

OPENING SESSION: Food Safety in the European Union

Key Note Lecture: Food Safety in Portugal

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Zoonoses are diseases or infections that are transmissible from animals to humans. The infection can be caused by the direct contact from animals, or due to the ingestion of contaminated food which can occur at many different stages of the food chain farm-to-fork; thus, it may be controlled in different ways and at various stages of the chain. The diseases caused through consumption of contaminated foodstuffs may result in a wide range of symptoms, depending on the pathogenic agent which also determines the severity of the consequences which range from mild symptoms to death. The regulatory framework for monitoring and controlling food-borne diseases is described in EU legislation Directive 2003/99/EC. Since 2005, the Animal Diseases Transmissible to Humans (Zoonoses) Unit of the European Food Safety Authority, in collaboration with the European Centre for Disease Prevention and Control (ECDC), has been entrusted to prepare yearly summary reports on trends and sources of zoonoses, zoonotic agents, antimicrobial resistance, and foodborne outbreaks in the European Union, which is validated by Member States and published by EFSA. According to Directive 2003/99/EC the Member States should report annually on a mandatory basis, the results on the monitoring of Brucellosis, Campylobacteriosis, Echinococcosis, Listeriosis, Salmonellosis, Trichinellosis, Tuberculosis, Verotoxigenic *Escherichia coli* and antimicrobial resistance; on a mandatory basis the results of epidemiological investigations of foodborne outbreaks, and, according to the epidemiological situation, the results on monitoring of viral, parasitic and bacterial zoonoses. The last available report was published in December 2007, and includes the most recent data available, from year 2006. In 2006, twenty-four Member States submitted information on the occurrence of zoonoses, zoonotic agents, antimicrobial resistance and food-borne outbreaks. Further information on zoonoses cases in humans was acquired from the ECDC. The information available covers 17 diseases (1, 2)

The EFSA-ECDC last annual report on zoonoses indicates that these diseases affect over 350,000 people in the European Union every year in the member states that provide information. *Campylobacter* is still the most frequently reported animal infection transmissible to humans. Over 175,000 people in the EU suffered from *Campylobacter* infections in 2006 (46 cases per 100,000 people). There were no reports of human Campylobacteriosis from Portugal (2). Resistance of *Campylobacter* bacteria to ciprofloxacin, in both humans and animal, is of increasing concern in the EU and some studies suggest that this may also be the case in Portugal (3). Salmonellosis remains the second most frequently reported human zoonotic disease across the EU with 160,649 people infected in 2006 (35 cases per 100,000). The number of confirmed human Salmonellosis reported in Portugal were 387 which corresponds to 3.7 cases per 100,000 people, a number considerably lower than the average in the other EU Member States; this may be due to underreporting of cases. *Salmonella* Enteritidis and *Salmonella* Typhimurium were the most frequently reported agents (2). The number of human listeriosis cases was up by 8.6% in the EU, from 1,427 cases in 2005 to 1,583 in 2006. No confirmed cases of human listeriosis were reported from Portugal (2).

Portugal has a human population of around 10 million people but every year, as one of the main tourism destinations in Europe, receives more than double its population in visitors. This may have implications in human health with cases being acquired in one country and reported as imported cases in another country (2). The Health Protection Scotland in a 2008 surveillance report (5) presented information on the surveillance system with information on outbreaks of infectious intestinal disease believed to have been acquired abroad. In 2007, information was circulated concerning 73 reported outbreaks of infectious intestinal disease in persons returning to Scotland from abroad. Turkey was the most frequently reported country, associated with 13 outbreaks, Tunisia was associated with 10 outbreaks, and Portugal was linked to four outbreaks. These 73 outbreaks were an increase of five (7%) over 2006 when 68 overseas outbreaks were reported.

The general causes for outbreaks in Portugal are similar to the reported in other EU countries and are mainly associated with deficiencies in food preparation, cooling and reheating, and food handling leading to cross-contamination. Training the people that handle food is a major but important task that should lead to a decrease in the incidence of foodborne disease.

The data provided by Portugal according to EU legislation framework, Directive 2003/99/EC, for monitoring and controlling foodborne diseases in the EU may be underestimated due to problems arising from limitation in the connection and communication among the many agencies that are

important in terms of food safety and regulatory controls. In Portugal the Food and Economic Safety Authority (ASAE), a criminal police institution, is the national administrative authority overseeing food safety. The Health Authorities (DGS) are also involved as they license industrial establishments, including drawing up of plans regarding installation or alteration projects. It is also their responsibility to intervene in the licensing of restaurants (or similar outlets) and other food supply establishments, assure conditions of health and hygiene, and perform sanitary surveillance of the quality of water for human consumption and its bottling. The DGS intervenes directly at the level of evaluation of National Guides to Good Hygiene Practices and at the level of labelling and control of pesticide residues, nitrites, patulin, and others (4). The National Veterinary Authority (DGV) is involved in animal sites, concerning controls at the level of animal production and slaughtering among others.

