knudsen
The Danish Veterinary and Food Administration
19, Mørkhøj Bygade
2860 Søborg
Denmark
Tel.: +45-33956525
Fax: +45-33956698
E-mail: ik@fdir.dk

PARTNERS

Prof. Dr Engel, Karl-Heinz
Technische Universität München
Lehrstuhl für Allgemeine Lebensmitteltechnologie
Am Forum 2
85350 Freising-Weihenstephan
Germany
Tel.: +49 8161 714250
Fax: +49 8161 714259
E-mail: K.H.Engel@lrz.tu.muenchen.de

Prof. Dr Davies, Howard
The Scottish Crop Research Institute
Cellular & Environmental Physiology Department
Invergowrie
DD2 5DA Dundee
United Kingdom
Tel.: +44 1382 568513
Fax: +44 1382 568503
E-mail: hdavie@scri.sari.ac.uk

Dr Gatehouse, Angharad
University of Durham
Department of Biological Sciences
South Road
DH1 3LE Durham
United Kingdom
Tel.: +44 19 3742423
Fax: +44 19 3742417
E-mail: A.M.R.Gatehouse@durham.ac.uk

Dr Peijnenburg, Ad
RIKILT-DLO
Department of Food Safety and Health
Bomsesteeg 45
PO Box 230
6708 PD Wageningen
The Netherlands
Tel.: +31 317 475462
Fax: +31 317 417 717
E-mail: a.a.c.m.peijnenburg@rikilt.dlo.nl
New methods for the safety testing of transgenic food

BACKGROUND
This project proposal deals with the development of a sensitive and specific animal test which is necessary for safety analysis of genetically modified plants according to the Opinion of the Scientific Committee for Food on the assessment of novel foods. The test will be based on the OECD 90 day rodent study supplemented with sensitive and specific markers for potential toxicity of the products encode by the inserted genes in the tested food item, the use of a semisynthetic diet with interchangeable constituents and the extensive use of initial chemical and in-vitro testing for guiding the precise design of the animal study. The genetically modified food plants to be used for this test development will be 3 transgenic rice varieties (2 types of lectins and the Bt toxin).

OBJECTIVES
The overall objective of this project is to develop and validate the scientific methodology which is necessary for assessing the safety of foods from genetically modified plants in accordance with the EU Regulation 258/97 of 27 January 1997 concerning novel foods and novel food ingredients. The project is designed to meet the urgent need for a sensitive and specific testing strategy for GM foods in a scientifically valid and economically feasible manner.

The specific objectives are to:

• improve the sensitivity and specificity of standard OECD guideline toxicity tests towards detection of specific chemical entities in the GM food matrix by the measurement of additional biological endpoints based on prior knowledge.

• improve the quality of this prior knowledge through precise information regarding the gene construct, its site of insertion and the chemical and toxicological characteristics of the gene product based upon chemical analytical studies and short term in vivo and in vitro studies.

• improve the quality of this prior knowledge through precise information regarding unintended secondary changes in the GM food item, which may alter the nutritional-toxicological properties of that food.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The results of the project will be evaluated at a final workshop and the recommendations will be used to guide future test requirement for the safety assessment of genetically modified food plant within EU and worldwide.
QLK1-1999-00651: New methods for the safety testing of transgenic food
New methodologies for assessing the potential of unintended effects in genetically modified food crops

GMOCARE

Contract number: QLK1-1999-00765
Contract type: Shared Cost Project
Total cost: € 3.780.147
EC contribution: € 2.695.203
Starting date: 1/02/2000
Duration: 36 months
Scientific Officer: Barend Verachtert
Project website: http://www.entransfood.com

Coordinator:
Prof. Dr Hubert P.J.M. Noteborn
RIKILT-WUR
Bornsesteeg 45
6700 AE Wageningen
The Netherlands
Tel.: +31-317 475462
Fax: +31-317 417717
E-mail: h.p.j.m.noteborn@rikilt.wag-ur.nl

Dr Bramley, Peter
Royal Holloway and Bedford New College
University of London
School of Biological Sciences
Egham Hill
TW20 0EX Egham
United Kingdom
Tel.: +44-1784434326
Fax: +44-1784434326
E-mail: p.bramley@rhbnc.ac.uk

Prof. Dr Angenon, Geert
Vrije Universiteit Brussel
Institute of Molecular Biology
Paardenstraat 65
1640 Sint-Genesius-Rhode
Belgium
Tel.: +3223590252
Fax: +3223584547
E-mail: Geert.angenon@vub.ac.be

Dr Pedersen, Jan
Institute of Food Safety and Toxicology,
Munkhoj Bygade 19
2680 Søborg
Denmark
Tel.: +45 33 95 66 10
Fax: +45 33 95 60 01
E-mail: jp@vfd.dk

Dr Celis, Julio
Institute of Cancer Biology and Danish Centre for Human Genome Research,
Strandboulevarden 49
2100 Copenhagen O
Denmark
Tel.: +45 3525 7363
Fax: +45 3525 7375
E-mail: jec@cancer.dk

Prof. Dr Dipl.-Ing. Altmann, Friedrich
Universität für Bodenkultur
Institut für Chemie
AG Glykobiologie
Gregor Mendelstraße 33
1190 Wien
Austria
Tel.: +43 1 36006 6062
Fax: +43 1 36006 6059
E-mail: faltmann@edv2.boku.ac.at

Dr Ian Colquhoun
Institute of Food Research
Food Quality and Materials Science Division
Norwich Research Park Colney
NR4 7 UA Norwich
United Kingdom
Tel.: +44 1603 255353
Fax: +44 1603 507723
E-mail: ian.colquhoun@bbsrc.ac.uk
New methodologies for assessing the potential of unintended effects in genetically modified food crops

BACKGROUND
Market introduction of genetically modified (GM) food crops in Europe has given rise to broad public concern, which of a great deal is based on uncertainties related to safety for humans, animals and environment. One of the key issues in safety evaluation of GM plants is whether unexpected or unintended changes may have taken place in the organism due to genetic modification, that could affect its safety or nutritional status. The project was designed to answer the question: Does genetic modification induce (un-)intended effects in the Genetically Modified (GM) crop plant, that may affect levels of nutrients, natural toxins or other compounds if compared to the parental line? The answer addresses the issue of ‘Substantial Equivalence’ and therefore, the main thrust of the research programme targets on exploiting ‘omics’ techniques like genomics (DNA chip technology), proteomics (2D-PAGE/MALDI-TOF) and metabolomics (LC-NMR/GC-MS) for a ‘holistic’ compositional analysis of plant tissues. The overall objective is to adapt these new technologies to identify and/or eliminate potential hazardous metabolic perturbations in whole complex GM crop plants at the earliest step in the food chain.

OBJECTIVES
The overall first year objective was to imply the ‘omics’ technologies, which should be of sufficient sensitivity and specificity, to assure a screen for identifying possible unintended effects (i.e. metabolic perturbations) in GM crop plants. Implicit in this objective was the development of new knowledge intended to understand the implications of genetic modification processes, such as the use of sense/antisense constructs, on metabolic pathways in crop plants. The ‘omics’ tools were tested through the evaluation of transgenic potato lines modified in, for example, starch, polyamine, glycoalkaloid and amino acid metabolism and transgenic tomato lines with modified carotenoids content. Other GM-lines like Arabidopsis and Nicotiana were used for academic and control purposes in order to determine what genes are involved in the process of flavonoid and lysine metabolism, growth and development.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The wealth of techniques and methods developed and evaluated during the first year of the project provided a firm basis for identification of possible hazardous metabolic perturbations in whole complex GM crop plants. In the first year crop plant production (i.e. glasshouse, polytunnel and field environments) has been arranged to supply sufficient transgenic plants for experimental usage in both ‘targeted (i.e. selected critical nutrients and key natural toxins analysis)’ as well as in ‘non-targeted (i.e. non-specific broad-spectrum profiling analysis)’ compositional studies. Transgenic plants have been selected as follows: 5 types of GM potato lines i.e. Mal1 (defective glycoprotein processing), SAM35S (polyamine metabolism), W2GBSS (starch composition), FK (modified sugar metabolism) and DHDPS (lysine content); 5 types of GM tomato lines i.e. 35S crtl (2-fold increase of b-carotene and lutein), crtB (increased carotenoids), anti-Psy (dramatically reduced carotenoids), beta-Lcy (2.5-fold increase of b-carotene) and HMG (increased end-product phytosterols). The GM crop plants have been characterised on sizes of T-DNA, vector backbone integration, copy number and expression levels. These transgenic plants have been screened for phenotypes with metabolic and/or developmental disturbances, which would be of particular interest. For acade-
mic purposes Arabidopsis cv. Wassilewskija has been selected and characterised further i.e. one parental line, 3 CHS (modified flavonoid content) antisense (single copy) and 3 CHS (multi copy) transformants. The construction of Arabidopsis lines with anti-sense/sense constructs of DFR under control of an ethanol inducible promoter is under way. In the case of Nicotiana sylvestris 4 types of mutants i.e. RAEC-1 (mutated dhfps-r1), RLT-70 (mutated aklys 1), hybrid RLT-70/RAEC-1 and parental line have been chosen and studied in more detail.

Targeted approach

Different methodologies as tools for a targeted analytical comparison (e.g. sugars, fatty acids, glycoalkaloids, carotenoids, amino acids, organic acids, aromatic compounds, flavonoids etc.) have been evaluated for the compositional analysis of the selected transgenic and parental plant material (e.g. potato, tomato, Arabidopsis and tobacco), which were bred under identical conditions. Technologically, these tools are operational and reproducibility tests including data analysis by chemometrics are under way.

Non-targeted approach

Genomics: Technologically, the DNA array technology (i.e. genomics) is operational. With respect to the gene expression profiling experiments, two tomato cDNA libraries have been constructed and part of these libraries have been spotted in array formats. These microarrays consist of ESTs (i.e. expressed sequence tags = fragments of genes that are expressed under specific conditions) derived from red and green tomato fruit as well as cDNAs corresponding to genes with known function. Hybridisation experiments have taken place in order to determine levels of gene expression in subsequent ripening stages of tomato (i.e. natural variation).

Proteomics: The evaluation of sample preparation and extraction procedures for the proteome analysis of plant material (i.e. protein expression profiling or proteomics) has been completed and optimised to find a practical approach for sample delivery and compatibility with other analyses done within the project. Protein (2D-PAGE) patterns of various potato, tomato and Arabidopsis GM lines have been analysed and the identification of landmark proteins by ESI-MS in GM and non-GM material is under way. A strategy for glycome analysis (i.e. post-translation modifications in protein-linked carbohydrates) of minor amounts of glycoprotein post-PAGE and in whole plant tissue has been developed and its application to the selected GM and non-GM materials is in progress. For the development of tools to profile (possible) alterations in endogenous allergens, human sera containing specific IgE antibodies directed to rape seed has been collected and analysed for specific subclasses between allergic patients. A strategy to prepare western blots based on minimal amounts of human sera has been evaluated and demonstrated for plant material. The collection of pollen from (wild type) Arabidopsis and subsequent selection of Arabidopsis-specific human IgE is under way.

Metabolomics: The utilisation of special growth chambers for potato, tomato, Arabidopsis and tobacco pot plants has been evaluated for the metabolite profiling (metabolomics) experiments in vivo (during growth). Specific adaptations have been made. At present biomass is fixed for 13C-NMR analysis and other measurements. For the metabolomics experiments post harvest sample preparation and extraction procedures for proton-NMR, HPLC and GC-MS have been established. The fractionation procedure for tomato and potato has been tested and modified to reduce running time. The automated acquisition and processing of NMR spectra has been evaluated, whereas NMR, HPLC and GC-MS reproducibility check is in progress including the chemometrics treatment of the large potato and tomato batches.
Dr Leguay, Jean-Jacques  
Commissariat à l’Energie Atomique  
Cadarache  
Département d’Ecophysiologie  
Vegetale et de Microbiologie  
Batiment 177  
13108 Saint-Paul-Les-Durance  
France  
Tel.: +33 442257088  
Fax: +33 442254656  
E-mail: jjleguay@cea.fr  

Prof. Dr Kaerenlamp, Sirpa  
Department of Biochemistry  
University of Kuopio  
Savilahdentie 9  
PO Box 1627  
70211 Kuopio  
Finland  
Tel.: +358 17 163 069  
Fax: +358 17 2811 510  
E-mail: skarenla@messi.uku.fi

Dr Wal, Jean-Michel  
INRA Jouy-en-Josas  
Laboratoire Associé INRA-CEA  
d’Immmuno-Allergie Alimentaire  
Service de Pharmacologie et  
d’Immunologie  
CEA de Saclay Batiment 136  
91191 Gif-sur-Yvette  
France  
Tel.: +33-1 69080892  
Fax: +33-1 69085907  
E-mail: wal@dsvidf.cea.fr
New methodologies for assessing the potential of unintended effects in genetically modified food crops
A risk assessment on Cryptosporidium parvum, an emerging pathogen in the food and water chain in Europe

CARAFE

Contract number: QLK1-1999-00775  Coordinator:
Contract type: Shared Cost Project
Total cost: € 2.205.170
EC contribution: € 1.323.208
Starting date: 1/02/2000
Duration: 36 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr Geraldine Duffy
Teagasc, The National Food Centre,
Dunsinea
Castleknock
15 Dublin
Ireland
Tel.: +353-1-8059500
Fax: +353-1-8059550
E-mail: g.duffy@nfc.teagasc.ie

PARTNERS

Dr C. William Keevil
University of Southampton
School of Biological Sciences
Basset Crescent East
SO16 7PX Southampton
United Kingdom
Tel.: +44 2380 594726
Fax: +
E-mail: cwk@soton.ac.uk

Dr Bob Hartog
TNO Nutrition and Food Research
Institute
Microbiology & Quality Management
P.O. Box 360
3700 AJ Zeist
The Netherlands
Tel.: +31 30 6944 728
Fax: +31 30 6944 901
E-mail: hartog@voeding.tno.nl

Dr James Dooley
Dept. Applied Biology and Chemical Sciences
University of Ulster
Cromore Road
Coleraine. BT52 1SA
Northern Ireland
Tel.: +44 80 1265 32447
Fax: +44 80 1265 324906
E-mail: JSG.Dooley@ulst.ac.uk

Ms Heidi Enemark
Ministry of Agriculture and Fisheries
Danish Veterinary Laboratory
Pathology and Epidemiology
27, Bülowsvej
1790 Copenhagen V
Denmark
Tel.: +45 35 30 01 00
Fax: +45 35 30 01 20
E-mail: hle@svs.dk

Dr Simone Caccio
Laboratory of Parasitology
Istituto Superiore di Sanità
Viale Regina Elena 299
00161 Rome
Italy
Tel.: +39 06 4990 2304
Fax: +39 06 4938 7065
E-mail: caccio@iss.it

Dr Stuart Clark
Microgen Bioproducts Ltd.
1 Admiralty Way, Camberley
Surrey GU15 3DT
United Kingdom
Tel.: +44 1276 600081
Fax: +44 1276 600151
E-mail: stuartcl@hotmail.com
A risk assessment on Cryptosporidium parvum, an emerging pathogen in the food and water chain in Europe

BACKGROUND
This project will carry out research on Cryptosporidium parvum, an emerging pathogen in water and food. The research will focus on the following areas:

• Development of methods which can be used to isolate and detect C. parvum in food and water samples;
• Determination of the survival and infectivity of C. parvum in food and water;
• Development of procedures for control of C. parvum in food and water;
• A risk assessment of C. parvum in the food and water industry.

OBJECTIVES
This project will carry out research on Cryptosporidium parvum, an emerging pathogen and will establish the risk that C. parvum poses for the food and water industry. The objectives of the project are:

• Routine procedures will be developed for the isolation and detection of oocysts from test samples (food and water)
• Techniques for the isolation of Cryptosporidium spp. from a range of sample types will be developed based on physical, chemical or biological processes.
• Immunological or DNA procedures will be applied to the detection of oocysts. New monoclonal antibodies for C. parvum which are capable of detecting oocysts which have been present in the environment for long periods of time and which may have lost surface proteins (binding sites) will be developed and screened. Additional studies will investigate the application of PCR as a sensitive technique to detect low numbers of oocysts and distinguish between the different species of Cryptosporidium.
• The survival and infectivity of C. parvum in the food and water will be determined.
• Studies to be carried out will include inoculation studies (with C. parvum at different inoculum levels) to assess the effect of various stresses (heating, freezing, chemical preservatives etc.) on both the survival and virulence characteristic of the parasite when present in food, water or faeces.
• Procedures for control of C. parvum in the food and water industry will be developed.
• Research on control measures will focus on the use of a novel photocatalytic procedure for the inactivation of C. parvum in water (potable and waste water) either alone or in combination with other methods, such as filtration.
• Disinfectant and cleaning procedures will be assessed for use within the food industry.
• A risk assessment on C. parvum for the food and water industry
• A risk assessment model will be developed based on hazard identification, hazard characterisation, exposure assessment, and risk characterisation. Essentially, the model will be based on the distribution and incidence of C. parvum in the water and food supply; the reduction on numbers of oocysts that any process treatment is likely to yield; the amount of contaminated water or food consumed and the percentage of exposed people who are expected to become ill. Statistical calculations on this
data using deterministic, worst-case or stochastic analysis will be used to determine the risk which *C. parvum* poses and most importantly how this risk can be reduced by the implementation of practical control measures.

**EXPECTED RESULTS AND ACHIEVEMENTS**

It is anticipated that the project will result in the development of routine methods for the isolation, detection and typing of *Cryptosporidium spp.* from a range of sample types (food, water, environmental and clinical specimens). These methods will have application both in epidemiological studies (including outbreak investigation) and in inoculation studies to assess the survival of the pathogen in the food chain and in the investigation of factors that affect its pathogenicity and virulence for humans. It is also expected that practical strategies for control of the pathogen in the food and the water industry will be developed during the course of the project. The data generated in the project will be used in the development of a risk assessment model for *C. parvum* in the food and water industry in Europe.

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**PARTNERS**

Mr John Matthews  
Allied Irish Beef Processors  
Ardee  
CO. Louth  
Tel.: +353 41 6856100  
Fax: +353 41 6853064  
E-mail:

Dr John Moore,  
Department of Microbiology  
Belfast City Hospital  
Lisburn Road  
Belfast BT9 7AB  
United Kingdom  
Tel.: +353 80 1232 263554  
Fax: +353 80 1232 321084  
E-mail:
Development of assays for the detection and prediction of co- and antimutagenic constituents in food with cells of human origin

HEPADNA

Contract number: QLK1-1999-00810
Contract type: Shared Cost Project
Total cost: € 1,069,386
EC contribution: € 898,019
Starting date: 1/02/2000
Duration: 36 Months
Scientific Officer: Alkmini Katsada
Project website: not yet available

Coordinator:
Prof. Dr Firouz Darroudi
Leiden University Medical Centre
Department of Radiation Genetics and Chemical Mutagenesis
Wassenaarseweg 72
2333 AL Leiden
The Netherlands
Tel.: +31-71-5276168
Fax: +31 71 5276173
E-mail: f.darroudi@lumc.nl

PARTNERS

Prof. Dr Schulte-Hermann, Rolf
Institute for Cancer Research
Environmental Toxicology Group
Borschkegasse 8A
1090 Vienna
Austria
Tel.: +43-1-4277 65130
Fax: +43-1-4277 65193
E-mail: rolf.schulte-hermann
univie.ac.at

Dr Huber, Norbert
Ruprecht-Karls-Universität Heidelberg
Fakultät für Klinische Medizin
Mannheim
Institut für Medizinische Mikrobiologie und Hygiene
Theodor-Kutzer-Ufer 1-3
PO Box 100023
68167 Mannheim
Germany
Tel.: +49 6221 54 2157
Fax: +49 6221 54 2618
E-mail: nhuber@sun1.zuv-heidelberg.de

Prof. Heinrich, Uwe
Fraunhofer-Institut für Toxikologie und Aerosolforschung
Nikolai-Fuchs-Straße 1
30625 Hannover
Germany
Tel.: +49-5115350120
Fax: +49-5115350115
E-mail: heinrich@ita.fhg.de

Dr Courtois, Sylvie
INRA Jouy-en-Josas
Unité d’Ecologie et de Physiologie du Système Digestif
Domaine de Vilvert
Bâtiment 440
78352 Jouy En Josas
France
Tel.: +330134652079
Fax: +330134652088
E-mail: courtois@jouy.inra.fr
Development of assays for the detection and prediction of co- and antimutagenic constituents in food with cells of human origin

BACKGROUND

It is well documented that diet and the existing food contaminants play crucial roles in the aetiology of cancer in humans. In order to perform a reliable risk assessment for human in the present proposal we plan to develop and validate new assays using human hepatoma and hepatocyte cell systems. DNA-damage, repair, and biological consequences will be studied. Furthermore, the key role of the specific enzymes in mutagenicity will be determined. An automated scoring analysis of micronuclei will be used to analyse a larger number of chemicals, and with the help of a computer automated structure evaluation methodology, attempts will be made to detect structure activity relationship of different chemicals, in order to detect/predict the hazard/protective effect of active compounds in the food matrix.

OBJECTIVES

A number of epidemiological studies indicated that the composition of the diet plays a major role in the aetiology of cancer in humans and it has been estimated that 40-70% of the cancer incidence in humans is due to nutritional factors.

So far, the main approaches which enable detection of mutagens, co- and anti-mutagens are in vivo models with laboratory animals, but in general they are relatively time consuming and costly, and the requirement of large animal numbers urges against their use in screening trials. Furthermore, the outcomes may not be true representatives of human situations in vivo.

The overall aim of the project is to investigate the effect of dietary constituents and contamination on the genotoxic effects of representatives of major groups of food derived carcinogens in cells of human origin. To obtain reliable information which of the food constituents may enhance or reduce the health risks of humans.

Techniques will be developed and applied using human derived liver cells that reflect the activation/detoxification of genotoxic carcinogens better than other indicator cells that are currently being used. Therefore, have an increased predictive value for the identification of mutagens, co- and anti-mutagenic constituents of human foods.

(EXPECTED) RESULTS AND ACHIEVEMENTS

• To increase our knowledge for the mutagenic, co- and anti-mutagenic potential of human food constituents.
• To define the mode of action, DNA damage induction, repair and biological consequences.
• To detect and elucidate the role of different enzymes involved and responsible for mutagenic, co- and anti-mutagenic potential of food constituents.
• To detect and may predict chemical structures that are of particular importance for the protective/hazardous properties of the various classes of food constituents
• Ultimately improve human health: This project is designed to provide the scientific basis for the development of improved food products and is targeted on the provision of health benefits to consumers.
• Identification of desirable and optimal levels of mutagens, co- and anti-mutagens in human food constituents, will enable advice, strategies and recommendation for healthy diets to be more effectively targeted nationally and through European channels.
Development of assays for the detection and prediction of co- and antimitogenic constituents in food with cells of human origin
Cartridges with molecularly imprinted recognition elements for antibiotic residues monitoring in milk

CREAM

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Contract type: Shared Cost Project
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Scientific Officer: Barend Verachtert

Coordinator:
Dr Maria Kempe
Centre for Chemistry and Chemical Engineering
Department of Pure and Applied Biochemistry
Getingevagen 60
221 Lund
Sweden
Tel.: +46-46 2220857
Fax: +46-46 2224611
E-mail: maria.kempe@tbiokem.lth.se

Dr Fiaccabrino, Givanni Carlo
Université de Neuchâtel
Institut de Microtechnique
Rue Jaquet-Droz 1
2007 Neuchâtel
Switzerland
Tel.: +41 32 7205 644
Fax: +41 32 7183 640
E-mail: Jean-Charles.Fiaccabrino@unine.

