



AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

FINAL REPORT

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Current Food Safety Priorities: Report on the European Union Risk Analysis Information Network (EU-RAIN)



**Ashtown Food
Research Centre**

RESEARCH & TRAINING FOR THE FOOD INDUSTRY

RESEARCH REPORT NO 82

CURRENT FOOD SAFETY PRIORITIES

REPORT ON THE EUROPEAN UNION RISK ANALYSIS INFORMATION NETWORK (EU-RAIN)

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SUMMARY

An estimated 10 to 30% of the population in industrialised countries suffers food-borne illness annually, resulting in an unacceptable social (human suffering) and economic (health care and lost working days) cost. Risk analysis, a proactive preventative approach to food safety, was the focus of the European Union Risk Analysis Information Network (EU-RAIN) concerted action project. Funded by the European Commission, this project commenced in March 2003 and concluded in February 2006.

The EU-RAIN project involved six international meetings or conferences which were held over the 3-year duration of the project as follows: (1) Project Framework & Database: Inaugural EU-RAIN conference (Dublin, Ireland; July 2003); (2) Catering Food Safety: A Responsibility Ignored? (Budapest, Hungary; November 2003); (3) Farm to Fork Food Safety: A Call for Common Sense (Athens, Greece; May 2004); (4) Food Pathogen Epidemiology: Microbes, Maladies and Methods (Padua, Italy; December 2004); (5) Food Safety Risk Communication: The Message and Motivational Strategies (Gothenburg, Sweden; May 2005); and (6) The Science of Food: Safety and Nutrition (Dublin, Ireland; December 2005).

In addition to the EU-RAIN conferences, a series of food safety management publications for the farm, beef, pork and lamb slaughter, retail, catering and domestic kitchen sectors were produced as part of the project. These publications are based on Hazard Analysis and Critical Control Point (HACCP) and prerequisite programmes.

The combined attendance for the EU-RAIN conference series was over 640 people. In addition, many people contacted EU-RAIN management via the project website (www.eu-rain.com). At the conferences, scientists presented research, identifying areas in which food safety problems may arise and highlighting where further research is required. Furthermore, EU-RAIN provided regulators with an insight into the problems encountered by food

producers and processors when implementing food safety management systems. It is envisaged that the EU-RAIN publications will assist with the implementation of more effective food safety systems from farm to fork.

PARTNERS IN EU-RAIN

Teagasc – Ashtown Food Research Centre, Ireland

University of Ulster at Jordanstown, Northern Ireland

Food Standards Agency, United Kingdom

Campden & Chorleywood Food Research Association, United Kingdom

University of Bristol, United Kingdom

University of Veterinary Medicine, Vienna, Austria

Utrecht University, The Netherlands

TNO Nutrition and Food Research, The Netherlands

Norwegian Meat Research Centre, Norway

MATFORSK - Norwegian Food Research Institute, Norway

The University of León, Spain

SIK - Swedish Institute for Food & Biotechnology, Sweden

University of Helsinki, Finland

Agricultural University of Athens, Greece

OFE - National Association for Consumer Protection, Hungary

Warsaw Agricultural University, Poland

Istituto Zooprofilattico delle Venezie, Italy

INRA - Institut National de la Recherche Agronomique, France

Agriculture & Agri-Food Lacombe Research Centre, Canada

INTRODUCTION

As consumers we expect food to be wholesome, nutritious and, above all, safe. However, an estimated 10 to 30% of the population in industrialised countries suffers food-borne illness annually. In relation to the European Union, this represents 46 to 137 million cases per year. The resultant illness usually involves gastro-enteric symptoms like diarrhoea, cramps and/or vomiting. Occasionally, however, more serious consequences result such as meningitis, kidney failure and sometimes even death, with young children, elderly people, pregnant women and people already suffering from underlying illness particularly vulnerable. Contamination of food with micro-organisms (*e.g.* bacteria, viruses and parasites) is the most frequent cause of food-borne illness.