It is possible that, as in Europe, the cases of foodborne diseases in Portugal are under-reported. Efforts during the last years on both, compliance with the EU legislation on Hygiene and Safety improved the general knowledge about these matters among the persons who handle food and the consumers. Efforts and investments by the industry (including the tourism industry) regarding the issues concerning installations, equipment and training in food hygiene may also result in a continuous improvement of the safety of the food we produce and eat in Portugal.

Food Safety in the European Union: Trends in Foodborne Pathogens

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The European Community system for monitoring and collection of information on zoonotic agents in foodstuffs and animals is based on the Zoonoses Directive 2003/99/EC, which obligates the European Union (EU) Member States to collect relevant and where applicable comparable data of zoonoses, zoonotic agents, antimicrobial resistance and foodborne outbreaks. The Member States (MSs) transmit to the European Commission, every year, a report covering the data collected. The European Food Safety Authority (EFSA) is assigned the tasks of examining the data collected and publishing the Community Summary Report. This Report is prepared in collaboration with the European Centre for Disease Prevention and Control (ECDC) and EFSA's Zoonoses Collaboration Centre (ZCC, in the Technical University of Denmark).

Another system for collecting zoonoses data at the Community level is the EU-wide baseline surveys, which concept has only recently been launched in accordance with Directive 2003/99/EC. The European Commission coordinates these surveys and the Decision/Regulation laying down the fully harmonised survey protocols oblige all MSs to conduct the surveys. The duration of the surveys is typically one year, and the results are analysed by EFSA. So far, baselines surveys have been performed for *Salmonella* in poultry and pig populations, and the ongoing and forthcoming surveys concern *Salmonella*, *Campylobacter* and *Listeria monocytogenes* in foods as well as methicillin-resistant *S. aureus* (MRSA) in pigs.

Food Safety Challenges to New EU Member States

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No Abstract

SESSION 2: The Thin Line between Microbiological Quality & Safety

Microbiological Quality versus Safety – Industry Point of View

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The microbiological quality and microbiological safety of foods intimately connected. Microbiological quality may relate to product spoilage or potential for spoilage, or to the hygienic status of the product. In the later case, the microbiological quality of a product may provide an indication of whether conditions exist during the product that could also impact product safety. While not a direct indicator of safety, spoilage can also provide an effective alarm that the product is not suitable for consumption. Efforts to suppress spoilage to extend product shelf life, often introduce new concerns in microbial safety that must be addressed during product development and managed during production.

Bacillus

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The genus *Bacillus* encompasses a great diversity of species broadly defined as aerobic, Gram positive, spore-forming rods. Due to secretion of several different enzymes, *Bacillus* species are widely used in the fermentation industry and in production of the majority of microbial industrial enzymes worldwide. Due to their ability to produce spores *Bacillus* species are of both public health and economic concern in the food processing industry. *B. cereus* is well-established as a significant cause of foodborne illness in humans. The possible contribution of other *Bacillus* species than *B. cereus* in food poisoning has, however, not been fully established.

The *Bacillus cereus* group consists of five different closely related species (excluding *B. anthracis*), and at least two of those species can cause food poisoning. *B. cereus* is widespread in nature, and frequently isolated from soil and growing plants. From its natural environment it is easily spread to foods, where it may cause an emetic or a diarrhoeal type of food-associated illness that is becoming increasingly important in the industrialized world. The emetic disease is a food intoxication caused by cereulide, a small ring-formed dodecadepsipeptide. The diarrhoeal syndrome of *B. cereus* is an infection caused by vegetative cells, ingested as viable cells or spores, thought to produce protein enterotoxins in the small intestine. Three spore-forming cytotoxins have been associated with diarrhoeal disease: Hemolysin BL (Hbl), Non-haemolytic enterotoxin (Nhe) and Cytotoxin K.

Three other species: *Bacillus subtilis*, *B. licheniformis* and *B. pumilus* have also been involved in food poisoning. Duration and range of symptoms are similar to that caused by *B. cereus*, however the incubation period and symptoms vary between and within species suggesting that other toxins than the well known *B. cereus* enterotoxins are involved. Similar small ring formed peptides with fatty acid tails have been shown to be produced by about 5% of strains of these species. These peptides are also toxic to several different cell types and are most probably the reason for the food poisoning symptoms caused by these strains.