Dr Moreno-Bondi, Maria C.
Universidad Complutense de Madrid
Facultad de Ciencias Quimicas
Quimica Analitica
Ciudad Universitaria S/N
28040 Madrid
Spain
Tel.: +34-91 3944196
Fax: +34-91 3944329
E-mail: mcmbondi@maraton.sim.ucm.es

Dr French, Martin
Kalibrant Limited
Oakwood Drive 2 Loughborough Park
LE11 3NH Loughborough
Leicestershire
United Kingdom
Tel.: +44 1509 631706
Fax: +44 1509 631739
E-mail: MFrench@kalibrant.com

Dr Van Rhijn, Johannes A.
RIKILT-DLO
Bornsesteeg 45
PO Box 230
6700 AE Wageningen
The Netherlands
Tel.: +31 317 475 597
Fax: +31 317 417717
E-mail: j.a.vanrhijn@rikilt.dlo.nl
Cartridges with molecularly imprinted recognition elements for antibiotic residues monitoring in milk

BACKGROUND

Consumer’s rising concern on healthy food and environmentally sound production methods has set new technological challenges in food production. Quality management in the food chain to ensure product safety includes the monitoring for potential residues of pesticides, veterinary drugs and other chemical compounds. These residues can be found at different concentration levels in products from animal origin, such as milk or meat. In the case of antibiotics, residues may inhibit starter cultures in the production of yoghurt, cheese and other solid milk products, and affect the quality of these. More importantly, antibiotic residues may have in the long term a potential insidious effect on public health. Antibiotics are vital medicines considered as the ultimate strategy to treat human infections. Their effectiveness is however threatened by extensive and inappropriate use of these, not only in medicine but also in agriculture. In veterinary practice, antibiotics are utilised at therapeutic levels primarily to treat diseases and to prevent infection. They are also used at sub-therapeutic levels to increase feed efficiency, promote growth and prevent disease. Public health consequences from the excessive use of antimicrobials in livestock production include the emergence of resistant bacteria. Antibiotics favour such selection in the digestive tube of the host animal. Moreover, genes responsible for this resistance can migrate from one bacterial flora to another through the alimentary chain, and therefore increase the bacterial resistance. Additionally, bacterium resistant to one antibiotic in particular can potentially develop a multi-resistance profile. Unless new classes of antibiotics are devised or discovered, the increase of bacterial resistance will narrow the list of antibiotics that can ultimately be used for the treatment of infections. The needs to evaluate the safety of selected veterinary drugs residues used in food-producing animals, define acceptable daily intakes for humans, and recommend maximum residue limits have been recognised world-wide by various public authorities. Until now, the analysis or detection of these substances is most commonly performed using microbiological methods and physical-chemical HPLC methods in the post-screening phase. There are disadvantages to that approach as these tests can only be performed in a well-equipped laboratory. Aside from the fact that this approach is costly, there is a tendency to bring the “laboratory to the samples”, that is to identify critical points in the production chain and perform the control directly at these points: e.g. production chain management, hazard analysis critical control points. To make that a feasible approach, simple and cheap devices for on-site monitoring of critical parameters are needed. A number of rapid tests with detection sensitivities for most ß-lactam antibiotics in the low ppb (mg/kg) range, are already commercially available for screening residues in various biological fluids such as milk, plasma, and urine. These tests however cannot discriminate among different ß-lactam drugs. Alternative confirmatory methods with equivalent or better detection sensitivity are therefore needed, to confirm the identity or identities of the specific ß-lactams eliciting presumptive positive responses and to determine their residual concentrations.

OBJECTIVES

To meet the need of alternative confirmatory methods and practical instrumentation for on-site monitoring and discrimination of ß-lactam residues in milk, the main objective of this project is to develop and optimise a plug-in detection cartridge supporting a
molecularly imprinted polymer assay. This cartridge will consist of a microfabricated column accommodating an optical detection window. Molecularly imprinted polymers (MIPs) in the form of beads will be used as packing materials and recognition elements. Analyte binding will be detected by fluorescence. Different assay formats, labels, and optical detection schemes will be evaluated. The best candidates will be optimised to meet the required assay specificity and sensitivity. Participation of a national reference laboratory in the project will enable field trials of the developed cartridge in real experimental conditions and validation of the analytical method.

(EXPECTED) RESULTS AND ACHIEVEMENTS

The concept of a cartridge supporting a molecularly imprinted polymer (MIA-cartridge) will be demonstrated. State-of-the-art replication techniques in plastics will ultimately be utilised to produce cheap and disposable cartridges. A portable instrumentation will be developed to enable screening tests to be performed at the farm and processing dairy with MIA-cartridge prototypes. Field trials will assess the validity of this analytical system.

This novel analytical instrumentation will be designed and optimised to allow handling by non-chemists in non-laboratory settings. The approach relies on robust molecularly imprinted polymers as the recognition element and has therefore obvious advantages over conventional immunological and biochemical methods in terms of stability (mechanical, chemical, and thermal). The detection of β-lactam antibiotics in milk has been chosen as a model system to demonstrate the general principle of the system. It is anticipated that the approach can be applied also to other substances needed to be easily monitored in non-laboratory settings.
Cartridges with molecularly imprinted recognition elements for antibiotic residues monitoring in milk.
Safe organic vegetables and vegetable products by reducing risk factors and sources of fungal contaminants throughout the production chain: The carrot - Alternaria model

SAFE ORGANIC VEGETABLES

Contract number: QLK1-1999-00986
Contract type: Shared Cost Project
Total cost: € 2.175.647
EC contribution: € 1.299.189
Starting date: 1/01/2000
Duration: 48 Months
Scientific Officer: Achim Boenke
Project website: http://www.seedcentre.nl

Coordinator:
Dr Ruud van den Bulk
Plant Research International
Droevendaalsesteeg 1
6700 AA Wageningen
The Netherlands
Tel.: +31-317-476958
Fax: +31-317-418094
E-mail: R.W.vandenbulk@plant.wag-ur.nl

Dr Tylkowska K. & Dr Grabarkiewicz-Szczesna
August Cieszkowski Agricultural University
Department of Seed Science and Technology & Department of Chemistry
Baranowo, Szamotulska 24
62-081 Przezmierowo
Poland
Tel.: +48 61 8487014
Fax: +48 61 848714546
E-mail: kwtylk@poczta.onet.pl & jagrasz@owl.au.poznan.pl

Dr Knudsen, Inge M.B.
The Royal & Veterinary Agricultural University
Department of Plant Biology, section Plant Pathology
40, Thorvaldsensvej
1871 Frederiksberg, Copenhagen
Denmark
Tel.: +45 352 83306
Fax: +4535283310
E-mail: ik@kvl.dk

Dr M. Solfrizzo
Consiglio Nazionale delle Ricerche
Istituto Tossine e Micotossine
Iviale Einaudi 51
170125 Bari
Italy
Tel.: +39-080 5486013
Fax: +39-080 5486063
E-mail: itmpms12@area.ba.cnr.it

Ir. R. Driessen
Rijk Zwaan Zaadteelt en Zaadhandel B.V.
Burg. Crezeelaan 40
2678 ZG De Lier
The Netherlands
Tel.: +31 174 532 300
Fax: +31 174 513 730
E-mail: R.Driessen@rijkzwaan.nl

Dr M. Halkjaer
L. Daehnfeldt A/S Seed Technology
Odensevej 82
5290 Marselv
Denmark
Tel.: +45 63175506
Fax: +45 6317 5650
E-mail: m.halkjaer@daehnfeldt.com

PARTNERS
Safe organic vegetables and vegetable products by reducing risk factors and sources of fungal contaminants throughout the production chain: The carrot - *Alternaria* model

**BACKGROUND**

European agriculture is confronted with a growing demand of consumers for organic vegetables. For example, a leading supermarket chain in the UK has currently about over 400 organic products for sale, 60 of which are vegetables, fruits or salads. An estimated 2% of the total European vegetables (e.g. 6% to 10% in Denmark) and fruit market is now organically produced, and this number is expected to triple in the next few years based on an annual growth rate of up to 10% to 40% in Europe. These data are further underlined by the fact that the UK with its annual organic food market retail value is among the highest in the world at between 409 million euros and 455 million euros. The UK depends for 70% of its organic food supplies on imports. However, Austria is the European Country with the largest share of organic production in total agricultural output with 8% of its total agricultural area fully converted to organic production systems by the end of 2000. Consequently, a decrease in these above figure based on undesirable components such as mycotoxins, fungal poisons need to be prevented by setting suitable strategies in place to ensure a safe organic food supply by developing detection methods, anticipating mycotoxin risks, tracing the sources of contaminants in the food production chain, and eliminating the risk factors.

**OBJECTIVES**

The overall objective of this project is to develop strategies to ensure a safe organic food supply by developing detection methods, anticipating mycotoxin risks, tracing the sources of contaminants in the food production chain, and eliminating the risk factors. The research will be done with the model carrot – *Alternaria*, the latter fungus being a known producer of harmful mycotoxins.

**(EXPECTED) RESULTS AND ACHIEVEMENTS**

In the first year the work mainly focused on developing the methods needed throughout the project, in particular the methods for detection of the *Alternaria* fungus and its metabolites.

*Alternaria* detection

Suitable methods for detection of the mycotoxin-producing *A. alternata* and *A. radicina* on various types of carrot plant material, in particular seeds and roots, were developed and tested. Based on the results obtained, it was decided that for detection of *A. alternata* the blotter test will be the basis. A deep freezing step (overnight incubation of imbibed seeds at –20°C) will be included when testing seeds, in order to prevent germination. Seedling and root material can be placed directly on wet blotters. Evaluation will take place after 7 days of incubation at 20°C and a 12-h nUV cycle, based on morphological characteristics of conidia and conidiophores. For detection of *A. radicina*, seeds or samples of seedlings and roots will be plated on the selective ARSA (*Alternaria* Radicina Selective Agar) medium. For testing seedling and root material, the fungicide Botran can be omitted from the medium. Evaluation for fungal growth will take place after 7 and 14 days of incubation at 28°C. A PCR-based assay was developed for detection of both *Alternaria* species as well, because both the traditional deep-freeze-blotter method and plating on selective medium are time consuming methods and may not be sensitive enough. Specific primers for detection and identification of
the *Alternaria* species on carrot seeds and roots were designed, based on sequences of ribosomal gene repeats of 45 different *Alternaria* isolates, and tested. The primers were sensitive and could differentiate between the three *Alternaria* species occurring on carrot, i.e. *A. radicina*, *A. alternata* and *A. dauci*. *A. alternata* and *A. radicina* could be detected in DNA isolated from carrot material (seeds and infected root material) applying the specific primers, even at low infection levels. Comparison with the blotter method and plating on ARSA medium (the latter for *A. radicina*) by testing naturally infected seed samples and root material, showed that results of the PCR-assay were similar for the detection of *A. alternata* and *A. radicina*. A positive correlation was found between the percentage of seed infection established by the blotter method and the intensity of the amplified, specific product. A small-scale ring test with 5 participating laboratories was performed to evaluate the PCR-based assay developed. The results showed that several participants encountered problems, in particular with the DNA isolation and purification step. This shows that the PCR-based assay is not ready yet for routine testing of seed samples for the presence of *Alternaria*. According to the results of one project partner, isolating DNA from (infected) carrot root material was much easier to perform. This suggests that the PCR-based assay may be suited for testing of *Alternaria* contamination of harvested carrot roots.

**Mycotoxin detection**

For various purposes, suited analytical methods for the determination of the principal *Alternaria* mycotoxins alternariol (AOH), altertoxin I (ATX I), tenuazonic acid (TeA), and radicinin (RAD) were developed. An agar plug method will be applied in future work for preliminary determination of the toxigenicity of various *Alternaria* isolates, followed by a more extensive study of the toxigenicity by means of TLC and TLC densitometric methods. Rice grains were shown to be a good natural substrate to study production of the *Alternaria* mycotoxins under various conditions. TLC and HPLC will be used for analysis of this inoculated plant material. For the analysis of carrot plant samples, naturally infected or symptomless, HPLC will be applied. Different extraction and clean-up procedures as well as HPLC conditions had to be developed for the analysis of rice fungal cultures and carrot material respectively. For the analysis of rice fungal cultures, acceptable methods with regard to within-laboratory standard deviation, recovery, and limit of determination are now available. For analysis of carrot material, acceptable methods are available for determination of AOH, ATX I, RAD and AME. TeA could not be determined in the same analysis method, because it was not retained during the clean-up procedure. A separate HPLC method will have to be developed for TeA. Furthermore, the methods will need to be validated by testing spiked carrot material. In addition, a HPLC method for the simultaneous determination of AAL toxins (TA1 and TA2) and fumonins (FB1 and FB2) in inoculated rice cultures was developed. This method will be used to test whether the *Alternaria* species occurring on carrot also are able to produce these mycotoxins.

**Control measures**

Two tests, i.e. a root slice test and a petiole test, were developed to test carrot accessions for differences in resistance towards *Alternaria radicina*. The concept protocols are currently under discussion, and will be used in the next years to test various carrot accessions for *Alternaria* resistance. Accessions with high levels of resistance can be used, outside the scope of the project, in resistance breeding programmes. Furthermore, a method was developed to enable screening of microorganisms from the spermo- and rhizosphere of carrot for their ability to suppress *Alternaria*. This should lead to the selection of potential biological control agents that can be applied to seeds.
QLK1-1999-00986: Safe organic vegetables and vegetable products by reducing risk factors and sources of fungal contaminants throughout the production chain: The carrot - Alternaria model
Hazard analysis and control of food contamination: Prevention of Fusarium mycotoxins entering the human and animal food chain

CONTROLMYCOTOXFOOD

Contract number: QLK1-1999-00996
Contract type: Shared Cost Project
Total cost: € 2.335.987
EC contribution: € 1.476.290
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Duration: 42 Months
Scientific Officer: Achim Boenke
Project website: http://www.mycotoxin-prevention.com

Coordinator:
Prof. Dr. Naresh Magan
Institute of Bioscience and Technology
Cranfield University
Cranfield
MK43 0AL Bedford
United Kingdom
Tel.: +44-1234 754339
Fax: +44-1234 750907
E-mail: N.Magan@Cranfield.ac.uk

Prof. Dr. Sanchis, Vicente
Universidad de Lleida
Food Technology Department
Av. Rovira Roure, 177
25198 Lleida
Spain
Tel.: +34-973-702535
Fax: +34-973-238264
E-mail: Vsanchis@tecal.udl.es

Dr Kohl, Jürgen
Research Institute for Plant Protection
Department of Mycology & Bacteriology
Binnenhaven 5
PO Box 9060
6700 GW Wageningen
The Netherlands
Tel.: +31317476017
Fax: +31 317 410 113
E-mail: j.kohl@plant.wag-ur.nl

Dr Bateman, Geoff L.
Rothamsted Experimental Station
AL5 2Q Harpenden
United Kingdom
Tel.: +44 1582763133
Fax: +44 1582760981
E-mail: geoff.bateman@bbsrc.ac.uk

Dr Alldrick, Anton
Campden & Chorleywood Food Research Association
Cereals & Cereal Processing Division
Chipping Campden Gloucestershire
GL55 6LD
United Kingdom
Tel.: +44 1386 842002
Fax: +44 1386 842020
E-mail: A.Alldrick@Campden.co.uk

Prof. Fanelli, Corrado
University Rome “La Sapienza”
Department of Biology
L. Go Cristina di Svezia 24
00165 Rome
Italy
Tel.: +39-06 6833878
Fax: +39-06 49917137
E-mail: c.fanelli@axrma.uniroma1.it

Dr Corazza, Luciana
Instituto Sperimentale per La Patologia Vegetale
Via C.G. Bertero 222
00156 Rome
Italy
Tel.: +39-06-82070221
Fax: +39-06-86802296
E-mail: mc_Ispave@mail.inea.it

PARTNERS
Hazard analysis and control of food contamination: Prevention of *Fusarium* mycotoxins entering the human and animal food chain

**BACKGROUND**

In Europe wheat, barley and maize are significant components in food and feed processing. *Fusarium* moulds (e.g. *Fusarium moniliforme*) have become a serious problem because they produce a range of toxic metabolites (mycotoxins) which endanger the health of both humans and animals. *Fusarium* mycotoxins such as fumonisins cause animal diseases such as leukoencephalomalacia and porcine pulmonary oedema and may also induce liver cancer on experimental rats. The high levels of fumonisins (FB1 & FB2) occurring in maize intended for human consumption have been associated with human oesophageal cancer. Commercial maize-based foodstuffs obtained from single random purchases from retail outlets such as samples of extruded maize, maize flour, and polenta showed about 85% positive samples in 1995 with levels >1 mg/kg a level of concern for human health. In France, lower incidences were found, i.e. <50% positive samples. Levels of around 60 mg/kg of FB1 and 15 mg/kg of FB2.

**OBJECTIVES**

The overall objectives of this project are to examine systems of pre-harvest crop treatment, and post-harvest control to remove contaminants and prevent fungal development in food. It will provide biological and chemical means of detoxifying mycotoxins. This should also help identify the feasibility and the critical points where corrective measures can have a controlling effect for prevention of the entry of these mycotoxins into the food chain. The best combinations of treatments in the chain will be identified by the HACCP approach. The commercial exploitation of the technologies will be examined in collaboration with end users. This trans-European consortium includes partners in UK, Finland, Holland, Spain and Italy.

The six key objectives to control and prevent contamination of food with *Fusarium* species and their mycotoxins are:

- Development of critical control systems: Use of ecological and control data for developing a Hazard Analysis Critical Control Point (HACCP) system for identification, reduction and prevention of the risk of *Fusarium* mycotoxins entering the food chain.
- Preharvest Biocontrol: Development of biocompetitive strains for preharvest control and competitive exclusion of toxigenic fusaria, in cereal (wheat/barley/oats/maize) production.
- Post-harvest control: Novel natural control food-grade systems will be used for control of mycotoxigenic species and the reduction of chemical inputs into food.
- Decontamination using microbial inoculants for prevention of entry into animal production systems: Bacteria and yeasts will be used for the breakdown of mycotoxins in stored cereals
- Decontamination using physical means. Adsorbent materials and biomarkers will be used to assess the exposure to *Fusarium* mycotoxins (i.e. sphinganine/sphingasine ratio for fumonisins) to quantify the effectiveness of treatments.
RESULTS AND ACHIEVEMENTS

Good progress has been made during the first reporting period of the project. Studies have determined in vitro discrimination between different bacteria, yeasts and filamentous fungi using simulated media for bread, cakes and cheese. These studies have generally been successful with discrimination being possible within 48-72 hrs of growth. The differentiation of different concentrations, e.g. $10^2$, $10^4$, $10^6$ CFUs, has been successful for some species but not all. However, it was noted that different groups of sensors in the different e.nose systems being used might be optimal for different spoilage microorganisms. A review of off-taints of different food types has been carried out and key volatile markers for these and for microbial spoilage have been determined. Studies using GC-MS and bread analogues inoculated with spoilage fungi have also enabled confirmation of key volatile compounds responsible for spoilage. Studies on grain and flour to detect spoilage moulds were compared using different e.nose systems. Studies showed that using one of the tested systems (Gas Detector, MGD-1-S) was mainly differentiating samples based on humidity and not on the presence of *Fusarium* in barley.
Dr Rizzo, Aldo
National Veterinary and Food Research Institute
Department of Chemistry
Hameentie 57
PO Box 368
00231 Helsinki
Finland
Tel.: +358 9 3931 909
Fax: +358 9 3931 920
E-mail: aldo.rizzo@eela.fi

Mr Abellan Ballesta, Pedro
Hero España S.A.
Department of Quality and Development
Avda. de Murcia 1
PO Box 8
30820 Alcantarilla Murcia
Spain
Tel.: +34 968 898900
Fax: +34 968 898952
E-mail: pedro.abellan@hero.es

Dr Tarantino, Francesco
Coopas Scrl ‘Produttori Agricoli Salentini’
Strada Statale SS 459 Maglie-Gallipoli
Km 3,600
73024 Maglie
Italy
Tel.: +39 0836 460189
Fax: +39 0836 460189
E-mail: coopas@mail.clio.it
Hazard analysis and control of food contamination: Prevention of Fusarium mycotoxins entering the human and animal food chain
European network on safety assessment of genetically modified food crops

ENTRANSFOOD

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EC contribution: € 751,839
Starting date: 1/01/2000
Duration: 36 Months
Scientific Officer: Barend Verachtert
Coordinator:

Coordinator:
Prof. Dr Harry Kuiper
Food Safety and Health
Bornesteeg 45
The Netherlands
Tel.: +31-317-475463
Fax: +31-317-417717
E-mail: h.a.kuiper@rikilt.wag-ur.nl

PARTNERS

1. State Institute for Quality Control of Agricultural Products (RIKILT), Wageningen, NL (Dr H.A. Kuiper, Dr H.P.J.M. Noteborn, Dr H.J.P. Marvin, Dr A.A.C.M. Peijnenburg, Ir. E.J. Kok, Dr H.J.M. Aarts, Ir. J.P.P.F. van Rie)
2. Institute of Food Safety and Toxicology, Danish Veterinary and Food Administration (VFB), Søborg, DK (Dr I. Knudsen, Dr M. Poulsen, Dr B.L. Jacobsen, Dr B. Holst, Dr A. Wilcks)
3. University of Newcastle, UK (Dr A.M.R. Gatehouse)
4. Département d’Ecophysiologie Végétale et de Microbiologie CEA Cadarache (CEA-Cad), Saint Paul Lez Durance, FR (Dr J.J.Leguay)
5. Institute for Health and Consumer Protection, Joint Research Center of the European Commission (EC JRC IHCP), Ispra, I (Dr G. van den Eede)
6. Umweltbundesamt, Wien, A (Dr A. Heissenberger)
7. Institute of Food Research (IFR), Norwich, UK (Dr I. Colquhoun, Dr L. Frewer)
8. Rowett Research Institute (RRI), Aberdeen, UK (Dr A. Chesson, Dr H. Flint)
9. Unilever Research (UNILEVER), Colworth, UK (Dr R. Crevel)
10. Istituto Superiore di Sanita (ISS), Rome, I (Dr M. Miraglia)
11. Laboratoire Associe INRA-CEA d’Immuno-Allergie, Gif-sur-Yvette, F (Dr J. M. Wal, Dr C. Créminon)
12. Institute of Environmental Medicine, Karolinska Instituted (IEM), Stockholm, S (Prof. R. Grafted)
13. Immunotoxicology and Molecular Biology, TNO BIBRA Int. Ltd (BIBRATNO), Surrey, UK (Dr H. Atkinson)
14. Technische Universität München (TUM), D (Prof. Dr K.H. Engel)
15. Metapontum Agrobios (Metapontum), Metaponto, I (Dr F. Cellini)
16. Agricultural Economics Research Institute (LEI), The Hague, NL (Dr V. Bekman)
17. TNO Nutrition and Food Research Institute (TNO), Zeist, NL (Drs. J.W. van der Kamp, Dr A. Penninks, Dr J. van der Vossen)
18. KEPKA Western Greece (KEPKA), Patras, EL (Mr. D. Pittouras)
European network on safety assessment of genetically modified food crops

BACKGROUND

Market introduction of genetically modified (GM) food crops in Europe has given rise to broad public concern based upon unfamiliarity with the new molecular techniques applied and the fact that the genetic material of these food plants has been altered in a manner which in nature by way of reproduction or natural recombination is not possible. Hazards of large-scale cultivation of transgenic plants and of chronic exposure of humans and animals to transgenic food are issues of intense debate.