Food-borne illness results in an unacceptable social cost in terms of human suffering and economic cost through health care costs and lost working days. Furthermore, food-borne illness clearly adversely affects the competitiveness of the European food industry. Apart from bearing the economic costs associated with lost working days, the adverse publicity associated with food-borne illness may result in lost sales, lost market share and reduced profits.

Clearly, the prevention of food-borne illness is of high priority. Risk analysis, a proactive, preventative approach to food safety, has become the cornerstone in producing safe, acceptable food. Risk analysis may be divided into risk assessment, risk management and risk communication as follows:

- Risk assessment quantifies the magnitude of a risk and usually involves quantitative scientific research.
- Risk management is concerned with using risk assessment information to develop and implement science-based, cost-effective integrated actions that reduce or prevent risks. For example, food safety is often managed using the Hazard Analysis and Critical Control Point (HACCP) management system. HACCP involves the identification of hazards and measures to control and monitor them.
- Risk communication involves the exchange of risk and risk management information and opinions among all interested parties *e.g.* risk assessors, risk managers and consumers.

In March 2003, the European Union Risk Analysis Information Network (EU-RAIN) was established to bring food safety experts from research institutes, regulatory bodies and consumer agencies together to discuss current food safety issues with the objective of safer food and improved health for everybody. Twenty groups based in thirteen European countries, as well as Canada, participated as official project members. The project was co-ordinated by Teagasc – Ashtown Food Research Centre. In addition to concerted action members, hundreds of other people with an interest in food safety participated in various events organised as part of the project.

The primary aim of EU-RAIN was to contribute to food safety risk analysis through the following objectives:

- To establish an EU food safety risk assessment information network and web-based database;
- To focus on catering as the current weak link in risk assessment data and to identify risk assessment research priorities for the future;
- To develop HACCP (Hazard Analysis and Critical Control Point) based risk management strategies through the development of harmonised

farm, meat, retail and catering HACCP procedures/systems;

- 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.

The EU-RAIN project was funded by the European Commission under the Fifth Framework Programme – Quality of Life and Management of Living Resources (QoL), Key Action 1 (KA 1) on Food, Nutrition and Health (Project number: QLK1-CT-2002-02178).

EU-RAIN PROJECT FRAMEWORK AND DATABASE

The EU-RAIN concerted action project consisted of six work-packages as follows:

- Project Framework & Database
- Catering Food Safety
- Farm to Fork HACCP
- Epidemiology
- The Psychology of Food Safety
- Project Review

Each work-package involved an associated international meeting or conference held over the 3-year duration of the project as outlined in Table 1.

Issues relating to the project structure, timetable, deliverables, website and database were discussed at the inaugural EU-RAIN meeting. This meeting was

Table 1: EU-RAIN conference programme

Work package	Conference	Venue	Date	Number of people in attendance	Host institute
1	Inaugural EU-RAIN meeting: Project Framework and Database	Dublin, Ireland	Jul 10th-11th 2003	40	Teagasc - The National Food Centre, Ireland
2	Catering Food Safety: A Responsibility Ignored?	Budapest, Hungary	Nov 26th - 28th 2003	73	The National Association for Consumer Protection in Hungary – OFE, Hungary
3	Farm to Fork Food Safety: A Call for Common Sense	Athens, Greece	May 12th - 14th 2004	133	The Agricultural University of Athens, Greece
4	Food Pathogen Epidemiology: Microbes, Maladies and Methods	Padua, Italy	Dec 2nd - 3rd 2004	92	Istituto Zooprofilattico Sperimentale delle Venezie, Italy
5	Food Safety Risk Communication: The Message	Gothenburg, Sweden	May 19th - 20th 2005	77	SIK - The Swedish Institute for Food and Motivational Strategies and Biotechnology, Sweden
6	The Science of Food: Safety and Nutrition	Dublin, Ireland	Dec 1st - 2nd 2005	230	Teagasc – Ashtown Food Research Centre, Ireland (formerly The National Food Centre)

attended by approximately 40 people comprising concerted action members and a small number of invited guests. A leaflet and poster outlining the project background, objectives, work plan, expected results and achievements, management and contacts were distributed at the meeting.