Clostridium

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The two most significant foodborne pathogenic clostridia are *Clostridium perfringens* and *Clostridium botulinum*. Both are Gram-positive endospore-forming anaerobes. *Clostridium perfringens* is a frequent cause of foodborne disease in many countries. For example, it is the second most common cause of both illness and associated death in England and Wales (84,081 cases of diarrhoea and 89 deaths estimated in 2000), while in the USA it is estimated to be the fourth most frequently identified cause of bacterial-associated foodborne illness (248,500 cases of diarrhoea per year). *C. perfringens* is associated with food poisoning when cooked foods are not cooled correctly, permitting spore germination and subsequent rapid multiplication of emerged vegetative cells between 40°C and 50°C to an infectious dose. The presence of large numbers of vegetative cells in the gut and associated production of enterotoxin can lead to illness. *Clostridium botulinum* is responsible for foodborne botulism, an intoxication in which the bacterium grows and forms a highly potent neurotoxin in food. Botulinum neurotoxin is the most potent substance known (as little as 30-100ng can be fatal), and consumption of pre-formed botulinum can lead to botulism, a severe (but rare) disease with a high fatality rate. The ability to form botulinum neurotoxin is restricted to *C. botulinum* and some strains of *C. baratii* and *C. butyricum*. *C. botulinum* is not a homogeneous species, but a collection of four physiologically and genetically distinct bacteria, with the name "*C. botulinum*" retained to emphasise the importance of neurotoxin formation. There are seven major botulinum neurotoxins (types A to G).

Staphylococcus

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Staphylococcal food poisoning (SFP) is a foodborne toxinosis caused by heat-stable, protease-resistant enterotoxins released during growth of *S. aureus* on food. Affected persons experience severe nausea, projectile vomiting, convulsive retching, abdominal cramps and sometimes diarrhoea, usually within 2–8 hours of ingesting the contaminated food. Food with high protein content that requires considerable handling during preparation or merely adequate heating afterwards is commonly incriminated. Some staphylococcal food poisoning outbreaks have involved very large numbers of people – 14,870 cases (low fat milk, Osaka, Japan, 2000), ~4,000 cases (chicken–roast beef–rice, Minas Gerais, Brazil, 1998), 1,364 cases (deboned chicken salad, Texas, USA, 1992), 862 cases (grilled salmon, Shiga Prefecture, Japan, 2005), and 485 cases (éclairs, Thailand, 1990). To date, 20 staphylococcal enterotoxins (SEs) and enterotoxin-like proteins (SEIs) have been described. In addition, three SEs and four SEIs have variant isoforms. Estimates of the dose of enterotoxin required to induce emesis vary from 20–100 ng to micrograms. Progress in understanding the mechanism of action of enterotoxins has been made in recent years. SEA has been demonstrated to induce 5-hydroxytryptamine (5-HT) release in the intestine, rather than in brain, and the 5-HT₃ receptors on vagal afferent neurons are essential for SEA-stimulated emesis. The role of strains possessing newer SE or SEI genotypes in SFP needs evaluation, given their frequent isolation from nasal carriers. The acceptance of animal models other than monkeys would aid such evaluation. The use of reverse transcriptase PCR to assay expression of SE and SEI genes could provide an effective means of assessing levels of enterotoxin production.

SESSION 3: Microbial Hazards: Recently Emerged Pathogens

Listeria monocytogenes

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Listeria monocytogenes is a human foodborne pathogen that has a remarkable ability to colonize food processing environments and the processing environment is often the immediate source of product contamination. Disease is typically caused by food products in which the organism has grown to high numbers and that are consumed by immunocompromised individuals. Control of the organism relies on minimizing product contamination and preventing growth in relevant food products. We have found that a particular molecular sub-type may colonize independent fish processing plants over many years. We have investigated factors that may influence the remarkable persistence ability of *L. monocytogenes* including attachment to inert surfaces, tolerance to disinfection and tolerance to drying. Strains of the particular persistent sub-types do not differ systematically from pre-sumed non-persistent sub-types, however, most strains of *L. monocytogenes* are remarkably tolerant to drying and survive for months if protected by organic material or NaCl. The particular persistent subtypes which are likely contaminants of food products are less invasive in a number of mammalian cell line models. This may be explained by mutations in genes encoding proteins (ActA and IntA) that are important for cell invasion. In an animal model (pregnant guinea pig), the particular persistent strains are highly efficient in crossing the placental barrier, however, it is not known if the placental crossing in guinea pigs is representative of the human pregnant women. Indeed, these strains do not in a PFGE analyses cluster with isolates from clinical cases. However, these particular persistent strains should be regarded as virulent and efficient cleaning and sanitizing regimes should be used to control the processing plant contamination.