OBJECTIVES

• to identify key issues of the safety evaluation of genetically modified food crops, and
to examine whether current research methods are adequate to characterise specific safety hazards;
• to co-ordinate ongoing research regarding safety testing of transgenic foods in the framework of the European research program FP5;
• to design new (in-vitro) test methodologies for safety and nutritional evaluation of whole complex foods, which are of sufficient sensitivity and specificity;
• to address the risks of gene transfer from genetically modified organisms to the gut microflora of humans and animals;
• to examine new strategies for the detection of genetically modified foods, which enable detection at specific threshold levels for raw materials, processed products and food ingredients;
• to examine the fate of genetically modified raw materials and processed products throughout food production chains (tracking and tracing);
• to develop criteria for quality assurance systems to guarantee ‘non-GMO-containing’ materials throughout food chains
• to develop a communication platform of producers of GMOs, scientists involved in research and safety evaluation of GMOs, retailers, regulatory authorities and consumer groups with the scope to improve safety assessment procedures, risk management strategies and risk communication.

(EXPECTED) RESULTS AND ACHIEVEMENTS

The Thematic Network will identify proper research strategies and tools to address issues related to safety and management of transgenic food products. Participants involved in research, safety assessment and management, regulation and consumers interests will evaluate ongoing research activities in this area, discuss new approaches and establish a permanent platform for communication between the various parties involved. As a result various Working Groups will write a number of research papers and position documents. These documents will be incorporated into one position paper, which will give guidance on the various aspects mentioned above. It is important to demonstrate that the scientific challenges of safety testing of genetically modified foods can be met, while further initiatives will be taken in Europe to improve current test methodologies, using modern molecular based techniques. Agreement on safety assessment strategies for GMOs, and on issues related to risk management and risk communication will facilitate market introduction of GMOs in Europe, and therefore bring the European industry in a competitive position.
19. The Scottish Crop Research Institute (SCRI), Dundee, UK (Prof. H. Davies)
20. Robert Koch Institut, Zentrum Gentechnologie (RKI), Berlin, D (Dr H.J. Buhk)
21. International Life Sciences Institute ILSI Europe (ILSI), Brussels, B (Dr J. Klein-
er)
22. Bundesinstitut für Gesundheitlichen Verbraucherschutz und Veterinärmedizin, (BgVV), Berlin, D (Dr J. Zagon, Dr M. Schauzu)
23. Aventis CropScience, Sophia Antipolis Cedex, F (Dr E. Debruyne)
24. Institute of Food Technology, Hohenheim University (IFT), Stuttgart, D (Prof.Dr W.P. Hammes)
25. European Commission, Joint Research Centre, Institute for Reference Materials and Measurements, Reference Materials Unit-Ec-JRC-IRMM (EC-JRC-IRMM), Geel, B (Dr H. Schimmel)
26. Bureau Européen des Unions de Consommateurs (BEUC), Bruxelles, B (Dr B. Kettlitz)
27. University of Kuopio (UKU), Kuopio, FIN (Prof. S. Kärenlampi)
28. Monsanto Service International (Monsanto), Brussels, B (Dr A. Cockburn)
29. Nestlé Research Centre (Nestlé), Lausanne, CH (Dr A. Constable)
30. National Veterinary Institute, (NVI), Oslo, N (Dr A. Holst-Jensen)
31. Syngenta, Cheshire, UK (Dr I. Kimber)
32. Unilever Research, Vlaardingen, NL (Dr M. Smith)
33. Swiss Quality Testing Services (SQTS), Courtepin, CH (Dr J. Rentsch)
34. Harvard University, Kennedy School of Government, Cambridge, USA (Dr A. König)
35. Swedish National Food Administration, Uppsala, S (Dr U. Hammerling)
36. Royal Veterinary and Agricultural University, Frederiksberg, D (Dr J. Lassen)
37. Nestec SA, Vevey, CH (Dr D. Toet)
European Network
safety assessment of
genetically modified
food crops
Reliable, standardised, specific, quantitative detection of genetically modified food

QPCRGMOFOOD

Contract number: QLK1-1999-01301
Contract type: Shared Cost Project
Total cost: € 3.372.467
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Duration: 36 Months
Scientific Officer: Barend Verachtert
Project website: http://www.entransfood.com

Coordinator:
Dr Arne Holst-Jensen
National Veterinary Institute
Department of Feed and Food Hygiene
Section of Food and Feed
Microbiology
Ulevalveien 68
0033 Oslo
Norway
Tel.: +47 22597473
Fax: +47 22597475
E-mail: arne.holst-jensen@vetinst.no

PARTNERS

Dr Holck, Askild
Norwegian Food Research Institute
Oslo
1430 As
Norway
Tel.: +47 64970213
Fax: +47 64970333
E-mail: askild.holck@matforsk.no

Dr Bertheau, Yves
INRA
Unité de Phytopathologie et Méthodologie de la Detection
Rdlo / Route de St Cyr
78026 Versailles Cedex
France
Tel.: +33-1 30833204
Fax: +33-1 30833195
E-mail: bertheau@versailles.inra.fr

Dr de Loose, Marc
Agricultural Research Centre Gent
Department of Plant Genetics and Breeding
Gradistraat 21
9090 Melle
Belgium
Tel.: +32-9 2521052
Fax: +32-9 2525075
E-mail: m.deloose@clo.fgov.be

Dr Harris, Neil
LCC Teddington Ltd Lifesciences
Queens Road
TW11 0LY Teddington
United Kingdom
Tel.: +44-1819-437 675
Fax: +44-1819-342 767
E-mail: cjh@lgc.co.uk

Dr Riemer, Melanie
Gene-Scan GmbH
Bötzinger Straße 29 A
79111 Freiburg
Germany
Tel.: +49-761 4795210
Fax: +49-761 4795244
E-mail: riemer@genescan.com

Dr Anklam, Elke
Institute for Health and Consumer Protection
Via E. Fermi 1
PO Box 321
21 020 Ispra Va
Italy
Tel.: +39 0332 785390
Fax: +39 0332 785730
E-mail: Elke.Anklam@jrc.it

Dr Harris, Neil
LCC Teddington Ltd Lifesciences
Queens Road
TW11 0LY Teddington
United Kingdom
Tel.: +44-1819-437 675
Fax: +44-1819-342 767
E-mail: cjh@lgc.co.uk

Dr Riemer, Melanie
Gene-Scan GmbH
Bötzinger Straße 29 A
79111 Freiburg
Germany
Tel.: +49-761 4795210
Fax: +49-761 4795244
E-mail: riemer@genescan.com

Dr Anklam, Elke
Institute for Health and Consumer Protection
Via E. Fermi 1
PO Box 321
21 020 Ispra Va
Italy
Tel.: +39 0332 785390
Fax: +39 0332 785730
E-mail: Elke.Anklam@jrc.it
Reliable, standardised, specific, quantitative detection of genetically modified food

BACKGROUND
Future legislation in EU involves threshold values for labelling of genetically modified food, necessitating the development of quantitative GMO detection methods. Available techniques cannot distinguish between or quantify approved and non-approved GMOs (defined by transformation events). Quantification must rely on detection of the DNA sequence of the transformation junction region, which for most GMOs are unavailable and will be sequenced by us. Based on the junction sequences, single and multiplex qualitative and quantitative detection assays will be developed. Species specific non-modified reference genes with known, conserved copy numbers that can be amplified together with the GMO junction region will be identified, and will give the 100% of the ingredient (plant species) for food labelling. The DNA-extraction technique will be improved, and its limitations defined. All techniques will be validated in ring-trials.

OBJECTIVES
Primary objectives:
• Develop reliable and transformation-event-specific tests for qualitative and quantitative detection of genetic modifications in food.
• Develop reliable and transformation-event-specific multiplex tests for determination of the diversity of genetic modifications in food.
• Investigate how improved methods for detection of genetically modified foods will influence consumer confidence in food security and trust in science and risk regulators.

Specific goals:
• Define the domain of application of a standard DNA extraction procedure for complex and processed food (quality and yield).
• Design species-specific reference-gene primer-probe sets for qualitative and quantitative PCR amplification and detection.
• DNA sequence characterisation of the GMOs' junction regions (insertion site and insert) for each of at least twelve GMOs.
• Design GMO-transformation-specific primer-probe sets for qualitative and quantitative PCR amplification and detection for each of the at least twelve GMOs.
• on single reference materials in multiplex primer-probe assays.
• on mixed reference materials in single primer-probe assays.
• on mixed reference materials in multiplex primer-probe assays.
• on mixed reference materials in single primer-probe assays.
Based on the tests listed above, the best primer-probe sets for multiplex qualitative, and for specific quantitative detection of genetic modifications in food are selected and validated in ring-trials.

Investigate how improved methods for detection of genetically modified foods will influence consumer confidence in food security and trust in science and risk regulators.

(Expected) Results and Achievements

- Identification of the domain of application and matrix-limitations for a standard DNA extraction protocol.
- Identification and characterisation of suitable taxon-specific reference genes, and development of reference gene specific primer-probe sets for qualitative and quantitative PCR amplification and detection (that will define the 100% of the ingredient).
- Sequence characterisation of transformation events (obtain DNA sequence of junction regions).
- Development, validation through ring-trials and submission of proposed European standards for PCR based transformation event specific qualitative detection of at least 12 GMOs in single and multiplex assays.
- Development, validation through ring-trials, and submission of proposed European standards for PCR based transformation event specific quantitative detection of at least 12 GMOs.
- A report providing information about the impact of tests to improve traceability of genetically modified foods on consumer confidence.

In response to the European Council Directive 90/220/EEC concerning the intentional dissemination of genetically modified organisms to the environment, the European parliament’s and the European Council’s «Novel Food» Regulation 258/97/EC concerning new food products and ingredients, and the European parliament’s and the European Council’s Regulation 1139/98/EC covering the mandatory labelling of some food products produced from genetically modified organisms, reliable, specific, qualitative and quantitative standard methods for the detection of genetically modified organisms or their derivatives in food are urgently needed by the industry, European and National authorities, and consumer groups. A major objective of the project will be to provide methods which can be converted into such European standards. The National authorities, and the food industry will obtain information about the impact of tests to improve traceability of genetically modified foods on consumer confidence, with full policy guidelines detailing recommendations for the development of communication about traceability tests, and potential differences in countries with differing attitudes towards the technology.
Dr Brignon, Pierre
Tepral-Brasseries Kronenbourg
68, Route d’Oberhausbergen
67037 Strasbourg Cedex
France
Tel.: +33-3-88 27 40 98
Fax: +33-3-88 27 40 53
E-mail: obrignon@tepral.fr

Dr Verrips, Theo
Unilever Research Laboratory
Biotechnology Department
Olivier Van Noortlaan 120
Vlaardingen
The Netherlands
Tel.: +31-10 4605542
Fax: +31-10 4605383
E-mail: theo.verrips@unilever.com

Dr Philip, Patrick
Direction Générale de la Concurrence,
de la Consommation et de la Répression des Fraudes
Laboratoire Interrégional
Chemin du Routoir
67400 Illkirch-Graffenstaden
France
Tel.: +33-3 88664896
Fax: +33-3 88671832
E-mail: patrick.philipp@dgccrf.finances.gouv.fr

Dr Zhang, David
Groupe d’Etude et de Contrôle des Variétés et des Semences Biogènes
Domaine du Magneraud
17700 Surgères
France
Tel.: +33 05 46 68 30 36
Fax: +33 05 4668 3100
E-mail: david.zhang@geves.fr

Dr Frewer, Lynn
Institute of Food Research
Diet, Health & Consumer Science
Norwich Research Park, Colney
NR4 7UA Norwich
United Kingdom
Tel.: +44-1603 255321
Fax: +44-1603 255237
E-mail: lynn.frewer@bbsrc.ac.uk

Dr Prat, Salome
Consejo Superior de Investigaciones Científicas
Departamento de Genética Molecular
Jordl Girona, 18-26
08034 Barcelona
Spain
Tel.: +3493-4006189
Fax: +3493-2045904
E-mail: spmgms@cid.scic.es
QLK1-1999-01301: Reliable, standardised, specific, quantitative detection of genetically modified food
Early detection and control of toxigenic Fusarium species and ochratoxigenic fungi in plant products

DETOX-FUNGI

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Contract type: Shared Cost Project
Total cost: € 3.401.768
EC contribution: € 2.042.527
Starting date: 1/02/2000
Duration: 42 Months
Scientific Officer: Achim Boenke
Project website: http://detox.ba.cnr.it

Coordinator:
Dr Giuseppina Mulè
Consiglio Nazionale delle Ricerche
Instituto Tossine e Micotossine da Parassiti Vegetali
Viale Einaudi 51
70125 Bari
Italy
Tel.: +39 080 548 1570
Fax: +39 080 5486063
E-mail: g.mule@area.area.ba.cnr.it

Dr Waalwijk, Cees
Research Institute for Plant Protection
Departament of Mycology & Bacteriology
Binnenhaven 5
PO Box 9060
6700 GW Wageningen
The Netherlands
Tel.: +31-317-476 000
Fax: +31-317-410 113
E-mail: c.waalwijk@ipo.dlo.nl

Dr Gonzalez-Jean, Maria T.
Universidad Complutense de Madrid
Genetica
Facultad de Ciencias Biológicas
Ciudad Universitaria S/N
28040 Madrid
Spain
Tel.: +34 91 944 830
Fax: +34 91 944 844
E-mail: tegonja@eucmax.sim.ucm.es

Dr Banks, John
Central Science Laboratory
Sand Hutton
YO41 1LZ York
United Kingdom
Tel.: +44 1904 462335
Fax: +44 1904 462111
E-mail: j.banks@csl.gov.uk

Dr Nicholson, Paul
John Innes Centre
Cereals Research Department
Norwich Research Park, Colney
NR4 7UH Norwich
United Kingdom
Tel.: +44 1603 452571
Fax: +44 1603 456844
E-mail: paul.nicholson@bbsrc.ac.uk

Dr Holst-Jensen, Arne
National Veterinary Institute
Section of Food and Feed Microbiology
Ullevålsveien 68
PO Box 8156
0033 Oslo
Norway
Tel.: +47 22597473
Fax: +47 22597475
E-mail: arne.holst-jensen@vetinst.no

Dr Hornok, Laszlo
Agricultural Biotechnology Centre
Szent-Györgyi 4
PO Box 411
2100 Gödöllö
Hungary
Tel.: +36 28 430600
Fax: +36 28 430482
E-mail: hornok@abc.hu

PARTNERS
Early detection and control of toxigenic *Fusarium* species and ochratoxigenic fungi in plant products

**BACKGROUND**

The total EU cereal production, for example, is approximately 173 million tonnes per year and it has also been reported that about 20% of the cereal crops grown in Europe and used foods and animals feeds contain measurable amounts of mycotoxins. Also contaminated imports to the EU infested by these toxins are causing concerns. In 1996, the WHO/FAO-Joint Expert Committee on Food Additives (JECFA) has considered various secondary metabolites produced by several fungal genera as potent mycotoxins and has set a Provisional Tolerable Weekly Intake for some of them. That means there is an urgent need to develop validated reliable, rapid, robust and user-friendly detection methods as part of a cost effective and time efficient food safety control strategy for both toxigenic fungi that are widespread on various economically important plant products as well as for their toxigenic secondary metabolites which may be carried-over in the food chain causing human, animal and plant health implications.

**OBJECTIVES**

The aim of this project is to prevent and reduce consumer’s health risk derived from mycotoxin contamination in food and feed. This will be achieved through: (1) development of molecular diagnostic methods for an early detection of toxigenic *Fusarium* species and ochratoxigenic fungi in plant products, (2) new and more sensitive immunological tests for detection of mycotoxins in food, (3) biochemical and molecular studies to characterise genes responsible for ochratoxin A synthesis.

The objectives are:

- To clone mating-type genes from *Gibberella*;
- To obtain molecular detection methods (biochips, species-specific quantitative PCR, NASBA) for detection of fumonisins and beauvericin producing *Fusarium* species;
- To obtain molecular detection methods (biochips, species-specific quantitative PCR, NASBA) for enniatin and trichothecenes producing *Fusarium* species;
- To develop specific monoclonal antibodies to beauvericin and enniatin and relative producing *Fusarium* species;
- To develop robust quantitative PCR detection system for ochratoxin A producing fungi;
- To clone genes responsible of OTA biosynthesis.

**(EXPECTED) RESULTS AND ACHIEVEMENTS**

A BAC library of *Fusarium proliferatum* strain ITEM 2287, and a clone corresponding with the mat1-2 gene was identified. This has been sequenced and contains the entire mat locus. Moreover, 10 kb and 15kb of flanking sequence on either side of the locus have been identified. Strains of *Fusarium*, Liseola section, were characterised using DNA based techniques to differentiate them and develop tools to detect the FUM/BEA strains in natural products. Unique composition of populations of *F. proliferatum* that is isolated with host specific mtDNA RFLP patterns generally predominant on a given host, suggests that the observed heterogeneity is principally the result of a long host-pathogen and toxins production coevolution. Primer pairs have been identified which can be used to specifically amplify Tri4, Tri5 and Tri6 genes from sev-
eral trichothecene-producing *Fusarium* species. A specific assay for *F. sporotrichioides* has been developed, subject to the screening of further isolates. A primer pair has been developed to specifically amplify *F. sporotrichioides*, to produce a product of approximately 200bp. The assay has been screened against isolates of *F. sporotrichioides* and other *Fusarium* species in the John Innes Centre collection. Further isolates of *F. sporotrichioides* from diverse geographic sources and plant hosts have been obtained and will be used to fully evaluate the specificity of this assay. A variety of DNA extraction methods have been evaluated to determine the best method for DNA extraction from fungal mycelium. The results of this showed a considerable improvement in reproducibility compared to the established competitive PCR system of quantification. The Tri5 assay has been made quantitative using a competitive PCR system. Monoclonal antibody production was carried out using standard methods established and developed at CSL for these esadepsipeptides mycotoxins. Several arbitrary primers have been tested for their ability to produce a differentiating pattern with the chromosomal DNA of *P. verrucosum*. By RAPD analysis two major clusters (group I and group II) and a minor cluster (group III) occurred. The capacity of the strains to produce OTA, as determined by TLC, was assigned to the strains in the different RAPD groups. It became obvious that a clear correlation exists between the differentiation of the strains according to the RAPD analysis and their capacity to produce OTA. To further analyse the phylogenetic relationship between the two OTA producing *Penicillium* groups, the ITS1-5.8S-ITS2 region of selected strains of each group was sequenced and compared. The results support the view that two genetic different groups of *Penicillium* are able to produce OTA instead of a currently single species. It becomes clear, that OTA producing strains of *Penicillium* does not belong to a genetically homogenous species as is the current view, but obviously rather to different taxonomic groups. The AFLP protocol established for studies in *Fusarium* was adapted to give optimum results with the DNA samples prepared from *Aspergillus* spp. AFLP fingerprints of different *A. ochraceus*, *A. niger* and *A. carbonarius* isolates, OTA producers as well as non producers, were obtained. The raw data were processed to fit into a newly created database. In addition, the *A. ochraceus* isolates analysed could be attributed to two different groups based upon their AFLP patterns. Two fragments was isolated with heterologous primers which apparently originates from a pks gene resonsible for OTA production. The presence of this gene is correlated to the capacity to produce high amounts of OTA. A more general approach for the isolation of OTA biosynthetic genes was planned. The differential display PCR approach (DDRT-PCR) makes the isolation of all genes possible, which are differentially expressed during OTA synthesis. Growth conditions which are permissive respectively restrictive for OTA biosynthesis have been described. In parallel a transformation system for *P. verrucosum* has been established based on the dominant selectable marker hygromycin B.
Dr Geisen, Rolf
Bundesforschungsanstalt für Ernährung
Institute for Hygiene & Toxicology
Haid und Neustrasse 9
76131 Karlsruhe
Germany
Tel.: +49 721 6625459
Fax: +49 721 6625453
E-mail: rolf.geisen@bfe.uni-karlsruhe.de

Dr Niessen, Ludwig
Lehrstuhl für Technische Mikrobiologie
Technische Universität München
Weihenstephaner Steig 16
85350 Freising
Germany
Tel.: +49 8161 715171
Fax: +49 8161 713327
E-mail: niessen@bl.tum.de

Dr Holmes, Stephen
Agen Ltd
Product Research and Development Department
Nellies Gate, Auchincruive
KA6 5HW Ayr
United Kingdom
Tel.: +44 1292 525275
Fax: +44 1292 525477
E-mail: info@adgen.co.uk

Dr Ruggieri, Giacomo
Baricoop S.C.R.L.
Viale Einaudi 15
70100 Bari
Italy
Tel.: +39 080 5011066
Fax: +39 080 5011066
E-mail: ccipuglia@teseo.it

Dr Eusepi, Niccolò A.
Assocconsumatori and Ceres Institute for R&D in Consumer Protection and Welfare
Via Monte Santo N 25
00195 Rome
Italy
Tel.: +39 06 37353372
Fax: +39 06 3210685
E-mail: eusepi@exhibit.it

Mr Herrera Garica, Pascual
Estación Enológica de Castilla y León
Calle Santísimo Cristo 16
47490 Rueda Valladolid
Spain
Tel.: +34 983 868149
Fax: +34 983 868412
E-mail: cagrueda@dvnet.es

Mr Vaquero Sanchez, Ángel
Bodegas Antaño S.A.
Calle Arribas 7
47490 Rueda Valladolid
Spain
Tel.: +34 983 86 85 33
Fax: +34 983 868514
E-mail: cgonzalez@joseluis.es

Dr Torres Izquierdo, Basilio
Compañía Vinícola del Norte de España
Departamento Técnico
B de la Estación S/N
26200 Haro La Rioja
Spain
Tel.: +34 941 304811
Fax: +34 94 304812
E-mail: cvnebi@eurociber.es
Early detection and control of toxigenic Fusarium species and ochratoxigenic fungi in plant products
Evaluation of the inactivation / removal effect of the gelatin manufacturing process on TSE infectivity

GELATIN PROCESS

Contract number: QLK1-2000-00009
Contract type: Shared Cost Project
Total cost: € 781,679
EC contribution: € 277,589
Starting date: 1/01/2001
Duration: 36 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr Ir. Ad Grobben
Delft Gelatin B.V.
Quality Assurance Dept.
Rotterdamseweg 270
2600 AA Delft
The Netherlands
Tel.: +31-15-2512222
Fax: +31-15-2560101
E-mail: a.grobben@planet.nl

Dr Robert Somerville
Institute for Animal Health
Neuropathogenesis Unit
Ogston Building, West Mains Road
EH9 3JF Edinburgh
United Kingdom
Tel.: +44-131 6675204
Fax: +44-131 6683872
E-mail: robert.somerville@bbsrc.ac.uk

Dr Bram Schreuder
Institute for Animal Science and Health
Edelhertweg 15
PO Box 65
8200 AB Lelystad
The Netherlands
Tel.: +31320-238238
Fax: +31320-238050
E-mail: b.e.c.schreuder@id.wag-ur.nl
Evaluation of the inactivation / removal effect of the gelatin manufacturing process on TSE infectivity

BACKGROUND
For the manufacture of bone gelatin a down-scaled Pilot model has been developed and tested to reflect as close as possible the industrial processes and to represent the typical manufacturing conditions. Spiking crushed fresh bone with 30 I V infected mouse brain (BSE agent) and 263 K infected hamster brain (scrapie agent) and processing these materials through the down-scaled model to produce gelatin. Using the processed material from the whole process to determine the residual infectivity of gelatin and di-calcium-phosphate by bio-assay. Evaluating separately the inactivation capacity on individual process steps of the finishing unit operations by spiking the industrial starting material and processing this material through these steps and measuring the remaining infectivity. In total 17 samples are prepared and submitted to bio-assay. All samples are additionally tested by immunoblotting.