A series of short presentations on aspects of risk analysis to be covered at future EU-RAIN meetings followed. Topics addressed included: predictive modelling in risk assessment; animal feed safety; meat safety including inspection; chill chain management; hygienic food manufacturing; epidemiology and diagnosis of food-borne pathogens; catering food safety; risk communication.

The venues for future meetings were also discussed. It was agreed that all subsequent EU-RAIN conferences would have open registration including a call for poster abstracts, permitting anybody with an interest in the selected topics to attend. Conferences were attended by food producers, food processors, retailers, caterers, chefs, consumers, regulators, scientists, veterinarians, public health doctors, environmental health officers, nutritionists and other food safety professionals.

In addition to the EU-RAIN conference series, a website and risk assessment database were developed as part of the project. The website (www.eu-rain.com) served (and continues to serve) as a dissemination mechanism for the project. Forthcoming EU-RAIN conferences were advertised and delegates had the option of on-line registration. Users could also request free CDs of conference presentations. Over the 3-year project duration, requests for information were received from over 140 individuals from food research institutes and regulatory bodies world-wide. EU-RAIN guidance documents and information on past meetings, including conference reports and abstract/proceedings books, can still be downloaded in full from this site.

The EU-RAIN risk assessment database was accessible from the website and the submission of data to this database was an on-going task in the three-year

project work plan. In scientific papers, mean values of data are usually presented. However, in order to use data in risk assessment, raw data are required. The EU-RAIN Risk Assessment Database provided a facility where raw data could be deposited and shared by scientists. Scientists were asked to submit raw data from research into six pathogenic bacteria (*Salmonella*, *Campylobacter*, *Listeria monocytogenes*, *Escherichia coli* O157:H7, *Yersinia enterocolitica* and *Staphylococcus aureus*) in beef, pork, lamb, poultry, milk and vegetables. At the end of the project, the risk assessment database contained information on 186 scientific studies. The corresponding raw data file was available for 23 studies. In the case of 25 further studies, the authors agreed to provide raw data if contacted directly by a risk assessor. Over 80 people registered to use the database.

CATERING FOOD SAFETY

Many outbreaks of food-borne illness are linked to restaurants and other catering establishments. The implementation of food safety practices and good hygiene of personnel and premises are essential at this stage of the food chain to reduce the burden of food-borne illness. Catering food safety was discussed at the “Catering Food Safety – A Responsibility Ignored?” conference (Budapest, Hungary; November 2003) and at the EU-RAIN project review conference, “The Science of Food: Safety and Nutrition” (Dublin, Ireland; December 2005).

Presentations focused on:

- Food-borne pathogens
- Microbial studies in the catering environment
- Factors contributing to food poisoning
- Food safety knowledge surveys
- Food safety management including HACCP

- Catering food safety law and the regulator's perspective
- The industry perspective
- The consumer's perspective

Food-borne disease statistics, coupled with the results of microbiological studies and food safety knowledge surveys, highlighted that improvements are needed in the catering sector.

The considerations for future management of food safety in catering were identified as follows:

- Current food safety management systems based on HACCP may be too complicated and unsuitable for smaller establishments. The over-emphasis on record keeping is particularly burdensome. Simplified diary-based management systems, which are being introduced in the UK, may be more appropriate for small businesses.
- The introduction of a hygiene league for restaurants should be considered. Customers should know how restaurants rate in inspections, thus giving establishments that operate to high food safety standards due credit and recognition for their efforts.
- The need for training (using more effective risk communication strategies) for all kitchen staff in restaurants is recommended.
- Research singles out dishcloths or sink cloths as a source of dangerous bacteria. Their replacement with disposable equivalents, where appropriate, is recommended.
- Supplier control is vital for food safety. Through strict food safety requirements, large retailers have successfully raised food safety standards. Caterers should also demand foods of the highest standards from suppliers.