Enterobacter sakazakii

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Enterobacter sakazakii is an opportunistic pathogen that can cause meningitis, necrotising enterocolitis, and bacteraemia infants. It was first designated as a species in 1980 by Farmer et al. and several outbreaks in NICUs have been linked to contaminated powdered infant formula. The organism is therefore of concern to infant food manufacturers as well as clinical microbiologists and food safety regulators. In 2008 the taxonomy of *E. sakazakii* was updated using a polyphasic approach based on extensive geno- and phenotypic evaluations. This resulted in the description of five novel species and the proposal that these be incorporated into a new genus, *Cronobacter*, which is contaxic with *E. sakazakii*. The isolation of *Cronobacter* is complicated by the existence of closely related species, *Enterobacter pulveris*, *E. helveticus* and *E. turicensis*. These species share similar characteristics to *Cronobacter* and occur in the same ecological niches including infant foods. However, no health risk has been attributed to these organisms. Several culture media as well as molecular assays have been proposed and the development of an EN ISO horizontal standard for detection of *Cronobacter* is currently ongoing; the AOAC/FDA are also in the process of validating methods for detection of this genus. Molecular typing methods such as PFGE, RAPD, rep-PCR, ribotyping and MLVA can be applied to trace contamination and monitor infant food processing facilities. Although *Cronobacter* have been primarily associated with infections in infants, several recent reports have highlighted the risk posed in immunocompromised adults, particularly the elderly. Symptoms described in the patients include pneumoniae, sepsis, foot ulcers, wound infections, osteomyelitis and splenic abscesses.

TSEs: The Changing Picture

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BSE has dominated global headlines since 1996, influenced more by uncertainty and fears of the unknown than by hard facts. The political drivers to such misrepresentation of data continue, but in most countries affected by BSE the tide has turned. It is clear that measures put in place to prevent infection of cattle have been effective in most affected countries, while in others prevalence is so low that the detection of trends is difficult. Thirty-one countries are now categorised as “controlled” risk, in accordance with OIE rules for trade.

Where next? As recognised by the TSE Road Map published by the European Commission, the aim is to reduce, and potentially withdraw, prohibitively expensive protective measures. Withdrawal of measures is not easy, even though the risk reduction afforded is small. The process will therefore be slow, involving scientific consultation and open debate with politicians and consumer representatives. Whether they lead to total removal of protective measures remains in doubt, but many are now superfluous.

What of other TSEs, particularly scrapie in small ruminants and chronic wasting disease in cervids? Do they represent a risk to consumers and are rigorous measures to protect consumers justified? Where a disease occurs naturally in the wild, as with CWD, can science deliver means of controlling or eradicating disease?

So far there is no evidence that scrapie or CWD represent a risk to consumers. More than 20 years after the discovery of BSE, the debate about “absence of evidence” and “evidence of absence” continues, but drivers to apply BSE-type controls to small ruminants and cervids are muted. In some respects they present much bigger challenges than BSE.

Verotoxin Producing *Escherichia coli*: What Serotypes are Pathogenic?

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Shiga toxin-producing *Escherichia coli* (STEC) are foodborne pathogens causing severe human infections. Although STEC may belong to a variety of serogroups, STEC O157 is a major cause of human disease but also other serogroups, e.g., O26, O111, O103 and O145, are frequently associated with severe human disease and are referred to as enterohemorrhagic *E. coli* (EHEC). EHEC cause attaching and effacing lesion (eae) on the intestinal mucosa and are characterized by a low

infectious dose, requiring very sensitive methods for food testing. A standardized method based on immuno-magnetic enrichment is available for STEC O157, while for serogroups other than O157 the issue is still under debate. A possible approach aims at the detection of any STEC in the food sample by testing enrichment cultures for toxin production, and/or presence of *stx* genes. The STEC strains will be then characterized. An advantage is the identification of STEC belonging to any serogroup. A drawback is that the presence of low-pathogenic STEC will complicate the detection of EHEC, likely present in lower concentration, requiring the examination of large number of samples. An alternative strategy is directly targeted to the restricted number of EHEC serogroups. This approach is mainly based on the use of PCR to assess the presence of *stx*, *eae*, and serogroup-associated genes. It has the advantage to be very sensitive and to allow a direct discrimination between samples containing low pathogenic STEC (positive for *stx* only) and samples likely contaminated by EHEC. In this respect, the additional presence of *eae* and serogroup-related genes will predict the level of risk for human health associated with the food sample.