OBJECTIVES
The objective of the study is to prove reduction or complete removal of TSE infectivity by the gelatine manufacturing process as a whole including all sequential treatments, as well as by specific steps of the process using BSE strains in addition to scrapie strains, choosing the highest achievable infectivity level according to the principles of virus infectivity reduction studies. The level of spiking of the starting material used in the evaluation of the reduction of TSE infectivity by the entire manufacturing process is at least 106 ID50 per gram of fresh crushed bones. This level is sufficient to measure a considerable reduction, while this infectivity is at least 100 times higher than the theoretical highest possible infectivity and approximately 100,000 times higher than the highest infectivity that can be expected in reality, thus:

• Fulfilling demands by several international experts, institutions and regulatory bodies concerning the proof of inactivation procedures with regard to the gelatine process.
• Reassuring the general public and the industries using gelatine and its by-products that gelatine is safe under all circumstances.
• Producing data to carry out an updated risk assessment for gelatine and di-calcium-phosphate.
• Safeguarding the use of slaughtering by-products by adding value and avoiding waste.

To achieve these objectives, the following study design has been chosen after consultation of international experts.

For the manufacture of bone gelatine, a down-scaled pilot model has been developed and tested to reflect as close as possible the industrial processes and to represent the typical manufacturing conditions actually in use. The gelatine manufacturing processes and the down-scaling are described in detail in section IV, 1-5 of the protocol handed over to DG Research on May, 5, 2000.

The down-scaled model and the actual manufacturing processes of the different European gelatine manufacturers have been audited and certified by SGS, a European Quality Certification Institute. The final report certifies that the chemical and physical conditions used in the down-scaled model are in conformity with the minimum conditions.
described (see section V, 1 of the protocol), and represent the practices in the factories of the involved companies.

Investigated will be the inactivation by the complete manufacturing processes of limed bone gelatine, acid bone gelatine and gelatine manufactured by the heat and pressure process. Further the inactivation by the individual process steps: filtration, ion-exchange and UHT sterilisation will be tested as well as the manufacture of DCP, which is a by-product of gelatine manufacture. Finally the effect of a short treatment with NaOH of the acid treated bone will be tested. The latter is a new process step that could be incorporated in the bone gelatine manufacturing process. The starting material for all these test will be spiked with 301V agent (BSE) or with 263K agent (scrapie) and the obtained products will be bio-assayed in mice and hamsters.

(EXPECTED) RESULTS AND ACHIEVEMENTS

• Proof of reduction or complete removal of TSE infectivity by the bone gelatine manufacturing process as a whole including all sequential treatments and by individual process steps.
• Evaluation of newly developed gelatine production processes.
• Proof that the manufacturing processes used by the industry to produce bone gelatine are safe.
• Confirmation that the technology actually used by the EU bone gelatine producers is appropriate for the production of gelatine free of BSE infectivity.
QLK1-2000-00009: Evaluation of the inactivation / removal effect of the gelatin manufacturing process on TSE infectivity
Rapid assessment of food safety via novel at-line measurements

FOODSAFE

Contract number: QLK1-2000-00518
Contract type: Shared Cost Project
Total cost: € 1,542,418
EC contribution: € 922,791
Starting date: 1/10/2000
Duration: 36 Months
Scientific Officer: Alkmini Katsada
Project website: http://www.cranfield.ac.uk/ibst/ccas/foodsafe/

Coordinator:
Dr Steven Setford
Cranfield Centre for Analytical Science
Institute of Bioscience and Technology
Cranfield University
Building 39
MK45 4DT Silsoe
United Kingdom
Tel.: +44 1525 863549
Fax: +44 1525 863540
E-mail: s.j.setford@cranfield.ac.uk

Dr Alan Mathewson
National Microelectronics Research Centre
University College Cork
Lee Maltings, Prospect Row
Cork
Ireland
Tel.: +353-21 904000
Fax: +353-21 270271
E-mail: admin@nmrc.ucc.ie

Dr Begoña Pérez-Villareal
Fundación AZTI
Food Technology Department
Txatxarramendi Ugartea Z/G
48395 Sukarrieta
Spain
Tel.: +34-94-687 07 00
Fax: +34-94-687 00 06
E-mail: balfaro@suk.azti.es

Dr John Wijdenes
Diaclone
1 Boulevard Fleming
25020 Besançon Cedex
France
Tel.: +33 3 81 41 38 38
Fax: +33 3 81 41 36 36
E-mail: wijdenes@diaclone.com

PARTNERS
Rapid assessment of food safety via novel at-line measurements

BACKGROUND

The project centres on the creation of new and safer methods of food production. This will be achieved by critically examining a number of food processing operations to determine the optimum deployment of measurement tools to allow improved traceability of toxic contaminants and to identify hazard analysis critical control points within such processes. Rapid, low cost, simple to use immunochemical assay procedures will be developed to allow the at-line measurement of toxic compounds in food production processes, thereby creating a mechanism to achieve increased food safety. The specific problem addressed will be the reduction of toxic chlorophenol and chloroanisole fungicide residues in wine, potable water and fruit juice processing operations. These compounds are found in many food products at part per billion levels. Implementation of this approach will provide the consumer with a high quality safer food product.

OBJECTIVES

The main objective of the work centres on the creation of new and safer methods of food production. This will be achieved by developing a new generation of rapid, low cost, sensitive and simple immunochemical-based measurement technologies to aid identification of the Hazard Analysis Critical Control Points within liquid food processing operations. Such an approach is expected to allow the evaluation of raw materials in processes prior to their integration into the manufacturing process, aiding the traceability of toxic compounds within the overall operation. Application of these measurement tools within the process operation will act as a preventative measure to reduce the content of unwanted materials within these production processes. The applicability of this approach as a means of creating safer food production methods will be assessed using toxic chlorophenolic fungicides and their chloroanisole breakdown products, that are toxic contaminants of many food products at the part per billion level. The project will specifically target wine, fruit juice and potable water food production processes since the target compounds are commonly identified in such matrices due to fungicide treatment of raw materials.

(EXPECTED) RESULTS AND ACHIEVEMENTS

The expected achievements of the project are all linked to creating safer food products and can be summarised as scientific, technological and demonstration results as follows:

Scientific results:

• To develop standard commercially exploitable monoclonal antibody preparations and immunochemical test kits to allow the simple, low-cost and rapid measurement of trace levels of chlorophenol and chloroanisole fungicide residues in raw, part-processed and packaging materials for use within existing food processing operations where such problems are known to exist.

• To develop a suite of novel electrochemical immunosensor devices to further simplify the immunochemical assay procedure and to provide an objective comparison of sensor performance versus standard immunochemical test kits and existing instrumental methods for the measurement of said analytes under real process conditions. A hand-held electrochemical metering device will be developed to allow usage of the immunosensor devices in an at-line capacity.
• To develop immunosensors incorporating automated liquid handling to facilitate ease of operation. Miniaturisation of these fluid handling devices will be undertaken, and combined with the electrochemical metering devices to provide an at-line automated liquid handling immunosensor capability.

Technological results:
• To develop hazard analysis critical control point and traceability models to identify factors relating to the input and processing of toxic contaminants, specifically chloroanisole and chlorophenol fungicide residues within liquid food (wines, fruit juices and potable water) processing operations. This approach will encompass the design of efficient analytical measurement programmes in conjunction with improved measurement technologies to recognise and hence remove sources of contamination in selected food processing operations.

Demonstration results:
• To combine the optimum measurement model with the immunochemical assay approach to create a combined standard operating procedure and measurement regime capable of rapidly identifying contamination with the process operation and identifying the source(s) of contamination.
QLK1-2000-00518: Rapid assessment of food safety via novel at-line measurements
Thematic network to promote awareness of mycotoxins in food:
European mycotoxin awareness network
EMAN

Contract number: QLK1-2000-01248
Contract type:    Thematic Network
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Starting date:    1/01/2001
Duration:         36 Months
Scientific Officer: Achim Boenke
Project website: http://www.mycotoxins.org

Coordinator:
Dr Richard Lawley
Leatherhead International Ltd
Leatherhead Food Research Association
Randalls Road
KT22 7RY Leatherhead
United Kingdom
Tel.: +44-1372 376761
Fax: +44-1372 386228
E-mail: rlawley@lfra.co.uk

PARTNERS

Prof. Dr Kraska, Rudolf
IFBA - Tulln Center for Analytical Chemistry
Konrad-Lorenz-Straße 20
3430 Tulln
Austria
Tel.: +43 227 266280401
Fax: +43 227 266280403
E-mail: kraska@ifa-tulln.ac.at

Prof. Magan, Naresh
Cranfield University
Cranfield Biotechnology Centre
Institute of Bioscience and Technology
MK43 0AL Cranfield
United Kingdom
Tel.: +44 1234-750907
Fax: +44 1234 754339
E-mail: n.magan@cranfield.ac.uk

Dr Solfirizzo, Michele
Consiglio Nazionale Delle Ricerche
Istituto Tossine e Micotossine
Viale Einaudi, 51
70125 Bari
Italy
Tel.: +39-080 5486013
Fax: +39-080 5486063
E-mail: itmpms12@area.ba.cnr.it

Dr Dragacci, Sylvianne
Agence Française de Sécurité Sanitaire des Aliments
10, Rue Pierre Curie
94700 Maisons Alfort
France
Tel.: +33-1 49772742
Fax: +33-1 49772695
E-mail: s.dragacci@afssa.fr

Dr Sebastian Kastrup
Handelslabor Dr Wiertz, Dipl.-Chem.
Eggert, Dr Joerissen GmbH
Stenzelring 14 B
21107 Hamburg
Germany
Tel.: +49-40 75270927
Fax: +49-40 75270935
E-mail: sebastian.kastrup@wej.de

Dr Naess, Bjørn
National Veterinary Institute
Ullevålsvæien 68
PO Box 8156
0033 Oslo
Norway
Tel.: +47 22 96 46 10
Fax: +47 22 46 00 34
E-mail: bjorn.naess@vetinst.no
Thematic network to promote awareness of mycotoxins in food: European mycotoxin awareness network

BACKGROUND

Mycotoxins are toxic compounds produced by moulds as a result of growth in foods and feed. There are about 20 mycotoxins occurring naturally in food and feeds. As trace amounts of these can present a substantial health hazard for both animals and humans specific regulations are put in place (e.g. 98/1525/EC). It is worth observing that the levels set for e.g. aflatoxins in food in the EU are stricter than in other parts of the world. A cause of concern was noted earlier in 1999 when a survey in the UK for ochratoxin A in a number products reported that 95% of samples of dried vine fruit analysed contained this toxin. A great deal of excellent research has been carried out on mycotoxins in food up to now. To fully maximise the benefits that this work can bring, the research needs to be communicated to industry in a comprehensible form. There remains much scope for creating a better understanding of the problems caused by mycotoxins, particularly within SMEs.

OBJECTIVES

The primary objective of the network is the establishment of communication links between individuals, businesses and organisations who are affected in any way by mycotoxin-related issues. These may be SMEs, trade organisations, consumer groups, large multi-national food producers, research workers (both in industry and academia), policy makers, governments and law enforcement agencies. An important part of the network is the establishment of an interactive web-site, updated on a regular basis, and an e-mail mailing list to alert interested parties to the activities of the network. These activities include workshops/conferences, production of fact sheets (to disseminate information on mycotoxin related discoveries, innovations and developments), on-line training courses, and biannual newsletters. The final objective of the network is an agreement between the partners to continue the network after the 36-month funding period by operating it on a self-financing basis if possible.

(EXPECTED) RESULTS AND ACHIEVEMENTS

The project has generated a considerable quantity of information within the reporting period, and this has been made available by the following means:

- The project web-site was set up at www.mycotoxins.org in June 2001, to act as the focal point for the network, and for dissemination activities. It is organised by work-package and allows interested parties to register for e-mail updates. There are also links to other EC funded projects and relevant sites.
- A two-day workshop was held at Leatherhead Food RA, UK in March 2001. On day 1 a series of presentations about the project were given to an invited audience of representatives from industry and the research community. On day 2 the partners met to establish priorities for the future operation of the project.
- Partners and national contact points have actively compiled details of contacts for incorporation into national mailing lists.
- The first Newsletter has been posted on the web-site and produced as a printed document for circulation. The second Newsletter has been completed and is currently being prepared for publication.
• The seven partners have compiled lists of literature reports that relate specifically to the areas covered by their workpackage. These are being incorporated into a database for use only by the partners.

• A total of six basic fact sheets have been produced. These include an introduction to mycotoxins, and sheets specific to individual mycotoxins. All have been posted on the web-site, and the first five have been printed.

• So far the consortium has produced a total of 17 specific fact sheets relating to the content of the seven workpackages. The majority of these have been posted on the web-site, and produced as printed documents. The remainder are currently being prepared for publication.

• Two on-line interactive training courses have so far been made available via the web-site. These have been used by approximately 50 people to date.

The ultimate expected result of this project is the establishment of a Network providing readily available information on many aspects of mycotoxins through the Web. Further expected results are the establishment of priorities, content and format of newsletters, fact sheets, training courses, and workshops by equally making use of the newest research results generated in the MYCOTOX cluster and its associated projects.
Dr Olsen, Monica
National Food Administration
Biology Division
PO Box 622
751 26 Uppsala
Sweden
Tel.: +46-18 175598
Fax: +46-18 105848
E-mail: mool@slv.se

Prof. Dr Hald, Benedicte
The Royal Veterinary and Agricultural University
Department of Veterinary Microbiology
Bülowsvej 13
1870 Frederiksberg
Denmark
Tel.: +45 35 28 27 58
Fax: +45 35 28 27 57
E-mail: ben@kvl.dk

Dr O'Keefe, Michael
Teagasc
Food Safety Department
Dunsinea, Castleknock
Dublin 15
Ireland
Tel.: +353-1 8059500
Fax: +353-1 8059550
E-mail: m.okeefe@nfc.teagasc.ie

Dr Severo, Armanda
National Institute of Engineering and Industrial Technology
Departamento de Tecnología Das Indústrias Alimentares
Estrada Do Paco Do Lumiar Edifício S, 22
1649-038 Lisboa
Portugal
Tel.: +351-21-7127121
Fax: +351-21-7127162
E-mail: lilitia.Felgueiras@mail2.inei.pt

Ms Tsatsou-Dritsa, Angeliki
Ministry of Finance
General Chemical State Laboratory
Division of Environment.
An. Tsoha 16
115 21 Athens
Greece
Tel.: +30-1 64 79 450
Fax: +30-1 64 66 917
E-mail: gxk-environment@ath.forthnet.gr

Dr Spanjer, Martien
Inspectorate for Health Protection
Research & Development Department
Mycotoxin Analysis Group
Hooge Kadijk 401
1018 BK Amsterdam
The Netherlands
Tel.: +31 20 52 44 703
Fax: +31 20 52 44 700
E-mail: Martien.Spanjer@inspectu.nl
Rapid detection of microbial contaminants in food products using electronic nose technology

ENOSEFOODMICRODETECT

Contract number: QLK1-2000-01763
Contract type: Shared Cost Project
Total cost: € 1,494,712
EC contribution: € 1,129,462
Starting date: 1/12/2000
Duration: 36 Months
Scientific Officer: Dyanne Bennink
Project website: http://www.e-nose.net

Coordinator:
Prof. Dr Naresh Magan
Cranfield University
Institute of Bioscience and Technology
MK43 OAL Silsoe, Bedford
United Kingdom
Tel.: +44 1234 754339
Fax: +44 1234 750907
E-mail: N.Magan@Cranfield.ac.uk

Dr Sanchis, Vincent
University of Lleida
Food Technology Department.
Rovira Roure, 177
25198 Lleida
Spain
Tel.: +34 973 702535
Fax: +34 973 702596
E-mail: vsanchis@tecal.udl.es

Dr Voysey, P.
Campden & Chorleywood Food Research Association
Microbiology Department
Chipping, Campden
Gl55 6LD Gloucestershire
United Kingdom
Tel.: +44 1386 842000
Fax: +44 1386 842100
E-mail: pvoysey@campden.co.uk

Dr Nielsen, Per V.
Technical University of Denmark
Department of Biotechnology
Building 221
2800 Lyngby
Denmark
Tel.: +45 45252631
Fax: +45 45884922
E-mail: pvn@ibt.dtu.dk

PARTNERS

Dr Rizzo, Aldo
National Veterinary and Food Research Institute
Department of Chemistry
Hameentie 57
PO Box 368
00231 Helsinki
Finland
Tel.: +358 9 3931909
Fax: +358 9 3931920
E-mail: aldo.rizzo@eela.fi

Dr Latva-Kala, K.
VTT Biotechnology and Food Research Institute
Biologinkuja 1, Espoo
PO Box 1500
02044-VTT Espoo
Finland
Tel.: +358 9 4565210
Fax: +358 9 4552103
E-mail: kyosti.latva-kala@vtt.fi

Prof. Gareis, Manfred
Federal Center for Meat Research
Institute for Microbiology and Toxicology
E.-C. Baumann-Str. 20
95326 Kulmbach
Germany
Tel.: +49 9221 803220
Fax: +49 9221 803331
E-mail: gareis.baf@t-online.de
Rapid detection of microbial contaminants in food products using electronic nose technology

BACKGROUND
There is a need for the rapid and easy cost effective detection of undesirable harmful microbial contaminants, toxins and taints in the dairy and bakery product industries. This project will examine the use of innovative electronic nose (e.nose) detection systems for the early detection of bacteria yeasts and filamentous fungi and off-odours in these related economically important industries. In vitro, and in situ studies using food matrices will be utilised for the detection and differentiation between spoilage microorganisms, physiological tainting, and toxigenic and non-toxigenic species. Inter-laboratory validation will be carried out with four different e.nose systems for optimising detection. In collaboration with e.nose technology companies, and end users testing will be carried out in dairy and bakery product companies and the cost/benefit analyses for exploitation of the technology quantified for commercial exploitation.

OBJECTIVES
• In vitro studies on early detection and differentiation between important bacteria, yeasts and filamentous fungi in these three food matrices.
• Differentiation between physiological non-microbial food taints and microbial odours.
• Determine the potential for differentiation between toxin and non-toxigenic microorganisms in the food matrices and comparisons with bioassay systems.
• Examination of food grain and flour for detection of fungal contaminants and sensitivity of detection.
• Evaluate the potential for using e.nose systems for screening and evaluating food-grade preservative levels and shelf-life quality.
• Using laboratory scale food analogues to examine the sensitivity and the recognition of spoilage microorganisms in relation to legislative permissible microbial contamination levels, in relation to traditional methods of analyses.
• Collaborative studies between laboratories to validate the methodology; Optimise sampling protocols, multiple contaminant testing.
• Testing of e.nose systems in food processing plants for quality control and production and successful differentiation between good (acceptable) and poor (rejected) quality products and comparison with existing criteria.
• Quantification (cost/benefit analyses) for exploitation of the market and commercial take up of this technology by these food industries.

(EXPECTED) RESULTS AND ACHIEVEMENTS
• Rapid discrimination between activity of different spoilage microorganisms and toxigenic and non-toxigenic species for the first time in milk, cheese and bakery products in vitro and in situ and comparisons with bioassay systems.
• Relationship between legislative requirements for microbial levels and sensitivity of e.nose systems in these media.
• Correlation between existing colony count methods and enzymatic assays with e.nose systems for the first time.
• Rapid methods for the early detection of individual and mixed populations of spoilage microorganisms in food matrices.
• Potential and usefulness for screening for efficacy of preservatives for improving shelf-life.
• Evaluation of the use of e.nose systems for accurate quality control systems in situ in processing plants in relation to the production of milk, cheese and bakery products.
• First ever detailed collaborative study of e.nose systems for application in these food industries.
• Provide a wide range of generic data exploitable by the partners for expanding the market for e.nose systems.
• Cost/benefit analyses of the use of e.nose technology for these specific food-based applications.

PARTNERS

Mr Hulbert, John
Bloodhound Sensors Ltd
175 Woodhouse Lane
LS22 3AR Leeds
United Kingdom
Tel.: +44 113 2333492
Fax: +44 113 2333433
E-mail: j.n.hulbert@leeds.ac.uk

Mr Fernandez, F.
Granja Castello, Quality Control and R&D Department
Ferrer Busquets, 125
PO Box 5
25230 Mollerusa, Lleida
Spain
Tel.: +34 973 603650
Fax: +34 973 603475
E-mail:

Dr Paakkanen, H.
Environics Oy
Työmiehenkatu 2
PO Box 349
50101 Mikkeli
Finland
Tel.: +358 15 177011
Fax: +358 15 177013
E-mail: heikki.paakkanen@environics.fi
QLK1-2000-01763: Rapid detection of microbial contaminants in food products using electronic nose technology
Preventing Bacillus cereus foodborne poisoning in Europe: Detecting hazardous strains, tracing contamination routes and proposing criteria for foods

BACILLUS CEREUS

Contract number: QLK1-2001-00854
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EC contribution: € 1.410.836
Starting date: 1/10/2001
Duration: 36 Months
Scientific Officer: Dyanne Bennink
Project website: not yet available

Coordinator:
Dr Christophe Nguyen-The
INRA
Unite Mixte de Recherche Qualité et Sécurité des Produits d’Origine Végétale
Site Agroparc, Domaine St-Paul
84914 Avignon 9
France
Tel.: +33 432 722521
Fax: +33 4327 22492
E-mail: nguyenth@avignon.inra.fr

PARTNERS

Prof. Dr Granum, Per E.
The Norwegian School of Veterinary Science, Microbiology and Food Hygiene
PO Box 8146
0033 Oslo
Norway
Tel.: +47 22964845
Fax: +47 22964850
E-mail: nmhgranu@veths.no

Prof. Dr Märtlbauer, Erwin
Ludwig-Maximilians-Universität
Institute of Hygiene & Technology of Food
Veterinärstraße 13
80539 München
Germany
Tel.: +49 8921 803672
Fax: +49 8921 802985
E-mail: e.maertlbauer@mh.vetmed.uni-muenchen.de

Prof. Dr Scherer, Siegfried
Technische Universität München
Forschungszentrum für Milch und Lebensmittel
Institute of Microbiology
Weihenstephaner Berg 3
85350 Freising
Germany
Tel.: +49 8161713516
Fax: +49 8161714512
E-mail: siegfried.scherer@lrz.tum.de

Prof. Salkinoja-Salonen, Mirja
University of Helsinki
Department of Applied Chemistry and Microbiology
Viikinkaari 9
00014 University of Helsinki
Finland
Tel.: +358 919 159300
Fax: +358 919 123077
E-mail: mirja.salkinoja-salonen@helsinki.fi
Preventing *Bacillus cereus* foodborne poisoning in Europe: detecting hazardous strains, tracing contamination routes and proposing criteria for foods

**BACKGROUND**

*Bacillus cereus* is a foodborne pathogen which causes gastroenteritis. Fatal and severe cases have been reported within the last few years. Virulence of *B. cereus* is only partly understood. Most strains are presumably innocuous or mildly pathogenic whereas few are presumably highly virulent. No methods exist to distinguish virulent from non virulent strains. The project proposes to investigate virulence mechanisms of *B. cereus* in order to identify determinants specific of highly virulent strains. From these results, methods to detect virulent strains will be designed and dose response curve will be improved. The diversity of virulence within *B. cereus* and the ecology of virulent strains will be investigated in order to identify the contamination routes of foods with virulent strains and to estimate the risk for their presence and development in foods.

**OBJECTIVES**

*Bacillus cereus* produces several highly active toxins, it is common in foods, it forms spores and therefore resists most food processing treatments, and it can multiply actively during storage of many food products. However, virulence is very diverse among strains of *B. cereus*, ranging from innocuous strains to strains which caused fatal foodborne poisoning. Therefore, *B. cereus* should not be considered as a whole. Highly virulent strains should be treated much more stringently.