A catering HACCP document entitled “Guidelines for Food Safety Control in European Restaurants” was published as part of the EU-RAIN project. Food safety management based on HACCP principles is a requirement of European legislation. This publication describes a food safety management system tailored specifically for the catering sector. The system is science-based and involves both prerequisite and HACCP programmes. Prerequisites were discussed under the following headings: premise and structures; plant and equipment; hygiene of personnel; services; cleaning; storage; zoning; pest control; and supplier and delivery control. Potential CCPs for HACCP implementation were identified as chilling; chilled storage; frozen storage; thawing; cooking; hot holding; and reheating.

Furthermore, a book entitled “Restaurant & Catering Food Safety: Putting HACCP on the Menu” was published. In this book, European food safety experts share their experiences in the catering field. The background to catering food safety is set out. General HACCP concepts are explained, the requirements of catering food safety legislation are outlined and an insight into the current status of hygiene practices in catering establishments is provided. Using these concepts and real life case studies, it guides the reader through the development and implementation of HACCP systems for restaurants, small food service businesses, function/party catering and fast food establishments.

FARM TO FORK FOOD SAFETY MANAGEMENT

Good food safety management practices must be implemented at all stages of the food chain in order to prevent, reduce or eliminate hazards and thus maintain food safety from farm to fork. Pathogenic micro-organisms associated with foods of animal origin (*e.g. Salmonella, Campylobacter* and *Escherichia coli* O157) originate in animals at the farm or primary production stage of the food chain, where they are often carried in animal faeces. At the slaughterhouse, the transfer of animal faeces from animal intestines or animal hides onto meat is a major food safety hazard. Pathogens from other sources,

e.g. personnel and the environment, may also be introduced into food at this and later stages in the food chain due to poor hygiene, incorrect handling etc. If food is subsequently improperly stored (*i.e.* not held at refrigeration temperatures), any pathogens present may multiply. Cooking in the home or in a restaurant or catering establishment is the most effective way of eliminating food-borne pathogens. However, it is only effective if food is cooked to a sufficiently high temperature to eliminate pathogens and if it is handled properly to prevent the introduction of pathogens after cooking.

Hazard Analysis and Critical Control Point (HACCP) is a systematic and scientific approach to identifying and controlling hazards and is generally regarded as the most effective means of minimising the levels of contamination on many food products. This is reflected in food safety legislation. However, reports indicate that many European food businesses are struggling to implement the principles of HACCP. This clearly increases the risk of food-borne illness. Furthermore, an inability to demonstrate equivalence in food safety control systems may lead to reduced trade for such businesses.

Food safety management was debated at the inaugural EU-RAIN meeting (Dublin, Ireland; July 2003), at the “Farm to Fork Food Safety: A Call for Common Sense” conference (Athens, Greece; May 2004) and at the EU-RAIN project review conference, “The Science of Food: Safety and Nutrition” (Dublin, Ireland; December 2005).

Presentations focused on:

- Farm food safety
- Feed food safety
- Meat and poultry HACCP
- HACCP in the new EU member states
- Meat HACCP – the regulatory perspective

- Retail HACCP
- Domestic kitchen food safety

The major considerations for farm to fork food safety were identified as follows:

- HACCP is not required at the primary production stage of the food chain. While the direct application of HACCP at the farm level may not be fully appropriate, hazard analysis principles should be taken into account when developing guidelines for the farming sector.
- The removal of animal faeces from animal living areas could help prevent the spread of pathogens among animals at the primary production stage of the food chain. Research is required to develop husbandry practices or technologies to achieve this goal.
- Research has been conducted into on-farm interventions to prevent or reduce the shedding of pathogens. Probiotics or competitive exclusion and vaccination appear to have some potential. Further research is required to investigate how diet, nutrition and stress affect animal gut microflora. There is an urgent need for research involving the live animal in relation to the control of food-borne pathogens. It is recognised that the behaviour of bacteria under laboratory conditions can differ substantially from that *in vivo*.
- Further research is also required for the animal feed sector. Research priorities include investigating transfer factors (*i.e.* the transfer of toxic substances from animal feed through to human food) and the determination of acceptable levels of contamination.
- Future meat food safety legislation should focus on specific interventions, such as steam pasteurisation and antimicrobial washes, as a means of ensuring meat food safety. The approval of specific interventions is currently under consideration by the European Commission.