SESSION 4: Risk Assessment and Risk Management – Part I

Impact of Distributions of Microorganisms on Food Safety Management Criteria

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The physical distribution of microorganisms in food influences the effectiveness of detecting them by sampling (e.g., for lot acceptance, process control). The frequency distributions chosen to represent microorganism distributions are fundamental to the correct assessment of sampling plans and Microbiological Criteria. Discuss the physical (spatial) distributions that might occur in food. Consider their effects on the resulting frequency distributions and outline the criteria that might be considered when choosing frequency distributions to portray them. Illustrate the effects of that choice on the prediction of sampling plan performance.

Risk Assessment Approaches to Setting Thermal Processes in Food Manufacturing

Philip Richardson, Campden & Chorleywood Food Research Association, Head Food Manufacturing Technologies Dept., Chipping Campden, GL55 6LD Gloucestershire, UK

Thermal treatments are at the heart of many food preservation strategies. These may involve the application of heat to inactivate target organisms. Alternatively, the use of chilled temperatures is another form of heat treatment that requires careful management of risk.

All validated thermal processes require the assessment of the risks associated with raw materials, the thermal process and onward distribution to assure the safety of products to the consumer.

This risk assessment is the basis of HACCP-driven QA strategies in food manufacturing operations.

This paper describes approaches to the management of risk associated with raw materials for use in thermal processes and also considers the approaches that would be necessary to tailor processes to specific target microorganisms in an attempt to reduce any negative impact on product quality through over processing.

SESSION 5: Risk Assessment and Risk Management – Part II

Global Food Safety Management Standards

Catherine Francois, CIES – The Food Business Forum, Food Safety Programmes, 7, rue de Madrid, 75008 Paris, France

Consumer confidence in food bought around the world has dropped significantly over the last year or so, and managing food safety consistently in the global marketplace has become the major challenge in today's world for all stakeholders in the supply chain. Even though food has always been a global business, supply chains are becoming increasingly longer and more complex, as consumers

become more demanding and food safety can no longer be managed within national boundaries. The Global Food Safety Initiative is one of the solutions that has been developed to address this issue by the food business, to ensure food is as safe as possible for consumers.

Comparison between Different Standards

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Global trade of food including raw material, processed and fresh produce is increasing and with it the risk of exporting or importing food safety hazards. This risk can be dependent on the challenges of trading in different legal frameworks where food safety legislation may not be equivalent and of variable standards. Independent third party audits of food safety management systems are thus essential in providing confidence to the purchaser.

A range of food safety management system audit standards exist. Their goal is obviously the same thing – safe food. Although these standards may be recognised as equivalent or credible by the purchaser, it is plausible that the standards may not necessarily provide the same audit outcomes.

This presentation examines three widely used food safety management system audit standards. The standards are compared with respect to content and audit requirements. Selected criteria from the standards have been practically audited during the same supplier audit and differences were identified. These will be discussed in more detail with respect to the impact of these differences on the effectiveness of the food safety management system.

Other differences may exist regarding audit methodology, auditor competence requirements and audit conclusions. This presentation explores whether the differences are significant in selecting the audit standard. Could a supplier select an “easier” audit or would the selection of audit standard be based more on cost and/or market acceptability.

Auditor Consistency and Comparability

David Lloyd, University of Wales Institute, Cardiff, Llandaff Campus, Western Ave. Cardiff, South Wales CF5 2YB, UK

The growth in global food markets coupled with recent food incidents such as the melamine contamination of milk and infant powder formulas have highlighted the need for reassurances in international food safety. Variability in national legislation between countries has led to an increase reliance on international third party certification of food safety management systems.

Even when undertaking a heavily prescribed audit such as BRC/IFS the auditor variability is a key factor and this is likely to be even more critical when auditing standards such as ISO 22000 which allows greater auditor “freedom”.

Research undertaken at UWIC has investigated variations in auditor performance and inter-auditor variability.

The research focused on auditors who regularly audit against the BRC Global Standard for Food Safety and covers a period from March 2005 to October 2008. The research will be discussed within the content of two standard significant reviews and revisions of the standard and the effect of these changes on auditor performance.

The results for 100 BRC audits were evaluated for issue 3 and 4 in an 8 month period from March to October 2005. Only auditors with 5 full BRC audits either side of the Issue change were included in the analysis of results. This represented an audit time of 132 (1,056 hours).

The standard revision between Issue 3 and Issue 4 produced an increase in the number of defined clauses of 20%. The change in standard from Issue 4 to 5 in July 2008 created another 20% increase. The effect of these changes to the standard and increased training prior to its introduction impacted significantly on the levels of non-conformances raised. The results from the study conducted during the change from Issue 4 to 5, and comparison to Issue 3 to 4, will be discussed.