The objectives of the project are to acquire the knowledge necessary:

- to identify highly virulent food poisoning strains of *B. cereus*;
- to propose methods and tools to reduce their incidence in foods.

**(EXPECTED) RESULTS AND ACHIEVEMENTS**

To improve our knowledge of the virulence of *B. cereus*, the toxic activity of all the toxins identified so far, will be determined, taking into account possible synergies between toxins and their polymorphism within *B. cereus*. Then, mechanisms of the expression of the toxin genes will be investigated to explain the difference between high and low toxin producing strains. It should be possible to predict the toxicity of a strain (activity of the toxin x amount of toxin produced) from molecular determinants. Lastly, factors other than toxins which could increase virulence, such as adhesion to epithelial cells would be investigated. New toxic factors may also be identified. Rapid detection methods will be targeted on the virulence determinants. Both PCR methods (detection of genes) and immunochemical methods (detection of molecules) will be designed. Virulence of *B. cereus* is extremely diverse. For this reason, the project will be based on a selection of strains representative of the diversity of *B. cereus*, including strains from foodborne outbreaks, from various foods and from the environment. Strains from foods and from the environment will be collected in order to cover a wide diversity of products and to include several steps of the food chain, from the primary production to the final product. Representative strains will be characterised for virulence and for features necessary to predict their fate in foods (growth parameters and heat resistance). Results obtained on virulence and its diversity will permit a better hazard characterisation (how dangerous are the various types of *B. cereus*) and will be integrated in a model to improve the dose-response relation for *B. cereus*. Diversity for virulence will be combined with diversity for growth and survival parameters in another model to improve exposure assessment (probability for the presence and growth for virulent *B. cereus* as a function of food processing parameters).
Preventing *Bacillus cereus* foodborne poisoning in Europe: detecting hazardous strains, tracing Contamination routes and proposing criteria for foods
Application of bioassays for safety assessment of paper and board for food contact

BIOSAFE-PAPER

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Total cost: € 2,025,069
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Duration: 48 Months
Scientific Officer: Achim Boenke
Project website: not yet available

Coordinator:
Dr Asloeg Weber
Institute of Applied Biotechnology
Neulaniemiestie 2
70210 Kuopio
Finland
Tel.: +358 17 163 129
Fax: +358 17 163 322
E-mail: Assi.Weber@uku.fi

Prof. Dr Salkinoja-Salonen, Mirja
University of Helsinki
Department of Applied Chemistry and Microbiology
Viikinkaari 9, PO Box 56
00144 University of Helsinki
Finland
Tel.: +358 19159300
Fax: +358 9159301
E-mail: mirja.salkinoja-salonen@helsinki.fi

Prof. Dr Lhuguenot, Jean-Claude
Université de Bourgogne
Ecole Nationale Supérieure de Biologie Appliquée à la Nutrition et à l’Alimentation
Esplanade Erasme, 1
21000 Dijon
France
Tel.: +33380396635
Fax: +33380396641
E-mail: lhuguenot@u-bourgogne.fr

Dr. Stammati, Annalaura
Istituto Superiore di Sanità
Laboratorio di Tossicologia Comparata ed Ecotossicologia
Viale Regina Elena 299
00161 Rome
Italy
Tel.: +39 06 49903158
Fax: +39 06 49387139
E-mail: stammati@iss.it

Dr Castle, Laurence
Department of Environment, Food and Rural Affairs
Central Science Laboratory
Sand Hutton
YO41 1LZ York
United Kingdom
Tel.: +441904462540
Fax: +441904462133
E-mail: l.castle@csl.gov.uk

Dr Dahlman, Olof
Skogsindustrins Tekniska Forskningsinstitut
Swedish Pulp and Paper Research Institute
Drottning Kristinas Väg 61
PO Box 5604
114 86 Stockholm
Sweden
Tel.: +4686767120
Fax: +468108340
E-mail: Olof.dahlman@stfi.se

Dr. Aurela, Birgit
Oy Keskkulaboratoriori-Centrallaboratorium Ab
P.O. Box 70
02151 Espoo
Finland
Tel.: +358-9-4371259
Fax: +358-9-464305
E-mail: birgit.aurela@kcl.fi

PARTNERS
Application of bioassays for safety assessment of paper and board for food contact

BACKGROUND

The paper industry is part of a very important sector, the forest products industry, which includes several other industries as well such as the woodworking industry. If suppliers are added to this sector, the annual production value exceeds 450 billion euros and approximately 5 million people are employed. In the European Union, the legal foundations governing materials and articles coming into contact with food are covered in the Framework Directive 89/109/EEC. In contrast to plastics, ceramics and regenerated cellulose there is, as yet, no specific Directive for paper and board intended for food contact. The Council of Europe has, however, been working for many years on a draft resolution. This resolution is likely to be used as a basis for any future European Commission Directive on paper and board. This resolution states that “Chemical or toxicological screening tests for possible unknown substances are desirable. Furthermore the knowledge about the applicability of toxicological screening tests for paper is insufficient for the time being...”. Consequently, based on the above, the paper and board manufacturers are concerned about demonstrating high safety standards for their products and wish to exploit this gap in the existing legislation. Thus, they intend to develop a new methodology for the toxicological testing of their product using realistic tests based on end use applications.

OBJECTIVES

This pre-normative project aims to develop tests for rapid and cost effective detection of contaminants in food contact paper and board materials. The work will be prenormative research to develop, validate and intercalibrate a short term biological test battery for safety assessment of fibre-based food contacts materials. The project will bring together and build upon a number of pre-existing testing methods developed in various national projects. The final methodology should ensure that testing methods are available to ensure that only safe paper and board packaging materials are put onto the market. The final aim is to create a basis for scientifically sound recommendations for a harmonised risk evaluation and product testing and increase the confidence of consumers in the ability of European paper industries to continue to provide safe food contact materials.

(EXPECTED) RESULTS AND ACHIEVEMENTS

- Development and intercalibration of toxicity tests;
- Validation of new sublethal toxicity tests between partners;
- Recommendation of a test battery;
- Standard operating procedures (SOPs) for extraction;
- Internal and extended audience workshops on results;
- Decision tree based approach to toxicity testing;
- Basis for scientifically sound recommendations for harmonised risk evaluation;
- Improved understanding between stakeholders on risks.
...is to ensure the safety of paper and board food contact materials
Optimisation of safe food processing methods based on accurate characterisation of bacterial lag time using analysis of variance techniques

BACANOVA

Contract number: QLK1-2001-01145
Contract type: Shared Cost Project
Total cost: € 1,446,122
EC contribution: € 884,760
Starting date: 1/01/2002
Duration: 36 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr József Baranyi
Institute of Food Research
Food Safety Science Division
NR4 7UA Norwich
United Kingdom
Tel.: +44 1603 255 121
Fax: +44 1603 507 723
E-mail: jozsef.baranyi@bbsrc.ac.uk

Dr Joerg Ueckert
Unilever Research Vlaardingen
Olivier V. Noorlaan 120
PO Box 114
3133 AT Vlaardingen
The Netherlands
Tel.: +31 10 4605 196
Fax:
E-mail: joerg.ueckert@unilever.com

Dr Bernard Mackay
The University of Reading
Whiteknights, PO Box 226
RG6 6AP Reading
United Kingdom
Tel.: +44 1189-357229
Fax: +44 1189318979
E-mail: b.m.mackay@reading.ac.uk

Dr Tobin Robinson
Group Danone
15, Avenue Galilée
92350 Le Plessis-Robinson
France
Tel.: +33 141 07 8829
Fax: +33 144 352 469
E-mail: trobinso@danone.com

Dr Andras Ballagi-Pordany
Uppsala University
Husargatan 3
PO Box 577
751 23 Uppsala
Sweden
Tel.: +46 184 714 521
Fax: +46 185 550 16
E-mail: ballagi@bmc.uu.se

Dr Carmen Pin
University of Complutense
Facultad de Veterinaria
28040 Madrid
Spain
Tel.: +34 91 394 3744
Fax: +34 913 943 743
E-mail: carmenpi@eucmax.sim.ucm.es

Dr Tom Ross
University of Tasmania
Churchill Avenue
PO Box 252-54
7001 Hobart
Australia
Tel.: +61 362 261 831
Fax: +61 362 262 744
E-mail: tom.ross@utas.edu.au

PARTNERS
Optimisation of safe food processing methods based on accurate characterisation of bacterial lag time using analysis of variance techniques

BACKGROUND
This project aims to develop and validate a novel quantitative method, based on Analysis of Variance techniques, to give an improved prediction of bacterial lag time and growth in food. This would allow the optimisation of food processing methods, to ensure microbiological safety and quality. The distribution of the lag times of individual cells/spores will be measured by microscopic (automated image analysis) and turbidometric methods and analysed by stochastic mathematical models. The obtained distribution will be used to optimise earlier food process and treatment, and to predict the bacterial responses to the subsequent food environment accurately. The proposal addresses problems of variation of the lag time of individual cells that are not addressed by current predictive microbiology.

OBJECTIVES
The purpose of the project is to develop a method based on stochastic mathematical modelling techniques to improve the microbial safety and quality of food. It has three main objectives:

• To optimise the effect of processing methods with respect to microbial safety and quality of the food.
• To predict more accurately the probability of bacterial survival, lag and growth in food.
• To develop a methodology which is able to utilise the information on the variability of individual cells and complements the current techniques of predictive microbiology.

(EXPECTED) RESULTS AND ACHIEVEMENTS
QLK1-2001-01145: Optimisation of safe food processing methods based on accurate characterisation of bacterial lag time using analysis of variance techniques
Development of rapid easy-to-use immunochemical tests for the detection of proteins with allergenic potential in food

ALLERGENTEST

Contract number: QLK1-2001-01151
Contract type: Shared Cost Project
Total cost: € 1.453.238
EC contribution: € 1.010.761
Starting date: not yet determined
Duration: 42 Months
Scientific Officer: Barend Verachtert
Project website: not yet available

Coordinator:
Dr Rudolf Krska
Interuniversitäres Forschungsinstitut für Agrarbiotechnologie
Analytikzentrum
Konrad-Lorenz-Straße 20
3430 Tulln
Austria
Tel.: +43227266280401
Fax: +43227266280403
E-mail: krska@ifa-tulln.ac.at

PARTNERS

Dr Haasnoot, Willem
State Institute For Quality Control of Agricultural Products
Natural Constituents, Residues and Contaminants
Bornsesteeg 45, PO Box 230
6708 PD Wageningen
The Netherlands
Tel.: +31317475596
Fax: +31317417717
E-mail: w.haasnoot@rikilt.wag-ur.nl

Dr Banks, John
Ministry of Agriculture
Fisheries & Food Plant Health Group
Central Science Laboratory
Sand Hutton
YO41 LIZ York
United Kingdom
Tel.: +44 190 446 2335
Fax: +44 190 446 2250
E-mail: j.banks@csl.gov.uk

Dr Weller, Michael
Technische Universität München
Institut für Wasserchemie und Chemische Balneologie
Marchioninistraße 17
81377 München
Germany
Tel.: +49 89 7095 7986
Fax: +49 89 7095 7999
E-mail: michael.weller@ch.tum.de

Dr Immer, Ulrike
R-Biopharm GmbH
Dolivostraße 10
64293 Darmstadt
Germany
Tel.: +49-615-181 02 38
Fax: +49-615-181 02 20
E-mail: u.immer@r-biopharm.de

Prof. Restani, Patrizia
Università degli Studi di Milano
Istituto di Scienze Farmacologiche
Via Balzaretti 9
20133 Milano
Italy
Tel.: +39-02-20 48 83 71
Fax: +39-02-20 48 82 60
E-mail: patrizia.restani@unimi.it

Scarnie, Isabel
Verbruikersunie Test-Aankoop S .V.
Hollandstraat 13
1060 Brussel
Belgium
Tel.: +3225423204
Fax: +3225423250
E-mail: iscarnie@test-aankoop.be
Development of rapid easy-to-use immunochemical tests for the detection of proteins with allergenic potential in food

BACKGROUND
Allergenic proteins, such as peanut and hazelnut protein in certain food might cause severe adverse reactions in allergic patients. Rapid and easy-to-use methods are demanded if contaminated food products should be surveyed on the market. The major goal of this project is the development of rapid easy-to-use immunochemical tests for the detection of these proteins in food. The test format should allow the detection of the soluble proteins of hazelnut or peanut (“protein-assay”). In addition, for some selected allergenic protein fractions of peanut and hazelnut, specific assays (“allergen-assay”) will be developed for the detection of a certain allergen. In-vitro cellular analysis will be carried out to assess the stimulatory activity of trace amounts of these proteins in order to obtain better information on the required sensitivity of the novel assay. In addition, the dissemination of the project results is an important element of this project.

OBJECTIVES
The presence of allergenic proteins, such as peanut and hazelnut proteins, in certain food might cause severe adverse reactions in allergic patients. Even traces can result in fatal reactions. Among food allergy, peanut and hazelnut allergy is common and severe. As the only effective measure for these individuals is avoidance of the offending foods, powerful analytical methods are required for the screening of trace amounts of potentially allergenic proteins in food samples. Rapid and easy-to-use methods are demanded if contaminated food products should be surveyed on the market. The major goal of this project is the development of rapid easy-to-use immunochemical tests for the detection of hidden proteins with allergenic potential in food. The developed tests are intended to be used as a diagnostic tool to avoid contamination and to check uncertain food.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Dr Wilson, Philip
Central Manchester Healthcare
NHS Trust Regional Immunology
Department
St Mary’s Hospital
Hathersage Road
M13 0TH Manchester
United Kingdom
Tel.: +44 0161 2766440
Fax: +44 0161 2766439
E-mail: pwilson@labmed.cmht.nwest.nhs.uk
QLK1-2001-01151: Development of rapid easy-to-use immunochemical tests for the detection of proteins with allergenic potential in food
Safe pork and horse meat on EU-markets: Early and unbiased diagnostic tests for Trichinella

TRICHIPORSE

Contract number: QLK1-2001-01156
Contract type: Shared Cost Project
Total cost: € 1,685,773
EC contribution: € 1,281,129
Starting date: 1/01/2001
Duration: 36 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Mr Pascal Boireau
UMR 956 BIPAR INRA AFSSA ENV A
7, avenue du Général de Gaulle
94704 Maisons-Alfort Cedex
France
Tel: +33 1 43 96 71 11
Fax: +33 1 43 96 72 41
E-mail: p.boireau@vet-alfort.fr

Ms Christelle Zimmermann
Federal Institute for Health Protection of Consumers and Veterinary Medicine
Diedersdorfer Weg 1
12277 Berlin
Germany
Tel.: +4918884123532
Fax: +4918884123374
E-mail: c.zimmermann@bvgv.de

Mr Philippe Pourquier
Institut Pourquier S.A.
326, Rue de la Galéra
34090 Montpellier
France
Tel.: +33499232425
Fax: +33467042025
E-mail: institut.pourquier@wanadoo.fr

Prof. Benagiano, Giuseppe
Istituto Superiore di Sanità
Viale Regina Elena 299
00161 Rome
Italy
Tel.: +390649902693
Fax: +390644869440
E-mail:

Prof. Christian Kapel
The Royal Veterinary and Agricultural University
Ridebanevej 3
1870 Frederiksberg C
Denmark
Tel.: +4535282775
Fax: +4535282774
E-mail: chk@kvl.dk

Prof. Serrano Aguilera Francisco Javier
Universidad de Extremadura
Plaza de Cladereros
10071 Cáceres
Spain
Tel.: +34927257132
Fax: +34927257110
E-mail: fserrano@unex.es

Ph.D. Cabaj Władysław
W. Stefanski Institute of Parasitology
Polish Academy of Sciences
Twarda Str Hale 51/55
00-818 Warszawa
Poland
Tel.: +486206226
Fax: +48226206227
E-mail: cabajw@twarda.pan.pl
Safe pork and horse meat on EU-markets: Early and unbiased diagnostic tests for *Trichinella*

**BACKGROUND**

The final aim of this project is to ensure that meat put on the market is *Trichinella*-free. An overview of the main *Trichinella* strains infecting wild and domestic animals in Europe will be performed targeting reference isolates. The development of a method to enable an earlier serological diagnosis of trichinellosis in pigs before or after slaughter by a capture ELISA using monoclonal antibodies with high affinity for epitopes specific to the invasive stage of *Trichinella*, and indirect ELISA using recombinant antigens, will avoid the risk period of contamination for humans. Horsemeat control, based on the direct identification of the parasite after muscle digestion will be improved by the development of a new reading method using an image analysis system, an automation, a self-calibrating and the determination of a the highest *Trichinella* infected and most readily digested muscles in horse.

**OBJECTIVES**

- Determination of highly infected muscles in experimentally infected horses, using European *Trichinella* strains.
- Generation of reference material from horses and pigs infected by different European *Trichinella* strains. For each strain, infected horse meat (experimentally or naturally), sera from naturally or experimentally infected pigs, will be collected. Such reference material will be used to calibrate and validate the indirect and the automated detection methods of the parasite.
- Development of early ELISAs for pigs using purified recombinant antigens coming from invasive stages or monoclonal antibodies raised against new born larvae. Such tests will overcome the “diagnostic window” responsible of failures with traditional serological method.
- Improvement and automation of the digestion method to reduce the time burden and increase security concerning trichinellosis diagnosis.

**(EXPECTED) RESULTS AND ACHIEVEMENTS**
Dr Dubinsky, Pavol  
Parasitological Institute  
Slovak Academy of Sciences  
Hlinkova 3  
040 01 Kosice  
Slovak Republic  
Tel.: +421956334455  
Fax: +421956331414  
E-mail: dubinsky@saske.sk  

Prof. Ion Dida  
Faculty of Veterinary Medicine  
105, Splaiul Independentei  
Sector 5  
Bucharest  
Romania  
Tel.: +4014109847  
Fax: +4014119802  
E-mail:  

Mr Olivier Huin  
Microvision Instruments  
8 Rue du Forez Ce 1750  
91047 Evry  
France  
Tel.: +33169111550  
Fax: +33169111551  
E-mail: huin@microvision.fr
Safe pork and horse meat on EU-markets: Early and unbiased diagnostic tests for *Trichinella*
Demonstration of a rapid microbial monitor for operations and quality decision-making in the water industries

DEMOWATERCOLI

Contract number: QLK1-2001-01209
Contract type: Demonstration Project
Total cost: € 1,165,988
EC contribution: € 499,045
Starting date: 1/12/2001
Duration: 24 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator: Dr James Berg
Colifast A/S
Business and Application Developments Mgr.
Strandv, 35
1324 Lysaker
Norway
Tel.: +4767100514
Fax: +4767100520
E-mail: James.Berg@colifast.no

Dr Holt, David
Thames Water Utilities Ltd
Research and Technology
Spencer House, Manor Farm Road
RG2 OJN Reading
United Kingdom
Tel.: +441189236263
Fax: +441189236402
E-mail: David.Holt@Thameswater.co.uk

Dr Lucia Bonadonna
Istituto Superiore di Sanità
Laboratorio di Igiene Ambientale
Viale Regina Elena, 299
00161 Roma
Italy
Tel.: +39 06 499 02317
Fax: +39 06 448 69440
E-mail: Lucybond@iss.it

Prof. Jean Lesne
Ecole Nationale de Santé Publique
Avenue du Prof. Leon Bernard
35043 Rennes
France
Tel.: +33 2 99 022948
Fax: +33 2 99 022929
E-mail: Jlesne@ensp.fr

PARTNERS
Demonstration of a rapid microbial monitor for operations and quality decision-making in the water industries

BACKGROUND

The water supply and food industries rely largely on the use of indicator organisms for determining the safety and hygienic quality of their products. All methods for the examination of water and beverages are retrospective: the product tested has already been supplied to the customer or is already in bottles. Outbreaks in food and drinking products contaminated by pathogenic bacteria and recent trends in food safety show that there is a clear need for a fast, simple, robust and flexible system for the detection of microbial contamination of water.

OBJECTIVES

The main objective of the project is to demonstrate that a sensitive and fast microorganism enumeration at-line or in-laboratory system is more reliable and efficient than current reference methods, providing an alternative method for enhanced process control and strategic decision making in the water industry. The secondary objective is to prepare regulatory acceptance of the instrumentation and methods after completion of the project.

(Expected) RESULTS AND ACHIEVEMENTS

The demonstration and validation of the rapid detection system relies first on its ability to provide “Early Warning” of high levels of indicator bacteria, within 3 hours, and “Presence/absence” determinations of low levels within 16 hours. Examples of typical indicator organisms for the water industry include the coliform group, and for the bottled water and swimming pool industries, *P. aeruginosa*. The low-level specificity should be no less than 80% of the reference method, and the time-to-result should be <50% of comparable reference methods. The at-line monitor should be especially robust and operate in industrial conditions, with automatic sampling and reporting to remote operators continuously. Large field trials will be performed at three end-user locations. The final field data should be compiled as a pre-normative application to an internationally recognised organ, e.g. CEN/ISO.
Demonstration of a rapid microbial monitor for operations and quality decision-making in the water industries
The effect of gastrointestinal digestion on the allergenicity of foods
ALLERGEST

Coordinator:
Dr Shmuel Yannai
Technion Research and Development Foundation Ltd.
Department of Food Engineering and Biotechnology
Technion City
32000 Haifa
Israel
Tel.: +97248293350
Fax: +97248320742
E-mail: syannai@tx.technion.ac.il

PARTNERS

Dr Mills, Clare
Institute of Food Research
Food Materials Science Division
Norwich Research Park, Colney NR4 7UA Norwich
United Kingdom
Tel.: +441603255000
Fax: +441603507723
E-mail: ian.lester@bbsrc.ac.uk

Prof. Dr Szepfalusi, Zsolt
Department of Pediatrics and Juvenile Medicine
University of Vienna
Währinger Gürtel 18-20
1090 Vienna
Austria
Tel.: +431404003232
Fax: +431404003189
E-mail: zsolt.szepfalusi@akh-wien.ac.at

Dr Wal, Jean-Michel
INRA
Laboratoire d’Immuno-Allergie Alimentaire
Cea Saclay
Bâtiment 136
91191 Gif Sur Yvette
France
Tel.: +33134652079
Fax: +33134652088
E-mail: sylvie.courtois@jouy.inra.fr

Prof. Dr Papageorgiou, Photini
P&A Kyriakou Children’s Hospital
Department of Pediatrics
Allergy Unit
Thevou and Levadias Street
11527 Athens
Greece
Tel.: +3017214597
Fax: +3017214597
E-mail: allab@hol.gr

Mr Crevel, Rene
Unilever UK Central Resources Ltd
Investigative Toxicology Unit
Colworth House
MK44 1LQ Sharnbrook, Bedford
United Kingdom
Tel.: +441234222986
Fax: +441234222277
E-mail: derrick.kilsby@unilever.com

Dr Fetlinski, Andrzej
Rhodia Food Biolacta Spolka Z O O
Warszawska, 111
10-701 Olsztyn
Poland
Tel.: +48895240464
Fax: +48895240203
E-mail:
The effect of gastrointestinal digestion on the allergenicity of foods

BACKGROUND

We propose a novel in-vitro model of human digestion with gastric and duodenal phase of various specificity (human recombinant enzymes) and added bile salts. It will provide industries and regulators improved food-processing methods of assessing protein digestibility, data on allergen release and changes in allergenicity during digestion. Digestibility is part of the risk assessment of novel foods and transgenes selection for introduction into plant foods and relevant to assessing the macronutrient quality of proteins. Food allergens are notably resistant to hydrolysis, can escape digestion, cross the gut barrier and trigger allergic reactions. Current in vitro tests use animal enzymes but do not mimic the complexities of the human digestive tract. The digesta will be characterised for allergenicity, and at the biochemical level, thus enabling production of high-quality hypoallergenic foods for consumption by the society.