- Current meat inspection procedures involve the incision of various animal parts and can contribute to the spread of pathogens on carcasses. The replacement of unnecessary manual inspection procedures with visual inspections is currently under consideration by the European Commission.
- The new EU member states reported on difficulties in meat slaughter and processing HACCP implementation. Small meat companies are affected in particular and require guidance and support in the development of their food safety management systems.
- Food safety training is essential for all food handlers. Language difficulties experienced by immigrant employees represent a major challenge to training. Translation of information into the relevant languages is highly recommended.
- Increased trade in food means that food safety problems can be transported rapidly around the world. All countries will have to adopt equivalent food safety standards. This will require global establishment and acceptance of the equivalence of national and international standards.
- New, more sensitive detection methods mean that an increasing number of foods are being found with minute levels of genotoxic or carcinogenic substances. Risk assessments are required to determine the consequences of the presence of these compounds.
- Cold chain adherence was identified as key to food safety assurance in the retail sector. In future, new technologies such as active and intelligent packaging, e.g. using time-temperature indicators, will ensure that foods which have been subjected to inappropriate conditions are identified.
- Consumers urgently require food safety knowledge in order to encourage appropriate food handling behaviour in the home.

As part of the EU-RAIN project, a series of guidance publications was prepared as follows:

- Guidelines for Food Safety Management on Farms
- Beef Slaughter and Processing Food Safety
- Pork Slaughter and Processing Food Safety
- Lamb Slaughter and Processing Food Safety
- Guidelines for Food Safety Control in Retail Establishments
- Simple Steps to Safer Food at Home (leaflet for consumers) & an accompanying online publication: Guidelines for Domestic Kitchen Food Safety (www.eu-rain.com/publications).

In “Guidelines for Food Safety Management on Farms”, specific guidelines for food safety assurance are outlined and their background explained. Areas covered include: animal traceability; feed/fodder; animal housing and clean livestock; animal health and disease prevention; detergents, disinfectants and agro-chemicals; milk quality; animal waste and biosecurity.

Guidance publications on beef, pork and lamb slaughter and processing food safety describe food safety management systems consisting of a prerequisite programme, a HACCP programme and a chemical residues control sub-programme. In each case, the prerequisite programme covers slaughterhouse structure, maintenance of slaughterhouse equipment, sanitation of the slaughterhouse and operation of the slaughterhouse.

In the “Beef Slaughter and Processing Food Safety” publication, steam pasteurisation, hot water washing, chilling of carcasses, chilled/frozen storage and metal detection are discussed as potential critical control points (CCPs). In the “Pork Slaughter and Processing Food Safety” publication, hot water washing and/or steam pasteurisation are discussed as potential CCPs for pork

slaughter while carcass chilling, chilled/frozen storage and metal detection are discussed as potential post-slaughter/processing CCPs. In the “Lamb Slaughter and Processing Food Safety” publication, *ante-mortem* inspection (clean sheep policy), pelt removal, evisceration, steam pasteurisation and/or hot water washing are discussed as potential lamb slaughter CCPs while carcass chilling, chilled/frozen storage and metal detection are discussed as post-slaughter/processing CCPs.