Results from the 2008 study will also focus on the percentage of non-conformances raised against new clauses which are likely to have received greater emphasis during auditor re-training

An analysis of the most widely raised non-conformances per auditor will be presented and a comparative study of these clauses between the 2 studies for each auditor discussed. Results of personal interviews with the auditors to establish any trends in personal audit development or changes to industry practice which may have effected these results will be discussed.

The history of audits for specific companies was analysed and assessment of different auditors "performance" over a period of 4 year period assessed through interviews with company technical representatives.

Auditor variability in delivery against Issue 4 of the BRC standard was also covered in the research. The analysis encompassed audits from Europe, US, and Asia which showed significant differences in the levels of non-conformances raised during the period of analysis. Potential reasons for this variability in auditor findings will be discussed.

SESSION 6: Risk Communication

Novel Approaches to Risk Communication in an Electronic Age

Anthony Flood, International Food Information Council, 1100 Connecticut Ave. NW Ste. 430, Washington, D.C. 20036, USA

This session will explore the role and impact of the media on consumer perceptions about food safety and risk communications and recognize the emerging trends in media communications. Consumer research indicates that most consumers get their food safety information from the media, but globally more than one billion people are online, with 185 million of those in the United States. Research has shown that journalists, government officials, consumers and analysts defining key issues start online and that the internet influences food safety and nutrition opinion leaders more than any other medium. Food safety educators and students use the internet to search for information not readily available. Six percent of people online read blogs regularly, with 30% having read one on occasion and 10% posting to them. Although these are relatively small numbers, the number of social networking spaces and blogs continue to grow exponentially. According to Edison Research, the Internet has now taken over television as "the most cool and exciting medium" which means, to effectively communicate to target audiences, messaging strategies must be tailored to the online viewer. To date, many activist groups have capitalized on this new media format, often with misinformation which creates consumer confusion and potential negative opinions towards food safety related issues. This information is often spread "virally", reaching unprecedented levels thus compounding negative consumer perceptions about food related issues. In order to effectively communicate and reach target audiences in this medium, new and innovative techniques must be employed. The proposed panel will share real-world examples of information dissemination.

Lessons in Outbreak Communication: A Consumer Perspective

Arnout Fischer, Wageningen University, Social-Sciences, Marketing and Consumer Behaviour, Hollandseweg 1, 6706 KN, Wageningen, The Netherlands

Consumer risk perceptions is not necessarily the same as an economic weighing of risks and benefits. Consumers tend to be risk averse, tend to estimate catastrophic, unnatural or involuntary risks as larger, while personal lifestyle risks tend to be underestimated. When perceiving risks consumers may include "illogical" arguments such a fairness (for example demanding lower risks for vulnerable population groups), animal welfare and integrity of nature. Failure to integrate such psychological elements in risk communication by governments may lead to diminished trust, and neglecting the message.

In the case of outbreaks, standard risk communication has to be temporarily replaced by crisis communication. While consumers accept mistakes during a crisis situation, they demand transparent, professional and quick assessment and communication that can only follow from thorough pro-active development of communication during a crisis. Crisis follow up should provide additional information to provide context for the information provided during the crisis.

Several cases will be discussed to illustrate consumer information needs and wants and how risk management practices have dealt with these. Poultry contamination with *Campylobacter* will be compared to *Salmonella* contamination; comparing expert with consumer perspective. The risk management practices in the outbreaks of Foot and Mouth Disease and BSE will be discussed from a consumer perspective.

EFSA's Role in Risk Communication in Europe

Karen Talbot, European Food Safety Authority, Largo N. Palli, 5/A I-43100 Parma, Italy

This presentation will introduce EFSA's communications work within the context of the Authority's overall mandate covering both risk assessment and risk communications, underpinned by EFSA's key values: *openness and transparency; excellence in science; independence; and responsiveness.*

The purpose of EFSA's risk communications activities - *to provide appropriate, consistent, accurate and timely communications on food safety issues, to all stakeholders and the public at large, based on the Authority's risk assessment and scientific expertise* – will be explained and illustrated.

The importance of understanding consumer perception and bridging the gap between science and the consumer will be explored. As will the importance for EFSA of working coherently within a European food safety system with key partners. The related opportunities and challenges of risk communications in a system where EFSA provides independent scientific advice and there is a separation of risk assessment and risk management will also be addressed.

Case histories will be used to illustrate EFSA's approach to risk communications. One example will be animal cloning, which highlights the challenges of high profile scientific uncertainty and the importance of public/stakeholder engagement. It also raises the challenges of separating EFSA's independent scientific work from both wider ethical/societal issues and the work of risk managers, particularly when under intense media and stakeholder scrutiny.