OBJECTIVES

The project aims to expand current allergenicity assessment strategies regarding GMOs to encompass the whole organism and NOT just the target transgene, and to include novel food processing, ingredients and foods, especially nutritionally-enhanced foods. It will

• develop a small-scale in vitro model of the human digestive system to assess digestibility versus novel protein;
• provide information on the allergenic activity of degraded versus intact allergens;
• demonstrate the basis for linking the lack of digestibility of food allergens with their allergenic reactivity;
• investigate how release and digestion of allergens is determined by the food;
• develop a decision tree for determining allergenic risks posed by proteins, as part of the broader toxicological assessment of novel food.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Protein-lipid interactions in gastric and duodenal emulsions will affect allergen digestion from foods.

Emulsions are formed from ingested lipid stabilised by secreted phospholipid.

QLK1-2001-01239: The effect of gastrointestinal digestion on the allergenicity of foods
Biosafety evaluation of probiotic lactic acid bacteria used for human consumption

PROSAFE

Contract number: QLK1-2001-01273
Contract type: Shared Cost Project
Total cost: €1,687,746
EC contribution: €1,281,461
Starting date: 1/01/2002
Duration: 48 Months
Scientific Officer: Jürgen Lucas
Project website: http://www.vtt.fi/virtual/proeuhealth/

Coordinator:
Prof. Dr Herman Goossens
Universiteit Antwerpen
Universitair Ziekenhuis Antwerpen
Department of Medical Microbiology
Wilrijkstraat 10
2650 Edegem
Belgium
Tel.: +32-3-8213789
Fax: +32-3-8254281
E-mail: herman.goossens@uza.uia.ac.be

PARTNERS

Dr Jean Swings
Universiteit Gent
BCCM/MLG Bacteria Collection
Laboratorium voor Microbiologie
Vakgroep Biochemie, Fysiologie en Microbiologie
K.L. Ledeganckstraat 35
9000 Gent
Belgium
Tel.: +32-9-26 45 116
Fax: +32-9-26 45 092
E-mail: Jean.swings@rug.ac.be

Dr Wolfgang Witte
Robert Koch Institut
Laboratory of Nosocomial Infections
Burgstraße 37
38855 Wernigerode
Germany
Tel.: +49-39-43 67 92 46
Fax: +49-39-43 67 92 07
E-mail: Wittew@rki.de

Dr Marie-Bénédicte Romond
Université de Lille 2
Laboratoire de Bactériologie
Faculté des Sciences Pharmaceutiques
Rue du Professeur Lagasse
BP 83
59006 Lille
France
Tel.: +33-3-20 96 40 37
Fax: +33-3-20 96 40 37
E-mail: Mromond@phare.univ-lille2.fr

Dr Philippe Moreillon
Centre Hospitalier Universitaire Vaudois
Rue du Bugnon 46
1011 Lausanne
Switzerland
Tel.: +41-21-314 30 20
Fax: +41-21-314 10 36
E-mail: Philippe.Moreillon@chuv.hospvd.ch

Dr Anne Mensink
Numico Research B.V.
Bosrandweg 20
PO Box 7005
6704 PH Wageningen
The Netherlands
Tel.: +31-317-46 78 05
Fax: +31-317-46 65 00
E-mail: Anne.Mensink@numico-research.nl

Prof. Dr Emmanuel Wiertz
Leiden University Medical Center
Dpt of Medical Microbiology
PO Box 9600
Albinusdreef 2
2300 RC Leiden
The Netherlands
Tel.: +31-71-526 3932/3931
Fax: +31-71-524 8148
E-mail: wiertz@lumc.nl
**Biosafety evaluation of probiotic lactic acid bacteria used for human consumption**

**BACKGROUND**

Probiotic bacteria, mainly lactic acid bacteria (LAB) (e.g. lactobacilli, lactococci, enterococci, and bifidobacteria) have been considered safe for human consumption. However, recent reports of clinical infection, the spread of antibiotic resistance genes, and development of new and/or modified probiotic LAB strains, have caused concern of safety. This project aims to assess the biosafety of LAB. Isolates from healthy humans and immunocompromised patients, commercially available and new probiotic LAB will be studied. After polyphasic taxonomic identification, their biosafety will be assessed by several methods (see objectives). The project will result in recommendations for biosafe and biosafety testing of LAB.

**OBJECTIVES**

Overall objective: The safe use of probiotic Lactic Acid Bacteria (LAB) (e.g. lactobacilli, lactococci, enterococci, bifidobacteria) for human consumption, by proposing criteria, standards, guidelines, and regulations on the one hand, and procedures and standardised methodologies of pre-marketing biosafety testing and post-marketing surveillance on the other hand.

Specific objectives:
- Taxonomic description of probiotic and other LAB;
- Detection of resistance and horizontal transfer of antibiotic resistance genes among LAB;
- Detection of known and new virulence properties of LAB;
- Immunological adverse effects of LAB in the EAE model;
- Survival, colonisation, and genetic stability of probiotic LAB in the human gut.

**(EXPECTED) RESULTS AND ACHIEVEMENTS**

- Culture collection and database of probiotic and other LAB.
- Standardised methodologies to detect antibiotic resistance in LAB.
- Investigation of (potential) virulence properties in LAB, and their association with clinical disease and results obtained in rat endocarditis model.
- Potential immunological adverse effects of LAB.
- Genetic stability and colonisation of probiotic LAB in the human gastro-intestinal gut.
- Recommendations for biosafety evaluation of probiotic LAB.
Risk assessment of fungal biological control agents

RAFBCA

Contract number: QLK1-2001-01391
Contract type: Shared Cost Project
Total cost: € 3,041,389
EC contribution: € 1,915,857
Starting date: 1/11/2001
Duration: 36 Months
Scientific Officer: Achim Boenke
Project website: not yet available

Coordinator:
Prof. Dr Tariq Butt
University of Wales Swansea
Singleton Park
SA2 8PP Swansea
United Kingdom
Tel.: +441792295374
Fax: +441792295447
E-mail: T.Butt@Swansea.ac.uk

PARTNERS

Dr Strasser, Hermann
Institute of Microbiology
Leopold-Franzens University
Innsbruck
Technikerstraße 25
6020 Innsbruck
Austria
Tel.: +435125076008
Fax: +435125072929
E-mail: hermann.strasser@uibk.ac.at

Dr Vey, Alain
INRA
Station de Recherches de Pathologie Comparée
Avenue du General de Gaulle
30380 Saint-Christol Lez Ales
France
Tel.: +33466783718
Fax: +33466524699
E-mail: vey@ensam.inra.fr

Dr Altomare, Claudio
Consiglio Nazionale Delle Ricerche
Istituto Tossine e Micotossine da Parassiti Vegetali
Viale Luigi Einaudi, 51
70125 Bari
Italy
Tel.: +390805481570&
Fax: +390805486063&
E-mail: c.altomare@area.ba.cnr.it

Dr Niemi, Marina
Kemira Agro Oy
Espoo Research Centre
Luoteisrinne 2
PO Box 44
02271 Espoo
Finland
Tel.: +358108622485&
Fax: +358108622466&
E-mail: marina.niemi@kemira.com

Dr Ravensberg, Willem J.
Koppert Beheer B.V.
R&D Microbials
Veilingweg 17
PO Box 155
2650 AD Berkel en Rodenrijs
The Netherlands
Tel.: +31105140444
Fax: +31105115203
E-mail: WRavensberg@Koppert.NL

Dr Lueth, Peter
Prophyta Biologischer Pflanzenschutz GmbH
Inselstraße 12
23999 Malchow / Poel
Germany
Tel.: +49384252324
Fax: +49384252323
E-mail: plueth@prophyta.com
Risk assessment of fungal biological control agents

BACKGROUND

Increasing public sensitivity to environmental pollution and problems of pest resistance to chemical pesticides has led to a global consensus to reduce or phase out extremely noxious pesticides. This has prompted considerable interest in more benign crop protection strategies including the use of fungal biocontrol agents (BCAs). Significant progress has been made in recent years in the development of these agents for the control of pests (insects, nematodes), weeds and diseases of a wide range of forest, horticultural and agricultural crops. However, few products reach the market. More fungal BCAs would be available to growers if production and development costs could be reduced. One major hurdle is the registration and in particular the risk assessment of BCAs, since there are no guidelines or simulation models available to evaluate the fate of secreted fungal metabolites in the environment. Little is known about the range of metabolites produced and whether they enter the food chain so posing a risk to human and animal health. This project will generate data that could help address key registration questions: an alternative where pests have built up resistance to synthetic chemical plant protection products or where these have been withdrawn.

OBJECTIVES

The overall aim of this unique project is to establish whether metabolites produced by fungal BCAs enter the food chain and if they pose a risk to human and animal health. This will be achieved through:

• (1) development of sensitive tools (e.g. biosensors) and methods (including high throughput assays like ELISA and the Vitotoxin test) for rapid and accurate detection of fungal metabolites,
• (2) biochemical and molecular studies to elucidate their mode of action,
• (3) molecular markers to monitor fungal BCAs in the environment
• (4) studies to determine if metabolites enter the food chain and, if so, identify the route of entry and type and quantities present.

(EXPECTED) RESULTS AND ACHIEVEMENTS

• Methodologies and tools for sensitive, high throughput screening of fungal BCA metabolites;
• Molecular probes to monitor fungal BCAs, and biosensors as an alternative to whole animal testing;
• Methods and data to accelerate risk assessment of fungal metabolites and reduce registration costs;
• Data that will help end users (policy makers, registration authorities, industry) and the public in making more informed decisions regarding the risks, if any, fungal BCA metabolites pose to human and animal health;
• Data on the role and mode of action of fungal BCA metabolites.
Prof. Dr Milton, Typas  
National and Kapodistrian University  
of Athens  
Dept. Genetics and Biotechnology  
Faculty of Biology  
Panepistimioupolis, Ilisia  
15701 Athens  
Greece  
Tel.: +30 17274638  
Fax: +30 17274318  
E-mail: matypas@bio.uoa.gr

Prof. Dr Defago, Geneviève  
Swiss Federal Institute of Technology  
Zürich  
Plant Science Institute  
Phytopathology  
Universitätsstrasse 2  
8092 Zürich  
Switzerland  
Tel.: +41 1 53468 235  
Fax: +43 1 53468 280  
E-mail: genevieve.defago@ipw.agrl.ethz.ch

Dr Raffalt, Josef  
F. Joh. Kwizda GmbH  
Division Kwizda Agro  
Dr Karl Laeger-Ring 6,  
1010 Vienna  
Austria  
Tel.: +43 1 53468 235  
Fax: +43 1 53468 280  
E-mail: j.raffalt@kwizda.co.at
Predicting microbial death during heat treatments on foods

**BUGDEATH**

**Contract number:** QLK1-2001-01415  
**Contract type:** Shared Cost Project  
**Total cost:** € 1,947,918  
**EC contribution:** € 1,576,850  
**Starting date:** 1/09/2001  
**Duration:** 36 Months  
**Scientific Officer:** Dyanne Bennink  
**Project website:** not yet available

**Coordinator:**  
Dr Steve James  
The University of Bristol  
Food Refrigeration and Process Engineering Research Centre  
Churchill Building, Langford  
BS40 5DU Bristol  
United Kingdom  
Tel.: +44 117 9289269  
Fax: +44 117 9289314  
E-mail: steve.james@bristol.ac.uk

---

**PARTNERS**

Dr Silva, Christina L.M.  
Universidade Católica Portuguesa  
Escola Superior de Biotecnologia  
Rua Dr António Bernardino de Almeida  
4200 072 Porto  
Portugal  
Tel.: +351 22 5580004  
Fax: +351 22 5090351  
E-mail: xmalcata@esb.ucp.pt

Dr Geeraerd, Annemie  
Katholieke Universiteit Leuven  
Department of Food and Microbial Technology  
Kardinaal Mercierlaan 92  
3001 Heverlee  
Belgium  
Tel.: +32 16 324063  
Fax: +32 16 324198  
E-mail: gerard.cielens@doc.kuleuven.ac.be

Dr Sheridan, James  
Teagasc  
The National Food Centre  
Dunsinea, Castleknock  
15 Dublin  
Ireland  
Tel.: +353 1 8059500  
Fax: +353 1 8059550  
E-mail: j.sheridan@nfc.teagasc.ie

Mr Wilkinson, John  
Campden & Chorleywood Food Research Association  
Microbiology Department  
Station Road  
Chipping Campden  
Gloucestershire  
GL55 6LD  
United Kingdom  
Tel.: +44 1386 842002  
Fax: +44 1386 842020  
E-mail: wilkinson@campden.co.uk

Dr Halton, David  
University of The West of England  
Bristol Faculty of Applied Sciences  
Frenchay Campus  
Coldharbour Lane  
BS16 1QY Bristol  
United Kingdom  
Tel.: +44 117 3442808  
Fax: +44 117 3442688  
E-mail: linda.skinner@uwe.ac.uk
Predicting microbial death during heat treatments on foods

BACKGROUND
Food poisoning is increasing throughout the EU. Since most of the microbial contamination of foods is present on the surface of foods before they are processed, the elimination or substantial reduction of pathogens from the surface of red and poultry meat and fruit and salad vegetables would significantly reduce food poisoning. Recent decontamination investigations have not achieved the degree of microbial reduction that was predicted using existing microbial death kinetic models. Accurate models of microbial death on foods during surface pasteurisation processes would be of considerable help in the development of efficient thermal decontamination systems for meat, fruit and vegetables. The development of such systems would lead, in turn, to improved food safety and quality. This project will develop and verify such models.

OBJECTIVES
The prime objective of this project is to create models that predict accurately the microbial death on the surface of solid foods resulting from surface pasteurisation processes. To develop and verify these models, reliable experimental data will be produced on the microbial death observed on a variety of food surfaces, under a variety of surface pasteurisation treatments. These treatments will be carried out in equipment designed and constructed during the project, to produce a range of repeatable time-temperature cycles on food surfaces. To tune the models, understanding will be gathered from microbiological experiments use specialist techniques to quantify the effects of the microbial position, adhesion and heat tolerance distribution on their survival under the heated conditions of these tests in real time.

EXPECTED RESULTS AND ACHIEVEMENTS
The major milestones are: Production of heat treatment apparatus; production of microbial death data resulting from heat treatments of surfaces; production of data on interaction between microorganisms, food and heat treatments; creation of a user-friendly, coined heat transfer and microbial death model. The models produced by the project should predict accurately the microbial death on foods under a range of surface heat treatments.
Mr Vallauri, Jean-Marc  
Ecole Nationale d’Ingenieur des  
Techniques des Industries Agricoles et  
Alimentaires  
Laboratoire de Génie des Procédés  
Alimentaires  
La Geraudière  
BP 82225  
44322 Nantes  
France  
Tel.: +33 2 51785454  
Fax: +33 2 57785455  
E-mail: vallauri@enitiaa-nantes.fr  

Dr Delaux, Bernard  
INRA Theix  
Unité de Recherches sur la Viande  
63122 Saint-Genès-Champanelle  
France  
Tel.: +33 473 624433  
Fax: +33 473 624452  
E-mail: Bernard.Delaux@sancy.clermont.inra.fr
QLK1-2001-01415: Predicting microbial death during heat treatments on foods
Sources, consumer exposure and risks of organotin contamination in seafood

OT-SAFE

Contract number: QLK1-2001-01437
Contract type: Shared Cost Project
Total cost: € 513,000
EC contribution: € 374,500
Starting date: 1/01/2002
Duration: 24 Months
Scientific Officer: Sigurdur Bogason
Project website: not yet available

Coordinator:
Dr Jan-Willem Wegener
Vrije Universiteit Amsterdam
Institute for Environmental Studies
De Boelelaan 1115
1081 HV Amsterdam
The Netherlands
Tel.: +31204449555
Fax: +31204449553
E-mail: jwegener@ivm.vu.nl

Dr Roberto Morabito
Ente per le Nuove Tecnologie, l’Energia e l’Ambiente
Divisione Tein
Via Anguillarese 301
00060 S. Maria di Galeria - Roma
Italy
Tel.: +390630484933
Fax: +390630486678
E-mail: morabito@casaccia.enea.it

Dr Florence Pannier
Université de Pau et des Pays de L’Adour
Laboratoire de Chimie Analytique
Bioinorganique et Environnement
Avenue de l’Université
64000 Pau
France
Tel.: +33559923444
Fax: +33559808380
E-mail: florence.pannier@univ-pau.fr

Dr Kuballa, Jürgen
Galab Gbr
Max-Planck-Straße
21502 Geesthacht
Germany
Tel.: +4941522835
Fax: +4941522834
E-mail: juergen.kuballa@gkss.de

Dr Bryn Jones
The Centre for Environment, Fisheries and Aquaculture Science
Pakefield Road
NR33 0HT Lowestoft, Suffolk
United Kingdom
Tel.: +44-1621787273
Fax: +44-1621784989
E-mail: b.r.jones@cefas.co.uk

Prof. Gómez Ariza, José Luis
Universidad de Huelva
Dpto. de Química y Ciencia de los Materiales
Escuela Politécnica Superior
Campus de la Rábida
21819 Palos de la Frontera
Spain
Tel.: +34959017403
Fax: +34959017414
E-mail: ariza@uhu.es
Sources, consumer exposure and risks of organotin contamination in seafood

BACKGROUND
The biocide tributyltin (TBT) is widely used in anti-fouling ship paint and accumulates through the marine food chain.

A recent literature survey revealed that in some European countries present levels of TBT in seafood exceed the Tolerable Daily Intake for humans and may pose a risk to the consumer. However, the available data were very limited and for most EU-countries no information was available. The main objective of OT-SAFE is to improve the quality of seafood in Europe and end the current uncertainty regarding TBT levels and the associated risks to consumers. An extensive database will be compiled on TBT levels in seafood at major EU fishing grounds and the possibilities to reduce the TBT content of seafood during kitchen preparation will be studied. A risk assessment will be made and maximum residue limits for TBT in seafood will be derived, taking import/export fluxes and consumption patterns into account. OT-SAFE will contribute positively to the ongoing discussion between scientists, government, industry and environmental pressure groups on the risks of TBT. If found necessary, the results will help EU-regulators to set seafood advisory guidelines.

OBJECTIVES
Summarising, the objectives are to improve the quality of seafood and reduce the current uncertainty regarding its safety for consumers by:

• Building an EU-wide database on TBT in seafood at major European seafood farms and fishing grounds;
• Studying possibilities of TBT-level reduction in seafood during various different cooking procedures;
• Assessing whether there is a risk for consumers associated with the consumption of TBT-containing seafood sold on the European market;

If found necessary the final results of this study can be used to assist authorities in drawing up seafood advisory guidelines.

(EXPECTED) RESULTS AND ACHIEVEMENTS
Milestones of OT-SAFE are the completion of an evaluated database on TBT levels in seafood at major shellfish farms and fishing grounds across Europe, and a full evaluation of TBT degradation during kitchen preparation of seafood. The final outcome will be a thorough risk assessment of TBT in seafood for EU consumers. Irrespective of the results, OT-SAFE will reduce the current uncertainty regarding TBT levels in seafood in Europe and the associated risks to consumers.
QLK1-2001-01437: Sources, consumer exposure and risks of organotin contamination in seafood
Mechanisms of ochratoxin A induced carcinogenicity as a basis for an improved risk assessment

OCHRATOXINA-RISK ASSESSMENT

Contract number: QLK1-2001-01614
Contract type: Combined Project
Total cost: € 2,482,367
EC contribution: € 1,574,374
Starting date: 1/10/2001
Duration: 36 Months
Scientific Officer: Achim Boenke
Project website: http://www.uni-wuerzburg.de/toxikologie/EU-OTA/OchratoxinA.html

Coordinator:

Prof. Dr Wolfgang Dekant
Department of Toxicology
Versbacher Straße 9
97078 Würzburg
Germany
Tel.: +499312013449
Fax: +499312013865
E-mail: dekant@toxi.uni-wuerzburg.de

PARTNERS

Dr Benoit Schilter
Nestec S.A.
Nestlé Research Centre
P.O.Box 44
1000 Lausanne
Switzerland
Tel.: +4121788977
Fax: +4121785853
E-mail: benoit.schilter@rdls.nestle.com

Prof. Dr Peter Mantle
The Imperial College of Science, Technology and Medicine
Department of Biochemistry
SW7 2AY London
United Kingdom
Tel.: +44-2075945245
Fax: +44-2075945207
E-mail: p.mantle@ic.ac.uk

Dr Dogliotti, Eugenia
Istituto Superiore di Sanità
Laboratory of Comparative Toxicology
and Ecotoxicology
Viale Regina Elena, 299
00161 Rome
Italy
Tel.: +390649902580
Fax: +390649902355
E-mail: dogliotti@iss.it

Dr Mosesso, Pasquale
Università degli Studi della Tuscia
Dipartimento di Agrobiologia e Agrochimica
Via San Camillo de Lellis S.N.C.
01100 Viterbo
Italy
Tel.: +390761357257
Fax: +3907613257242
E-mail: Mosesso@unitus.it

Prof. Dr Paul Honegger
Université de Lausanne
Institute of Physiology
7, Rue du Bugnon
1005 Lausanne
Switzerland
Tel.: +41216925555
Fax: +41216925595
E-mail: Paul.Honegger@iphysiol.unil.ch

Prof. Dr Leszkowicz, Annie
Institut National Polytechnique de Toulouse
Unité de Toxicologie et Sécurité Alimentaire
Ecole Nationale Supérieure Agronomique de Toulouse
Avenue de l’Agrobiopole
PO Box 107
31326 Auzelle-Tolosane
France
Tel.: +33562193947
Fax: +33562193947
E-mail: leszkowicz@ensat.fr
Mechanisms of ochratoxin A induced carcinogenicity as a basis for an improved risk assessment

BACKGROUND
Ochratoxin A is a mycotoxin which contaminates a variety of human food. In experimental animals, ochratoxin A is nephrotoxic and induces tumours, in the kidney, but also in other organs of rodents. In humans, exposure to high levels of ochratoxin A in diet has been linked with chronic renal disease (Balkan endemic nephropathy, interstitial nephritis) and an increased incidence of urinary tract tumours.

OBJECTIVES
The objective is to elucidate mechanisms of ochratoxin A tumorigenicity, this project intends to quantify relevant biochemical endpoints in the toxicity and tumorigenicity of ochratoxin A. Individual projects will address the mechanisms of DNA-damage induced by ochratoxin A and the time course of ochratoxin A induced changes on the biochemical, cellular and morphological level during tumorigenesis. In addition to providing information on mechanisms of tumour induction by ochratoxin A, the project will also give relevant information on mechanisms of tumour induction, promotion and progression in the kidney. The major focus is to obtain information on the dose-response curve for ochratoxin A-induced toxic effects and the relevance of observations made in animals at high dose for human risk assessment.