In “Guidelines for Food Safety Control in Retail Establishments”, general retail prerequisite requirements are discussed as follows: premises and structure; equipment and maintenance; storage and display; zoning; cleaning/sanitation; services; pest control; training/hygiene of personnel; product recall/withdrawal and traceability; packaging; supplier control; transport to the retail outlet and delivery controls; and home deliveries. A retail HACCP programme is presented with chilled storage; frozen storage; thawing; cooking; cooling/chilling; reheating; and hot holding as potential critical control points (CCPs).

In the leaflet “Simple Steps to Safer Food at Home” specific guidelines for food safety in the home are outlined, with the background to their use explained. Areas covered include: cleaning; avoiding cross-contamination; responsible food handling; refrigerated and frozen storage; cooking; chilling; hot holding; reheating; and avoiding chemical residue problems. In “Guidelines for Domestic Kitchen Food Safety”, short summaries on the bugs most frequently implicated in food borne-illness are provided. These include *Salmonella*, *Campylobacter*, *Listeria*, *Staphylococcus*, *Yersinia*, *Shigella*, *Clostridium*, *Escherichia coli*, Norovirus, Rotavirus, Hepatitis A virus and Hepatitis E virus. The specific guidelines for food safety in the home are then provided in further detail.

Epidemiology is the study of the occurrence and distribution of diseases in populations. Epidemiological methodologies and data in relation to food-borne pathogens were reviewed at the “Food Pathogen Epidemiology: Microbes, Maladies and Methods” conference (Padua, Italy; Dec 2004) and at the EU-RAIN project review conference “The Science of Food: Safety and Nutrition” (Dublin, Ireland; Dec 2005).

International experts presented on:

- Bacterial pathogens
- Viral pathogens
- *Cryptosporidium*
- Pathogen control
- Current trends in food-borne illness
- Public health surveillance
- Outbreak investigation
- Monitoring of zoonoses in the European Union from 2004
- Food-borne pathogen risk assessment
- Typing and sub-typing of pathogens
- International epidemiological collaboration

Participants reviewed current trends in food-borne illness, public health surveillance or monitoring initiatives, outbreak investigation and pathogen detection. The priorities for the future were identified as follows:

- Harmonisation of monitoring and reporting systems.
- Harmonisation of laboratory techniques.
- The development of modern molecular techniques including improved sub-typing methods. Such techniques have the potential to rapidly detect food safety problems.
- Analysis of collated data to maximise the benefits in future testing. For example, if samples never test positive or if no action is taken if samples test positive, the value of continuing to test such samples is questionable.
- Cross-contamination in laboratories was highlighted as an under-recognised but potentially significant problem.

THE PSYCHOLOGY OF FOOD SAFETY

The primary goal of food safety risk communication is to improve transparency and thus increase consumer trust and confidence in the food chain. Numerous crises such as BSE, the illegal use of growth hormones, *E. coli* O157 outbreaks and dioxin contamination have adversely affected consumer trust, not only in food producers and processors, but also in government regulators. In order to reduce the risk of food-borne illness, regulators have sought to enforce new food safety management systems in the food production and processing stages of the food chain. In the home, consumers also have a key role to play in the prevention of such illnesses through good hygiene and food safety practices. Thus, effective food safety risk communication is required to inform food producers, food processors and consumers of steps that can be taken to control food safety hazards.

Risk communication and the psychology of food safety were discussed at the inaugural EU-RAIN meeting (Dublin, Ireland; July 2003), at the “Food Safety Risk Communication: The Message and Motivational Strategies” conference (Gothenburg, Sweden; May 2005) and at the EU-RAIN project review

conference “The Science of Food: Safety and Nutrition” (Dublin, Ireland; Dec 2005).

Presentations focused on:

- Food safety risk perception
- Consumer trust
- Reaction to food safety crises
- Consumer knowledge and education
- Food safety risk communication in the food processing environment
- Future food safety risk communication strategies for Europe.