This and other examples will be used to illustrate how EFSA works to deliver appropriate, consistent, accurate and timely communications based on the best available scientific advice. The presentation itself will hopefully simply provide the basis for a two-way exchange of ideas and experience.

Real Example of Incident: A Consumer Point-of-View

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Foodborne illness outbreaks make media headlines no matter where they occur, whether in the United States, Europe, or Asia. Yet the effectiveness of the messages issued by government agencies, industries, consumer associations and the media itself is seldom reviewed.

Within the risk analysis framework adopted by the World Health Organization and the Food and Agriculture Organization of the United Nations, risk communication is on equal footing with both risk assessment and risk management, yet it has gotten much less attention. For most countries, risk communication is an essential food safety tool, especially when preventative control systems are lacking or ineffective. Government agencies utilize product recall notices and consumer alerts frequently, and much more study to increase their effectiveness is warranted.

In the US, repeated outbreaks and recalls have contributed to declining consumer confidence in the food supply, much as the BSE outbreak did for European consumers over a decade ago. This paper will illustrate the risk communication challenges related to a recent US meat recall, with discussion of recent outbreaks linked to canned foods, produce and dairy products. It will present an overview of consumers' point-of-view of food recalls, awareness and attitudes toward food safety, and the role of consumer organizations in distributing food safety information and in protecting consumers from foodborne illnesses. Ultimately, greater expertise in risk communication within governments, industries and consumer associations is needed both to trigger appropriate consumer responses and to protect industries from overly broad messages.

S21 Real Example of Incident: Industry Point-of-View

Darren Blass, Jack in the Box, 9330 Balboa Ave., San Diego, CA 92123, USA

Jack in the Box[®] restaurants is one of the nation's largest quick-service chains, with more than 2,100 company and franchised restaurants in the U.S. In 1993, Jack in the Box experienced an *E. coli* outbreak that sickened hundreds of people. Tragically, four children died. The outbreak damaged the company's reputation among consumers, its standing in the business community, and embroiled the company in numerous lengthy and costly legal battles.

With tough lessons learned, the company rebuilt the Jack in the Box brand largely through aggressive efforts to improve the restaurant industry's food-safety practices and procedures. The company introduced a Hazard Analysis Critical Control Points (HACCP) system for managing food quality and safety that encompasses farm-to-fork procedures for safe food handling and preparation in every restaurant. Today, the company's food safety program is recognized as one of the most comprehensive in the restaurant industry. In 2004, the company was awarded the IAFP's prestigious Black Pearl Award as well as the Food Safety Leadership Award from NSF International, a nonprofit organization also committed to food safety.

Darren Blass, director of quality assurance and product safety for Jack in the Box Inc., will discuss the chain's award-winning food-safety program, its success in rebuilding the Jack in the Box brand, and steps the company has taken to protect its guests and improve food safety and quality throughout the foodservice industry.

SESSION 7: Impact of Changing Climate and Changing Demographics on Food Safety

Climate Change and the Challenge of New Pathogens

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Meteorological and related studies indicate that the climate is undergoing certain changes, which are generally considered to include an increase in average global temperatures over time, plus more extreme weather incidents, for example drought, storms, high rainfall levels and flooding. Also different regions of the world may experience different specific changes in weather patterns, and at different times.

These changes are likely to lead to accompanying changes in the environmental niches which pathogens and vectors (e.g., insects, ticks) of vector-borne diseases inhabit, and conditions may become more favourable for some species, in some areas, and less so in others. In addition, there are likely to be changes in agricultural land use and arable and livestock management, as adaptations to these changes. This in turn may affect the types and species of raw food materials cultivated or raised. Attempting to predict exactly what might happen in terms of pathogen or vector survival, expansion or reduction in the future, and the likely effect on levels of contamination of food ingredients, is therefore extremely difficult.

However, based on what we currently know about the conditions most favourable to particular organisms, coupled with observational evidence to date and modelling predictions of likely future changes, some suggestions can be made. This presentation will consider selected examples of bacteria, viruses, and vectors and outline the pathways by which climate change may influence their presence or effect in the food production process.