(EXPECTED) RESULTS AND ACHIEVEMENTS
In the 1st year, methods for quantification of ochratoxin A induced effects will be evaluated, in the 2nd year samples will be generated and analysed in the 3rd year. An improved understanding of mechanisms resulting in DNA-damage by ochratoxin A and their role in tumorigenesis will be obtained. In addition, relevant information on tumour induction and progression in the kidney will be available after completion of the project.
QLK1-2001-01614: Mechanisms of ochratoxin A induced carcinogenicity as a basis for an improved risk assessment
Development of single and multi-analyte affinity sensors for rapid detection of androgen residues in live and post-mortem animals

RADAR

Contract number: QLK1-2001-01670
Contract type: Shared Cost Project
Total cost: € 1.710.152
EC contribution: € 1.366.801
Starting date: 1/12/2001
Duration: 36 Months
Scientific Officer: Achim Boenke
Project website: not yet available

Coordinator:
Dr George Guilbault
National University of Ireland, Cork
University College Cork
Chemistry
Western Road
Cork
Ireland
Tel.: +353214902403
Fax: +353214903103
E-mail: g.guilbault@ucc.ie

Coordinator:
Dr Tothill, Ibtisam
Cranfield University
Cranfield Biotechnology Centre
Silsoe
MK45 4DT Bedfordshire
United Kingdom
Tel.: +441525863531&
Fax: +441525863533&
E-mail: I.tothill@cranfield.ac.u

Coordinator:
Prof. Dr Hock, Bertold
Technische Universität München
Lehrstuhl für Botanik
Alte Akademie 12
85350 Freising
Germany
Tel.: +498161713396&
Fax: +498161714403&
E-mail: hock@weihenstephan.de

Coordinator:
Dr Marco, Pilar
Consejo Superior de Investigaciones Científicas
Biological Organic Chemistry
Jordi Girona, 18-26
08034 Barcelona
Spain
Tel.: +34934006100
Fax: +34932045904
E-mail: mpmqob@iiqab.csic.es

Coordinator:
Dr Crowe, Mark
University College Dublin
Ballsbridge
Dublin 4
Ireland
Tel.: +35317062154
Fax: +35317062157
E-mail: mark.crowe@ucd.ie

Coordinator:
Dr O’Donovan, Michael
Audit Diagnostics
2, Westlink Park
Doughcloyne
Cork
Ireland
Tel.: +353214341455
Fax: +353214341604
E-mail: michael.odonovan@eircom.net

Coordinator:
Dr Magner, Edmond
University of Limerick
Department of Chemical and Environmental Sciences
University of Limerick
Limerick
Ireland
Tel.: +35361202629
Fax: +35361202568
E-mail: edmond.magner@ul.ie

PARTNERS
Development of single and multi-analyte affinity sensors for rapid detection of androgen residues in live and post-mortem animals

BACKGROUND

The use of hormonal substances for growth promotion is prohibited (Directive 85/649/EEC replaced by Directive 88/146/EEC) and the determination of residues thereof is scheduled in animals and in fresh meat (Directive 86/849/EEC). A thorough screening program would allow regulatory bodies to continuously monitor animals prior to slaughter and thus identify animals with enhanced levels of hormone residues for detailed analysis of biological fluids. Current screening does not lend itself to such a thorough process due to the inherent cost involved (e.g. ~25 euros per sample), the non-in situ nature of the analysis technique employed as well as the time lag involved (typically 24-36 hours). Such sensors would allow widespread screening of animals and animal products before entry into the human food chain thus facilitating the implementation of EU directives on consumer protection in a cost-effective (typically 0.5-1.0 euros per sample), rapid (less than 30 minutes), specific and sensitive.

OBJECTIVES

The objectives of this project are:
- the development of individual sensitive and specific biosensors for testosterone, methyltestosterone, 19-nortestosterone, stanozolol and trenbolone;
- the development of a receptor-based sensor that will bind testosterone and other metabolites of testosterone;
- the development of a multi-analyte immunosensor capable of detection of residues of a number of testosterone derivatives simultaneously in the same sample;
- development of pre-production prototype that can be used for cost-effective in field measurements;
- establishment of background levels of testosterone in bovine blood;
- validation and application of developed sensors to real samples;
- evaluation of potential commercial application.

(EXPECTED) RESULTS AND ACHIEVEMENTS

Production of recognition molecules; biosensor development; production samples, establishing the background levels of testosterone; solution of sample matrix effects; development of a prototype biosensor and associated instrumentation; evaluation and validation of developed biosensors; Evaluation of commercial potential and exploitation.
Development of single and multi-analyte affinity sensors for rapid detection of androgen residues in live and post-mortem animals
Risk assessment and integrated ochratoxin A (OTA) management in grape and wine

WINE-OCHRA RISK

Contract number: QLK1-2001-01761
Contract type: Shared Cost Project
Total cost: € 2.630.756
EC contribution: € 1.860.795
Starting date: 1/05/2001
Duration: 48 Months
Scientific Officer: Achim Boenke
Project website: not yet available

Coordinator:
Dr Paola Battilani
Università Cattolica Sacro Cuore
Facoltà di Agraria
Istituto di Entomologia e Patologia Vegetale
Via Emilia Parmense 84
29100 Piacenza
Italy
Tel.: +39523599254
Fax: +39523599256
E-mail: paola.battilani@pc.unicatt.it

PARTNERS

Dr Cabanes, Javier
Universitat Autonoma de Barcelona
Sanitat i Anatomia Animals
Campus Universitari de Bellaterra
08193 Bellaterra Cerdanyola Del Valles
Barcelona
Spain
Tel.: +34935811749/34 & 34935812153
Fax: +34935812006
E-mail: javier.cabanes@uab.es

Dr Lawrence Zofia
Cabi Bioscience
UK Centre Bakeham
Bakeham Lane
TW20 9TY Egham
United Kingdom
Tel.: +44-1491-829 100
Fax: +44-1491-829 061
E-mail: z.lawrence@cabi.org

Dr Venancio, Armando
Universidade do Minho
Centro de Engenharia Biologica
Campus de Gualtar
4710-057 Braga
Portugal
Tel.: +351253604413&
Fax: +351253678986&
E-mail: pgomesp@reitoria.uminho.pt

Dr Mulé, Giuseppe
Consiglio Nazionale Delle Ricerche
Istituto Tossine e Micotossine da Parassiti Vegetali
Viale Luigi Einaudi, 51
70125 Bari
Italy
Tel.: +390805481570&
Fax: +39805486063
E-mail: g.mule@area.area.ba.cnr.it

Prof. Tjamos, Eleftherios
Agricultural University of Athens
Department of Plant Pathology IERA ODOs Votanikos
11855 Athens
Greece
Tel.: +30/1/5294505 or 5294513
Fax: +30/1/5294509
E-mail: ctp2rze@auade.aua.gr

Dr Lichter, Amon
Department of Postharvest Science
ARO The Volcani Centre
PO Box 6
50250 Bet Dagan
Israel
Tel.: +97239683684
Fax: +97239683622
E-mail: vtlicht@volcani.agri.gov.il
Risk assessment and integrated ochratoxin A (OTA) management in grape and wine

BACKGROUND

Ochratoxin A (OTA) is a mycotoxin, considered to be a genotoxic carcinogen, and therefore possible exposure to OTA should be reduced as much as possible. A threshold limit is not yet fixed for wine, but values in the range of 0.2 µg/kg to 1 µg/kg are suggested as a potential limit. OTA was signalled in wine and grape juice since 1996. Samples from Southern Europe were mainly contaminated; red wines were more frequently found positive with higher levels than white ones. The species of fungi responsible for OTA presence in grape are not yet know, neither are the conditions which favour OTA synthesis. The few results available point out that the species are different from those found in cereals. But Aspergillus niger group may play an important role.

OTA in wine is a consistent problem for Europe which has about 40% of the world areas planted in vines (2.8 millions of ha) and 75% of wine production (190 millions of hl); yearly wine consumption is about 150 millions of hl (about 75% of world production) with a mean of 29.39 litres per capita, which exceed 50 litres in some countries. In addition, the OTA-content in wine can exceed 10 µg/kg, which is 10 times higher than the suggested threshold.

OBJECTIVES

The aim of this multidisciplinary project is to assess the real risk of presence of ochratoxin A (OTA) in grape and wine and to reduce the intake of OTA from grapes and wine. This will be pursued by using the HACCP concept, identifying the key elements for OTA in grape and wine, and providing tools for preventive and corrective actions, according to an integrated approach.

(EXPECTED) RESULTS AND ACHIEVEMENTS

- The ochratoxin A producing fungi in grape grown in the Mediterranean basin are identified and molecularly characterised;
- Definition of the CCP for infection with OTA producing fungi related to the host;
- Identification of critical key steps of winemaking for OTA carry-over in wine;
- List of useful products and guidelines to reduce OTA in grape, must and wine;
- Risk assessment for OTA presence in grape and wine;
- Development of a decision support system (DSS) for integrated management of grape.
European Union-risk analysis information network
EU-RAIN

Contract number: QLRT-2001-02178
Contract type: Concerted Action
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Achim Boenke
Project website: not yet available

Coordinator:
Dr Declan Bolton
Teagasc
Food Safety Department
The National Food Centre
Dunsinea, Castleknock
Dublin 15
Ireland
Tel.: +353-1-8059500
Fax: +353-1-8059550
E-mail: dbolton@nfc.teagasc.ie

Dr James Sheridan
Teagasc
Food Safety Department
The National Food Centre
Dunsinea, Castleknock
Dublin 15
Ireland
Tel.: +353-1-8059523
Fax: +353-1-8059550
E-mail: jsheridan@nfc.teagasc.ie

Dr Ian Blair
University of Ulster
Food Microbiology Research Group
School of Applied Medical Sciences
University of Ulster at Jordanstown
Shore Road
Newtownabbey, Co. Antrim
BT37 0QB
United Kingdom
Tel: 44 28 90366137,
Fax: 44 28 90368811,
E-mail: is.blair@ulst.ac.uk

Prof. Dr Frans Smulders
University of Veterinary Medicine
Vienna
Institute of Meat Hygiene, Meat Technology and Food Science
Veterinärplatz 1
1210 Wien
Austria
Tel.: +431250773301
Fax: +431250773390
E-mail: frans.smulders@vu-wien.ac.at

Mr Peter Hewson
Food Standards Agency
Aviation House
125 Kingsway
WC 2B 6NH London
United Kingdom
Tel.: +442072768344
Fax: +442072768362
E-mail: Peter.Hewson@foodstandards.gsi.gov.uk

PARTNERS
European Union-risk analysis information network

BACKGROUND

There are an estimated 34.5 million cases of food poisoning within the EU every year, which represents an unacceptable social (human suffering) and economic (health care and lost working days) cost. Food safety assurance is traditionally retrospective, relying on random testing of the finished product. This may be unreliable and gives no real information about the safety of the food in question at the time of consumption. Risk analysis is a new, proactive, preventative approach to food safety and is becoming the new cornerstone in producing safe, acceptable food. Risk analysis may be divided into risk assessment, risk management and risk communication.

OBJECTIVES

• To establish an EU risk assessment information network and database where researchers, epidemiologists, etc. can pool data for subsequent application in microbial risk assessment. Although primarily targeted at EU scientists, this database will be web-based and therefore accessible to the entire international community and may accommodate data from non-participating European and other countries.

• To focus on catering as the current weak link in risk assessment data and identify risk assessment research priorities for the future by establishing other areas of the food chain where the necessary microbial data is lacking.

• To develop HACCP-based risk management strategies through the development of harmonised, farm, meat, retail and catering HACCP procedures/systems for horizontal application within a given sector of the food chain but which may also be vertically integrated to form a HACCP control system covering the entirety of the food chain.

• To review epidemiological methodologies and data in relation to food poisoning with particular focus on its application in risk assessment.

• To develop risk communication strategies for consumers, scientists and regulators based on the psychological and marketing sciences including such issues as perceptions of risk and current consumer food safety knowledge.

• To identify gaps in knowledge and to determine the research needs to reduce these and to further ensure the future implementation of tools developed during this concerted action. These identified research needs will be widely published by all possible means.

(EXPECTED) RESULTS AND ACHIEVEMENTS

This project will provide a database and data for microbial risk assessment from farm to fork, with particular emphasis on epidemiological data and catering. It will publish detailed HACCP based risk management guidance documents for farm HACCP, beef, pork and lamb slaughter and processing HACCP, retail and catering HACCP as well as a HACCP based guide for domestic kitchens. EU-RAIN will also provide the scientific basis for effective risk communication between consumers, food industry personnel, scientists and regulators. These will be achieved by the Concerted Action members and invited experts at 6 meetings/conferences where data will be presented and discussed.
Dr Phil Voysey  
The Microbiology Department  
Campden & Chorleywood Food Research Association  
Station Road  
Chipping Campden, Gloucestershire  
GL55 6LD  
United Kingdom  
Tel: +44 (0)1386 842069,  
Fax: +44 (0)1386 842100,  
E-mail: p.voysey@campden.co.uk

Dr Sava Buncic  
Department of Clinical Veterinary Science  
University of Bristol  
Langford, Bristol BS40 5DU  
United Kingdom  
Tel.: +44 117 928 9410,  
Fax: +44 117 928 9324,  
E-mail: sava.buncic@bristol.ac.uk

Dr Len Lipman  
Utrecht University  
Department of the Science of Food of Animal Origen  
Faculty of Veterinary Medicine  
Yalelaan 2  
3508 TD Utrecht  
The Netherlands  
Tel.: +31302535342  
Fax: +31302532365  
E-mail: L.J.A.Lipman@vvdo.vet.uu.nl

Dr S. Notermans  
TNO Nutrition and Food Research  
P.O.Box 360, 3700 AJ Zeist  
The Netherlands  
Tel: +31 30 6944943,  
Fax: +31 30 6944901  
Email: notermans@voeding.tno.nl

Professor Truls Nesbakken  
Norwegian Meat Research Centre  
PO Box 396 Okern  
0513 Oslo  
Norway.  
Tel: +47 22 09 23 99,  
Fax: +47 22 22 00 16,  
Email: truls.nesbakken@fagkjott.no

Dr Hans Blom  
Norwegian Food Research Institute  
Oslovn. 1  
1430 Ås  
Norway  
Tel: +47 64 97 01 00,  
Fax: +47 64 97 03 33  
E-mail: hans.blom@matforsk.no

Miguel Prieto Maradona  
Department of Food Hygiene and Technology  
Veterinary Faculty  
Campus la Vegazana  
University of León  
24071 León  
Spain  
Tel:  
Fax:  
E-mail:

Professor John N. Sofos  
Department of Animal Sciences  
Colorado State University  
Fort Collins  
Colorado 80523-1171  
USA  
Tel: +1-970-491-7703  
Fax: +1-970491-0278  
E-mail: john.sofos@colostate.edu

Colin O. Gill  
Agriculture and Agri-Food Canada  
Lacombe Research Centre  
6000 C & E Trail  
Lacombe, Alberta  
T4L 1R5  
Canada  
Tel: +1 403 782-8113  
Fax: +1 403-782-6120  
E-mail: gillc@em.agr.ca

Prof. Dr Elisabeth Borch  
The Microbiology and Product Safety Department  
SIK-The Swedish Institute for Food and Biotechnology  
Ideon  
223 70 Lund  
Sweden  
Tel: +46 46 286 88 20  
Fax: +46 46 18 87 65  
E-mail: eb@sik.se
Improved physiological, immunological and molecular tools for the recovery and identification of emerging campylobacteriaceae in the food and water chain

CAMPYCHECK

Contract number: QLRT-2001-02201
Contract type: Shared Cost Project
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Prof. Dr C. William Keevil
University of Southampton
School of Biological Sciences
SO16 7PX Southampton
United Kingdom
Tel.: +44-2380-594726
Fax: +44-2380-594459
E-mail: cwk@soton.ac.uk

Dr John Broughall
Oxoid Ltd
Wade Road
RG24 8PW Basingstoke
United Kingdom
Tel.: +441256694351
Fax: +441256811625
E-mail: John.Broughall@oxoid.com

Dr Stuart Clark
Microgen Bioproducts Limited
1 Admiralty Way
GU15 3DT Camberley
United Kingdom
Tel.: +441276600081
Fax: +441276600151
E-mail: Stuart.A.Clark@btinternet.com

Dr Stephen On
Danish Veterinary Institute
Bülowsvej 27
1790 Copenhagen V
Denmark
Tel.: +4535300259
Fax: +4535300120
E-mail: sto@svs.dk

Dr Geraldine Duffy
Teagasc, The National Food Centre
Dunsinea, Castleknock
15 Dublin
Ireland
Tel.: +35318059500
Fax: +35318059550
E-mail: gduffy@nfc.teagasc.ie

Prof. Dr Achille Franchini
Department of Food Science
Alma Mater Studiorum
University of Bologna
Via S. Giacomo 9
40126 Bologna
Italy
Tel.: +390512094220
Fax: +39051251936
E-mail: franchin@alma.unibo.it

Prof. Dr Albert Lastovica
Department of Medical Microbiology
Medical School
University of Cape Town
Anzio Road, Observatory,
7925 Cape Town
South Africa
Tel.: +27214066389
Fax: +27217622363
E-mail: lastojj@mweb.co.za
Improved physiological, immunological and molecular tools for the recovery and identification of emerging campylobacteriaceae in the food and water chain

BACKGROUND
At present there remains a lack of information on the prevalence of emerging campylobacteriaceae in the epidemiology of gastro-enteritis worldwide. Until formal studies are established using methods capable of isolating and identifying these bacteria, the extent of their clinical relevance will remain an unknown. Even when the clinical picture has been addressed, there is hardly any information on the environmental or animal reservoirs that harbour these new campylobacteriaceae. Indeed the approved isolation procedures across Europe and elsewhere are designed to primarily isolate thermo-tolerant *Campylobacter* spp. such as *C. jejuni* and *C. coli* and are known not to isolate these emerging campylobacteriaceae.

Therefore, this project involves leading laboratories from the EU, USA and South Africa for the isolation and immunological and molecular identification of emerging campylobacteriaceae in patient and animal faeces and the food and water chain.

OBJECTIVES
The global objective of this project is to develop improved physiological, immunological and molecular tools for the recovery of emerging campylobacteriaceae in the food and water chain and communicate the risk exposure to stakeholders. This information will enable stakeholders to formulate their own risk management strategies.

(EXPECTED) RESULTS AND ACHIEVEMENTS
- Development of quantitative resuscitation and culture techniques to detect emerging campylobacteriaceae of clinical and veterinary importance
- Establishment of culture collection and DNA bank
- Development of sensitive antibodies for ELISA and dipstick detection, and latex identification
- Development of complementary molecular and biochemical techniques for identification and typing
- National surveys to characterise prevalence of campylobacteriaceae in human and animal faeces, and in the food and water chains
- Determination of the quantitative risk exposure of these new species throughout the food chain
- Communication of the risk exposure to stakeholders, including a workshop
Dr Robert Mandrell
USDA, ARS
Western Regional Research Center
Produce Safety and Microbiology
800 Buchanan Street
94710 Albany, California
United States
Tel.: +15105595829
Fax: +15105596165
E-mail: mandrell@pw.usda.gov

Dr Richard Meinersmann
USDA, ARS
Poultry Microbiological Safety Research Unit
950 College Station Rd.
30605-2720 Athens, Georgia
United States
Tel.: +17065463236
Fax: +17065463633
E-mail: rmeiners@saa.ars.usda.gov
Improved physiological, immunological and molecular tools for the recovery and identification of emerging campylobacteriaceae in the food and water chain
Characterisation of *Listeria monocytogenes* to provide tools to predict biofilm formation during cheese making

LMTOOCE

**Contract number:** QLRT-2001-02219  
**Contract type:** Shared Cost Project  
**Total cost:** Under negotiation  
**EC contribution:** Under negotiation  
**Starting date:** not yet determined  
**Duration:** 36 Months  
**Scientific Officer:** Dyanne Bennink  
**Project website:** not yet available

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**Coordinator:**  
Prof. Dr Peter Andrew  
Department of Microbiology and Immunology  
University Road  
LE1 9HN Leicester  
United Kingdom  
Tel.: +44-116-2522951  
Fax: +44-116-2525030  
E-mail: pwa@le.ac.uk

---

**Dr Ilidia Felgueiras**  
Instituto Nacional de Engenharia e Tecnologia Industrial  
Departamento de Tecnologia das Industrias Alimentares  
Estrada do Paço do Lumiar  
Edificio S-N 22  
1649-038 Lisboa  
Portugal  
Tel.: +351217127144  
Fax: +351217127162  
E-mail: ilidia.felgueiras@mail2.ineiti.pt

**Mr Peter Townsend**  
Loughborough University  
Department of Chemical Engineering  
Ashby Road  
LE11 3TU Loughborough  
United Kingdom  
Tel.: +441509222450  
Fax: +441509223953  
E-mail: P.A.Townsend@lboro.ac.uk

**Dr Rui Marques**  
Universidade de Lisboa  
Unit of Applied Biochemistry  
Instituto de Ciencia Aplicada e Tecnologia da Faculdade de Ciencias  
Campo Grande  
EDF.LCAT  
1749-016 Lisbon  
Portugal  
Tel.: +351217500006  
Fax: +351217500172  
E-mail: rui.marques@icat.fe.ul.pt

**Prof. Dr José Ferreira Pereira Ferraz**  
Universidade do Algarve  
Faculdade de Engenharia de Recursos Naturais  
Campus de Gambelas  
8 000-117 Faro  
Portugal  
Tel.: +351289800100  
Fax: +351289817079  
E-mail: sfaisca@ualg.pt
Characterisation of *Listeria monocytogenes* to provide tools to predict biofilm formation during cheese making

**BACKGROUND**

The project is being undertaken in response to the need to control the presence of *Listeria monocytogenes* in the cheese making dairy. The persistence of *L. monocytogenes* in this environment will be correlated with its capacity for adaptation to acid and salt and its ability to form biofilm and resist disinfection. Identification of proteins involved in these physiological responses will allow identification of the corresponding gene. The data will be used to formulate advice on control of *L. monocytogenes* in the dairy. It will also provide tools that will predict the presence of strains with a high capacity to form biofilm in the dairy and hence are likely to become endemic. Finally it will provide evidence for which strain characteristics might be open to blockade as a strategy to prevent or remove biofilm.

**OBJECTIVES**

The overall objectives are

- To identify characteristics of *Listeria monocytogenes* that enable it to persist in cheese and within cheese-making dairies;
- To elaborate a manual of advice and good practice for control *L. monocytogenes* in the dairies;
- To provide evidence for which listerial proteins might be neutralised to prevent biofilm;
- To provide tools for predicting which strains of *L. monocytogenes* are likely to colonise the dairies.

**(EXPECTED) RESULTS AND ACHIEVEMENTS**
Biodiversity and anti-listerial activity of surface microbial consortia from limburger, reblochon, livarot, tilsit and gubbeen cheese

SCM

Contract number: QLK1-2001-02228
Contract type: Shared Cost Project
Total cost: € 2,290,595
EC contribution: € 1,694,680
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr Tim Cogan
Teagasc Dairy Products Research Centre
Moorepark
Fermoy
Ireland
Tel.: +3532542222
Fax: +3532542340
E-mail: tcogan@moorepark.teagasc.ie

Dr Irlinger, Françoise
INRA Laboratoire de Génie et Microbiologie des Procédés Alimentaires
147, rue de l’Université
75338 Paris
France
Tel.: +33 1 3081 5491
Fax: +33 1 3081 5597
E-mail: irlinger@grignon.inra.fr

Prof. Goodfellow, Michael
The University of Newcastle-upon-Tyne
Department of Agricultural and Environmental Science
King George VI Building
Queen Victoria Road
NE1 7RU Newcastle-upon-Tyne
United Kingdom
Tel.: +44 191 2227 706
Fax: +44 191 2225 228
E-mail: m.goodfellow@ncl.ac.uk

Dr Sebastiani, Hans
Bundesanstalt für Alpenländische Milchwirtschaft
Abteilung Kulturen
Rotholz 50A
6200 Rotholz
Austria
Tel.: +43 5244 622 6228
Fax: +43 5244 622 6229
E-mail: hans.sebastiani@rotholz.bmlf.gv.at

Dr Desmasures Nathalie
Université de Caen Basse-Normandie
Laboratoire de Microbiologie Alimentaire
Esplanade de la Paix
14032 Caen Cedex
France
Tel.: +33 2 3156 5522
Fax: +33 2 3156 6179
E-mail: nathalie.desmasures@ibba.unicaen.fr
Biodiversity and anti-listerial activity of surface microbial consortia from limburger, reblochon, livarot, tilsit and gubbeen cheese

BACKGROUND
Little is known about the microbial ecology of the surface flora, which develops on smear cheeses during ripening, and which is considered to be composed of several different species of bacteria and yeasts. The growth of the yeast results in an increase in the pH of the surface layer of the cheese which, in turn, allows growth of spoilage and pathogenic bacteria, particularly, *Listeria monocytogenes* to occur. Such cheeses support growth of listeria and have been implicated in listeriosis. This has obvious implications for the health of consumers. Some strains of brevibacteria from the surface of smear cheese have been shown to produce bacteriocins but this only reduce the growth of listeria by 1-2 log cycles. Whether yeast also inhibit listeria has not been studied.