The major considerations for future food risk communication were identified as follows:

- The public or consumers are a heterogeneous group and exhibit different levels of information requirement. Targeted risk communication strategies are needed for different subgroups.
- In particular, strategies need to target specific “at risk” groups *e.g.* young people and men.
- Food safety education at an early age (through school curricula) is highly recommended.
- Trust is very complex. However, measures taken to improve food safety have positively influenced consumer trust *e.g.* the aftermath to the BSE crisis.
- Different crises reveal a high degree of variability. There are limits to the applicability of lessons learnt to other risks.

- Early and proactive public engagement and the development of communication strategies are essential when new food technologies are being introduced. However, increased public engagement can lead to selection of the vocal minority rather than the silent majority. Continuous improvements to risk communication strategies are required.

These priorities were highlighted in a guidance document based on conference outcomes: “Food Risk Communication: Considerations for Food Safety Promotion Agencies”

BEYOND FOOD SAFETY: NUTRITION AND LIFESTYLE

The final EU-RAIN conference “The Science of Food: Safety and Nutrition” (Dublin, Ireland; Dec 2005) reviewed food safety highlights from previous conferences and, in addition, covered the areas of nutrition, lifestyle and health.

The food safety considerations raised at this conference have been highlighted in previous sections of this report. Considerations for the areas of nutrition, lifestyle and health highlighted at the conference were:

- Obesity has become a serious public health problem, leading to increased risk of illness such as Type II diabetes and cardiovascular disease. Studies have revealed that consumption of larger portions of many different foods is associated with significantly greater odds of being obese. This is referred to as passive over-consumption. Education of consumers regarding awareness of portion size rather than type of food is required. Also the food industry must be encouraged to produce a variety of food portion sizes.
- Social trends have led to the emergence of cash rich but time poor consumers. This has fuelled demand for convenience foods.
- There is a move towards minimal processing of food in order to retain

nutritional quality. However, the food safety implications of minimum preservation have to be carefully considered. New technologies include alternative thermal processes (e.g. radio frequency heating), non-thermal processes (e.g. irradiation and high pressure processing) and natural preservatives. In order to be accepted, new technologies must be seen by consumers as either useful or necessary.

- Consumer interest in foods that maintain or improve health is a growing trend. Functional foods (foods that claim to promote human health) represent tremendous potential for adding value to the food industry. The elucidation of the mechanisms of action of functional foods (e.g. probiotics) remains a key challenge.
- Cosmoceuticals, *i.e.* beauty-enhancing food products, are starting to emerge. This is also likely to be a growth area in the future.
- Nutritional genomics is an emerging science that involves studying the interaction of genes, diet and environment and how they impact on health. It can be divided into: (1) nutrigenomics - the effect of diet on gene expression and, subsequently, metabolism and (2) nutrigenetics – the effect of genes on responsiveness to diet. In the future, personalised nutrition based on genetic profiling may be considered by consumers. However, many illnesses involve the interaction of a number of genes (*i.e.* they are polygenic). Therefore, personalised nutrition is not likely to provide a simple solution.

CONCLUSIONS

A multidisciplinary approach is required to deal with food safety issues. Effective surveillance in animals, food and humans, the implementation of appropriate food safety management systems from farm to fork, and the ability to respond to crises are all essential. EU-RAIN brought food safety researchers, regulators, health specialists, food industry representatives and consumer groups together, enabling them to discuss issues and share ideas

with the common goal of safer food for everybody. The EU-RAIN conference series had a combined attendance of over 640 people. Many people also contacted EU-RAIN management via the project website (www.eu-rain.com). Scientists presented research, identifying areas in which food safety problems may arise in the food chain and highlighting where further research is required. Furthermore, EU-RAIN provided regulators with an insight into the problems encountered by food producers and processors when implementing food safety management systems. It is envisaged that the EU-RAIN guidance publications will assist the agricultural, meat slaughter & processing, retail and catering sectors and regulators with the implementation of more effective food safety systems.

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Bolton, D.J. and Maunsell, B. (2006). Guidelines for domestic kitchen food safety. Teagasc – Ashtown Food Research Centre, Ireland. ISBN 1 84170 445 8

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