OBJECTIVES
Very little is known about the microbial ecology of the surface flora of smear cheeses. These cheeses support growth of listeria and they have been implicated in listeriosis and death. This has obvious implications for human health. In this project we will: 1) characterise the surface microflora (both yeast and bacteria) of Limburger, Reblochon, Livarot, Tilsit and Gubbeen cheese using chemotaxonomic and molecular methods, to determine if the floras are the same or different. It is expected that several new taxa of yeast and bacteria will be described. 2) identify strains of yeast which have anti-listerial activity and which do not inhibit the growth of other bacteria in the smear, 3) show that they are useful in controlling growth of listeria in commercially made cheeses and 4) identify the inhibitor produced by the yeast.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The microflora of five European smear cheeses will be characterised. It is expected that several new species of yeast and bacteria will be described. Yeasts that inhibit the development of *L. monocytogenes* in commercial cheese will be identified and evaluated in commercial cheese production. Such yeasts will control the growth of listeria in the cheese and have no effect on the development of the smear bacteria. Thus, these cheeses will be safer to eat.
QLK1-2001-02228: Biodiversity and anti-listerial activity of surface microbial consortia from limburger, reblochon, livarot, tilsit and gubbeen cheese
Assessment and improvement of safety of traditional dry sausages from producers to consumers

TRADISAUSAGE

Contract number: QLRT-2001-02240
Contract type: Shared Cost Project
Total cost: Under negotiation
EC contribution: Under negotiation
Starting date: not yet determined
Duration: 36 Months
Scientific Officer: Antonio di Giulio
Project website: not yet available

Coordinator:
Dr Régine Talon
INRA Theix
Station de Recherches sur la Viande
63122 Saint-Genès-Champanelle
France
Tel.: +33-4-73624170
Fax: +33-4-73624268
E-mail: talon@clermont.inra.fr

Dr Georges Gosset
Ecole Nationale d’Ingénieurs des Travaux Agricoles de Clermont-Ferrand
Qualité et Economie Alimentaires
Site de Marmilhat
63370 Lempdes
France
Tel.: +33473981300
Fax: +33473981300
E-mail: gosset@enitac.fr

Dr Agusti Fonts i Cavestany
Institut de Recerca i Tecnologia Agroalimentàries
Meat Microbiology
Meat Technology Center
Granja Camps i Armet S/N
17121 Monells (Girona)
Spain
Tel.: +34934674040
Fax: +34934674042
E-mail: 

Dr Miquel Moreto
Universitat de Barcelona
Department of Nutrition and Food Science
Avinguda Joan XXIII S/N
08028 Barcelona
Spain
Tel.: +34934034572
Fax: +34934489434
E-mail: samir@pcb.ub.es

PARTNERS

Prof. Dr Roberto Chizzolini
Università degli Studi di Parma
Dipartimento di Produzioni Animali, Biotecnologie Veterinarie, Qualità e Sicurezza degli Alimenti
Via del Taglio 8, Cornocchio
43100 Parma
Italy
Tel.: +390521032750
Fax: +390521032750
E-mail: ROBERTO.chizzolini@unipr.it

Prof. Dr Adriana Ianieri
Università degli Studi di Teramo
Dipartimento di Strutture, Funzioni e Patologie Animali e Biotecnologie
Sezione di Ispezione degli Alimenti di O. A.
Piazza Aldo Moro 45
64100 Teramo
Italy
Tel.: +00393861266887
Fax: +00393861266887
E-mail: ianieri@izv.vet.unite.it
Assessment and improvement of safety of traditional dry sausages from producers to consumers

BACKGROUND

Food safety and quality are the primary concerns of consumers and the recent BSE crisis, but also the recurring food poisoning cases and the dispute on OGM derived food, have undermined public confidence on intensive or industrial food producing systems. Consumers are turning to “traditional” products. Traditional and/or organic agro-food production systems, besides responding to the requirements of a sustainable agriculture, can be important means to secure a sufficient income for people working in rural areas not suited for intensive agriculture.

Small producers experience technical and financial difficulties in complying with official food safety regulations. Hygiene standards, in particular, generally defined for large processing plants, are not always compatible which such small production units. This difficulty has created acute problems, particularly in the countries of south Europe. It is crucial, therefore, to give traditional producers the means to produce safe products, as it is the only way to insure the survival of local economies with positive effects on employment and environmental protection.

OBJECTIVES

The objective of the project is to evaluate and improve safety of traditional dry sausages from the producers to the consumers while preserving their typical quality.

The objective will be pursued according to the following plan:

• Traditional workshops in different European regions (France, Italy, Portugal, Spain, Greece and Slovakia) will be studied as for the know-how adopted, the links existing between raw material producers and processors, the sanitising procedures, the characteristics and the names of the products. The buyers-consumers of traditional sausages will be characterised and their habits of preservation and consumption will be studied.

• The hazards associated with traditional sausages and the critical control points (CCP) of the entire chain, consumption included, will be identified to ensure safety and quality of traditional sausages from production to consumption.

• The bacterial communities constituting the dominant positive bacterial flora in traditional workshops and sausages for each country will be identified and quantified. The dominant strains will be selected, with the aim of not changing traditional quality characteristics, for safety (non-amine producing), competitiveness and ability to colonise the workshop, ability to grow in the products and for synergy between strains.

• The safety of products and the hygiene of workshops will be improved and assured by directed microbial ecology which is based on: the introduction of targeting disinfecting procedures towards spoilage and pathogenic flora, while preserving technological flora; the development of protective flora growing in biofilm and protecting the workshop from the colonisation of pathogenic bacteria; the development of starter cultures that colonise the products and prevent the growth of pathogenic and spoilage bacteria in products.

• A process, that improves sanitary quality and keeps sensorial quality of the products, will be validated. The safety will be certified for the microbiological (pathogenic and
spoilage flora) and the chemical (biogenic amines and lipid oxidation products) sides and the quality will be assessed by sensory analyses. The final result will be the elaboration of a guide of good hygienic practice that will be explained directly to the producers by organising a specific workshop in each country.

- Recommendations for consumers for better handling of the products will be established. A brochure with developed information will be designed and distributed via the producers at the market level. Very concise recommendations will be proposed for the label on the products. All information will be diffused via the resource centre in a specific web site in different languages.

**EXPECTED RESULTS AND ACHIEVEMENTS**

- Safety risks on sausage production chain will be known both as nature and as magnitude.
- Processing conditions combining HACCP and directed microbial ecology and capable of assuring safety and quality of traditional dry fermented sausages will be developed.
- Good hygienic procedures will be elaborated and disseminated to producers.
- Habits of preservation and consumption of consumers will be established and, therefore, recommendations for proper handling will be provided.
Prof. Dr Henrique Guedes-Pinto
Universidade de Tras-os-Montes e Alto Douro
Departamento de Industrias Alimentares
Quinta dos Prados
5000-911 Vila Real
Portugal
Tel.: +351259350407
Fax: +351259350480
E-mail: rel.int.inv.cient@utad.pt

Prof. Dr Maria Lucilia Ferreira
Faculdade de Medicina Veterinaria	
Tecnologia dos Produtos Animais
R. Prof. Dr Cid dos Santos
Polo Universitario
Alto da Ajuda
1300-477 Lisboa
Portugal
Tel.: +00351213652801
Fax: +00351213658010
E-mail: luciliaf@fmv.utl.pt

Prof. Dr Sotirios Aggelidis
Agricultural University of Athens
Lab of Microbiology & Biotechnology of Foods
Iera Odos 75
11855 Athens
Greece
Tel.: +3015294821
Fax: +3015294693
E-mail:

Dr Jurak Koppel
Slovak Academy of Sciences
Institute of Animal Physiology
Soltesovej 4
040 01 Kosice
Slovakia
Tel.: +421556782162
Fax: +421556782162
E-mail: koppel@saske.sk
QLRT-2001-02240: Assessment and improvement of safety of traditional dry sausages from producers to consumers
Modelling migration from plastics into foodstuffs as a novel and cost efficient tool for estimation of consumer exposure from food contact materials

FOODMIGROSURE

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<td>Total cost: Under negotiation</td>
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<td>Duration: 36 Months</td>
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<td>Scientific Officer: Achim Boenke</td>
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<td>Project website: not yet available</td>
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Coordinator:

Dr Roland Franz
Fraunhofer Institut für Verfahrenstechnik und Verpackung
Giggenhauser Str. 35
85354 Freising
Germany
Tel.: +49-8161-491746
Fax: +49-8161-491777
E-mail: fr@ivv.fhg.de

PARTNERS

Dr Laurence Castle
Central Science Laboratory
Department of Food Environment & Rural Affairs
Sand Hutton
Y019 SPP York
United Kingdom
Tel.: +441904462540
Fax: +441904462133
E-mail: L.castle@C.S.L.GOV.UK

Dr Otto Piringer
Fabes Forschungs-GmbH für Analytik und Bewertung von Stoffübergängen
SCHRAGENHOFSTR. 35
80992 München
Germany
Tel.: +0498914900968
Fax: +049-8914900980
E-mail: fabes@t-online.de

Mr Ian Cooper
Pira International Ltd
Randalls Rd
KT22 7RU Leatherhead
United Kingdom
Tel.: +441372802182
Fax: +441372803238
E-mail: ianc@pira.co.uk

Dr Catherine Simoneau
European Commission
Joint Research Centre
Institute for Health and Consumer Protection
Via Enrico Fermi
21020 Ispra (Va)
Italy
Tel.: +390332785889
Fax: +390332785707
E-mail: catherine.simoneau@jrc.it

Prof. Dr Perfecto Paseiro
Universidade de Santiago de Compostela
Dpt. Química Analítica, Nutrición e Bromatología
Campus Sur
15782 Santiago de Compostela
Spain
Tel.: +3498594626
Fax: +3498594912
E-mail: qnpaseir@usc.es
Modelling migration from plastics into foodstuffs as a novel and cost efficient tool for estimation of consumer exposure from food contact materials

BACKGROUND
One important aspect within the European Union’s public health care is the exposure of the European consumer to undesirable chemicals in the diet. Food contact materials (FCM) are one potential contamination source and therefore of particular interest for food exposure assessments. On the other hand, scientific investigations concerning the migration potential and behaviour of food packaging materials have demonstrated that diffusion in and migration from FCM are foreseeable physical and, in principle, mathematically describable processes. The project aim therefore is to provide a novel and economic tool for estimation of consumer exposure to chemicals migrating from food contact plastic materials by establishing a physico-chemical migration model that can mathematically describe the migration processes from plastics into actual foodstuffs under any actual contact conditions.

OBJECTIVES
• To establish a physico-chemical migration model that describes mathematically the migration processes from plastics into actual foodstuffs under any actual contact conditions.
• To provide with this model a novel and highly economic tool for estimation of consumer exposure to chemicals migrating from plastics FCM.
• The model will be applicable for exposure estimations in different ways:
  • A stand alone tool to estimate exposure related migration within the conventional frame conditions of the EU food regulatory evaluation system and thus applying a worst case exposure scenario;
  • in conjunction with statistical data obtained from food consumption and plastics packaging surveys to estimate realistic or worse-case exposure for any situation of interest;
• Investigating the social acceptance of migration modelling versus chemical measurements, and its implications for exposure estimation.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The project will to provide a new versatile and rapid tool to estimate exposure from FCM. It will increase knowledge of the mechanisms of diffusion of organic compounds in foodstuffs. The project achievements will provide a scientific basis for further amendments of food packaging EU Directives 85/572/EEC as well as 90/128/EEC and allow quick and early compliance evaluation of food packaging plastics at the level of foodstuffs and make migration modelling transparent to the consumer.
Prof. Dr Ingrid Steiner  
Vienna University of Technology  
Institute of Food Chemistry and Food Technology  
Getreidemarkt 9  
1060 Wien  
Austria  
Tel.: +4315880116002  
Fax: +4315880116099  
E-mail: isteiner@mail.zserv.tuwien.ac.at

Dr André Mandanis  
Nestlé Research Center  
Vers-chez-les-Blanc  
P.O. Box 44  
1000 Lausanne 26  
Switzerland  
Tel.: +41217858218  
Fax: +41217858553  
E-mail: andre.mandanis@rdls.nestle.com

Dr Klaus Hinrichs  
CEFIC, BIT-FCA  
Av. E.v. Nieuwenhuyse 4, bte 1  
1160 Brussels  
Belgium  
Tel.: +492117977044  
Fax: +492117982375  
E-mail: klaus.hinrichs@cognis.de
Mycotoxin prevention cluster
MYCOTOX-CLUSTER

Contract number: Cluster
Contract type: Cluster
Total cost: € 15,469,500
EC contribution: € 9,968,476
Starting date: 1/02/2000
Duration: End: 31/12/2005
Scientific Officer: Achim Boenke
Project website: http://www.mycotoxin-prevention.com

Coordinator:
Prof. Dr Naresh Magan
Biotechnology Centre
Institute of Bioscience and Technology
Cranfield, Bedford
MK 43 OAL Bedford
United Kingdom
Tel.: +44 1234 754 339
Fax: +44 1234 750 907
E-mail: N.Magan@Cranfield.ac.uk

QLK1-1999-00433
OTA PREV
Prevention of ochratoxin A in cereals
Coordinator: Dr Monica Olsen
National Food Administration, S

QLK1-1999-0996
Control Mycotox Food
Hazard analysis and control of food contamination: prevention of Fusarium mycotoxins entering the human and animal food chain
Coordinator: Prof. Dr Naresh Magan
Cranfield University, UK

QLK1-1999-01380
DE-TOX FUNGI
Early detection of toxigenic Fusarium species and ochratoxigenic fungi in plant products
Coordinator: Dr Giuseppina Mulé
Consiglio Nazionale delle Ricerche, I

QLK1-1999-31248
EMAN
Thematic Network to promote awareness of mycotoxins in food: European mycotoxins awareness network
Coordinator: A. Chrevatidis
Leatherhead International Ltd, UK

QLK1-2001-01614
OCHRATOXINa-RISK ASSESSMENT
Mechanisms of Ochratoxin A Induced Carcinogenicity as a Basis for an Improved Risk Assessment
Coordinator: Prof. Dr W. Dekant
University Würzburg, D

QLK1-2001-01761
WINE-OCHRA RISK
Risk assessment and integrated ochratoxin A OTA management in grape and wine
Coordinator: Dr P. Battilani
Catholic University of Piacenza, I

QLK1-2001-70556
MYCOSENS
Development of a novel test kit for the rapid, on-site determination of mycotoxins in food
Coordinator: Dr S. Holmes
ADGEN Ltd, UK
Mycotoxin prevention cluster

BACKGROUND

This project brings together 81 research partners from 16 European countries in the quest to obtain greater knowledge related to the fungi growth, the production of ochratoxin A and Fusarium mycotoxins under different conditions, and the development and validation of mycotoxin control methods. Seven complementary multi-centre European projects are included in this cluster. They cover aspects related to the application of the Hazard Analysis Critical Control Principle (HACCP) including its optimisation; modelling and mapping of fungal growth including mycotoxin reductions; grain silo design (e.g. humidity, O₂-concentration, T (°C)); fungal growth conditions (e.g. micro- & macro-climate, environment);

competitions between fungi/fungi and fungi/bacteria; actions during processing; establish monitoring systems for fungi growth conditions; establish screening systems for mycotoxin contents control; genetic approaches at a fungal and plant level; seed and plant control, storage, treatment. In addition, the following two other European projects are loosely linked to this mycotoxin prevention cluster: (a) Safe organic vegetables and vegetable products by reducing risk factors and sources of fungal contaminants throughout the production chain: The carrot - Alternaria model (Safe organic vegetables; Contract QLK1-1999-00986) and (b) Risk assessment of fungal biological control agents (RAFBCA; Contract QLK1-2001-01391). For more details, please see the description of the projects elsewhere in this catalogue.

OBJECTIVES

The overall objective of the cluster co-ordination is the prevention / reduction of mycotoxins by the application of the Hazard Analysis Critical Control Point (HACCP) scheme. In addition, the cluster will seek to produce results, which can serve as a model approach for other natural toxins and possibly other undesirable substances in foods. The ultimate objectives are, therefore, to examine systems of pre-harvest crop treatment, and post-harvest control, to remove contaminants and prevent fungal development in food. Furthermore, it will provide biological and chemical means of detoxifying mycotoxins. This should also help to identify the feasibility and the critical points where corrective measures can have a controlling effect for prevention of the entry of these mycotoxins into the food chain. The best combinations of treatments in the chain will be identified by the HACCP approach.

(EXPECTED) RESULTS AND ACHIEVEMENTS

The cost effective and time efficient prevention strategies generated by this cluster will be discussed, evaluated and disseminated to target audiences and various end-users. Consequently, the following working groups have been put in place:

- HACCP/Risk Analysis (Chairs: Dr A. Alldrick and Dr David Aldred; Campden & Chorleywood Food Research Association, e-mail: A.alldrick@campden.co.uk; and Cranfield University, e-mail: d.aldred@cranfield.ac.uk);
- Pre-harvest (Chair: Dr J. Kohl, Plant Research International; e-mail: j.kohl@plant.wag-ur.nl);
- Post-harvest (Chair: Dr N. Jonsson, Swedish Institute of Agric. Engineering; e-mail: nils.johnsson@jti.slu.se);
- Dissemination and exploitation including training (Chair: Prof. Dr N. Magan, Cranfield University, e-mail: N.Magan@Cranfield.ac.uk).
The anti-microbial control cluster
ANTI-MICROBIAL-CLUSTER

Contract number: 
Contract type: Cluster
Total cost: € 2,818,063
EC contribution: € 1,945,012
Starting date: 1/01/2000
Duration: End: 01/01/2003
Scientific Officer: Achim Boenke
Project website: http://www.afsni.ac.uk/foodbrand
http://www.utu.fi/research/residues

Coordinator:

CLUSTER PROJECTS

QLK1-1999-00142
FoodBrand
Bound residues and nitrofuran detection: Development of rapid multi-residue screening tests and definitive multi-residue reference methods for tissue-bound residues of the EU-ban on the use of nitrofurans in food animal production
Coordinator: Dr G. Kennedy
University Belfast, UK

QLK1-1999-0996
Poultry-Check
Multi-residue screening for coccidiostat compounds used in poultry production
Coordinator: Prof. T. Lövgren
University Turku, FIN
The anti-microbial control cluster

BACKGROUND
This loose cluster brings together 13 research partners from nine European countries in the quest to establish a cost effective and time efficient measurement and control system by equally obtaining more knowledge on bound residues of anti-microbial substances. Two complementary multi-centre European projects are included in this loose cluster. For more details, please see the description of the projects elsewhere in this catalogue.

OBJECTIVES
The overall objective of this loose cluster is to coordinate efforts in establishing a cost effective and time efficient measurement and control system for anti-microbial substances. In addition, the aim is to combine and evaluate the gained knowledge on bound residues of anti-microbial substances and the possible impact of such bound residues on the health of the consumer in the light of the Community Activities related to anti-microbials.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The cost effective and time efficient measurement and control strategies generated by this cluster will be discussed, evaluated and disseminated to target audiences, such as consumer groups, and various other end-users. Consequently, one FoodBrand Consumer Workshop was held in Brussels on the 25th and 26th September 2001. This event actively involved also representatives from various Directorate Generals of the Commission, the EC’s Food and Veterinary Office in Dublin, National and Community Reference Laboratories for Veterinary Medicines, and different consumer sector groups.
European network safety assessment of genetically modified food crops

ENTRANSFOOD

Contract number:  
Contract type:  Cluster  
Total cost:  € 12,302,449  
EC contribution:  € 8,390,776  
Starting date:  31/01/2000  
Duration:  End: 31/01/2004  
Scientific Officer:  Barend Verachtert  
Project website:  http://www.entransfood.com

Coordinator:  
Prof. Dr Harry Kuiper  
RIKILT-DLO  
Food Safety and Health  
Bornsesteeg 45  
6708 PD Wageningen  
The Netherlands  
Tel.: +31-317/475463  
Fax: +31-317/417717  
E-mail: h.a.kuiper@rikilt.wag-ur.nl

CLUSTER PROJECTS

QLK1-1999-01182  
ENTRANSFOOD  
European network on safety assessment of genetically modified food crops  
Coordinator: Prof. Dr Harry Kuiper  
RIKILT-DLO, NL

QLK1-1999-00651  
SAFOTEST  
New methods for the safety testing of transgenic food  
Coordinator: Dr Ib Knudsen  
The Danish Veterinary and Food Administration, DK

QLK1-1999-00765  
GMOCARE  
New methodologies for assessing the potential of unintended effects in genetically modified food crops  
Coordinator: Dr Hubert P.J.M. Noteboom  
RIKILT-DLO, NL

QLK1-1999-00527  
GMOBILITY  
Safety evaluation of horizontal gene transfer from genetically modified organisms to the microflora of the food chain and human gut  
Coordinator: Dr Jan van der Vossen  
TNO Food and Nutrition, NL

QLK1-1999-01301  
QPCRGMFOOD  
Reliable, standardised, specific, quantitative detection of genetically modified food  
Coordinator: Dr Arne Holst-Jensen  
National Veterinary Institute, NO
European network safety assessment of genetically modified food crops

BACKGROUND
Market introduction of genetically modified food crops (GMOs) has attracted broad public attention and has given rise to concerns related to the safety of these types of foods for humans and animals. Questions have been raised whether current food safety assessment strategies and test protocols cover adequately risks of chronic exposure of humans and animals to these crops. Moreover, questions have been raised concerning the fate of GMOs throughout the food supply chain with respect to labelling of these components or the production of ‘GMO-FREE’ foods.

OBJECTIVES
A European Thematic Network has been composed consisting of experts of different disciplines to identify key issues of evaluate the adequacy of testing methods, the detection of unintended effects, gene transfer and traceability and quality assurance of GMOs. Working groups will evaluate the adequacy of testing methods, the detection of unintended effects, gene transfer and traceability and quality assurance of GMOs. This will result in integrated position documents, which may contribute to a better understanding of the hazards and risks associated with GMOs and may strengthen public acceptance of the market introduction of these products.

(EXPECTED) RESULTS AND ACHIEVEMENTS
The Thematic Network will identify proper research strategies and tools to address issues related to safety and management of transgenic food products. Participants involved in research, safety assessment and management, regulation and consumers interests will evaluate on-going research activities in this area, discuss new approaches and establish a permanent platform for communication between the various parties involved. As a result a number of research papers and position documents will be written by various Working Groups. These documents will be incorporated into one position paper, which will give guidance on the various aspects mentioned above. It is important to demonstrate that the scientific challenges of safety testing of genetically modified foods can be met, while further initiatives will be taken in Europe to improve current test methodologies, using modern molecular based techniques. Agreement on safety assessment strategies for GMOs, and on issues related to risk management and risk communication will facilitate market introduction of GMOs in Europe, and therefore bring the European industry in a competitive position,
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