Global Water and Related Food Safety for Industry and Consumers

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The importance of water quality has usually been overlooked in terms of its importance to food safety. It is not only essential in the growth of crops, but also in their processing. The microbial quality of this water is important in ensuring that contamination of produce does not occur during these events. Sewage contaminated irrigation water has long been associated with disease transmission. As a result the use of untreated sewage is forbidden in developed countries. However, nearly 70% of the irrigated cropland in the world is in developing countries where use of sewage and sewage contaminated waters is widespread. Because of the lack of standards and monitoring requirements the occurrence of enteric pathogens in irrigation water used for produce production not directly influenced by sewage discharges is largely unknown. Recent studies suggest that human pathogens occur in irrigation waters and may originate from many sources including wildlife, irrigation return flows, and storm water drainage. A better understanding of the ecology of pathogens in irrigation systems is needed as well as standards for the use of these waters for produce production. Such standards could be specific depending upon the irrigation method (drip, spray, flood) and crop dependent (pepper, melon, lettuce). Finally, microbial standards of process water used in washing and cooling need to be developed to control contamination.

Animal-borne Viruses of Interest to the Food Industry

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A number of viruses pathogenic to food animals have made headline news in Europe in the last few years, in particular highly pathogenic avian influenza (HPAI), bluetongue (BT), and foot and mouth disease (FMD). However, these are not the only viral infections present or potentially present in European livestock. Others include classical swine fever (CSF), African swine fever (ASF), and swine vesicular disease (SVD), all present in Europe; Newcastle disease (ND), a bird disease with sporadic outbreaks in Europe; and Rift Valley fever (RVF), not currently in Europe, but a vector-borne disease the range of which may well expand due to climate change.

Not all of the pathogens responsible are zoonotic – that is, cause disease in humans – but there are other ways in which these pathogens can affect the food industry; for example an outbreak may cause trade to be disrupted, or infected animals may be culled, leading to shortages of certain foods. Or there may be confusion, perhaps generated by media reports, which leads people to believe that the pathogen is zoonotic when it is not, and thus not buy the product.

The presentation will distinguish between those pathogens considered to be zoonotic and those not, and consider possible food-associated transmission routes (where relevant) to humans and pets. The current geographical range will also be described, and the potential effects on this range due to climate change, trading patterns, and illegal movement of animals or their products, particularly where such effects might increase the risks within Europe. Finally, current or potential safeguards will be considered.

SESSION 8: Hot Topics in Food Safety

The Pros and Cons of Using Cloned Animals as Sources of Meat and Dairy Products: EU Versus US Perspective

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In January 2008, the US FDA published their final risk assessment on animal cloning and in July the same year European Food Safety Authority (EFSA) published their opinion. The EFSA opinion assessed the food safety, animal health, animal welfare and environmental implications of animal clones, obtained through somatic cell nucleus transfer (SCNT) technique, of their progeny and of the products obtained from those animals. The two risk assessments reach similar conclusions but their scopes are somewhat different as EFSA were also asked to also address animal welfare. There are health and welfare implications for a cohort of animals involved in cloning and morbidity and mortality are higher for clones than in sexually reproduced animals. For cattle and pigs, food safety concerns are considered unlikely. No clear evidence has emerged to suggest any differences between food products from clones or their offspring, in terms of food safety, compared to products from conventionally bred animals. The presentation will focus on the EFSA opinion, discuss uncertainties and recommendations and put the outcome in perspective with the FDA assessment.

Molecular Microbiology of Foodborne Pathogens: Detection, Typing and Tracking

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Molecular biology was defined by J Monod as the “recognition that the essential properties of living beings could be understood in terms of macromolecules” and this is now more usually used to refer to the structure (sequence) and function of macromolecules, especially to DNA sequence. In the late 20th Century, molecular biological techniques became increasingly available to characterise microbial pathogens, including those transmitted via contaminated food or water. Advances in molecular biological techniques allowed the development of more rapid, robust, portable, internationally comparable techniques which allowed unprecedented information for both detection and typing of pathogens, as well as providing data on their potential to cause disease. With these techniques, it is now possible to internationally track pathogens, and allows the identification of

outbreaks and sources of contamination as well as global interventions. Examples of the use of data generated by molecular biological techniques will be given which have helped to control infections due to *Salmonella enterica*, *Listeria monocytogenes*, *Clostridium perfringens*, *Clostridium botulinum* and *Cryptosporidium*. All those involved with the food chain should be aware of the application of molecular microbiology to public health protection.

The Management of Risks Associated with Fresh Produce

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Fresh produce are an important component of a healthy diet and there is an international move to increase their consumption. From 1980 to 2004, the global production per annum of fruit and vegetables grew by 94% and their production and consumption are expected to continue to rise. At the same time concern about the safety of fresh produce is increasing. These commodities have been attributed as vehicles for the transmission of microbial foodborne disease and problems linked with pathogens in fresh produce have been reported in a number of countries worldwide, some of which are ongoing.

The health, economic and trade implications of some of these microbial contamination events have been enormous and brought the safety of fresh produce to the top of both national and international agendas. The Codex Alimentarius Commission has responded by developing specific commodity based risk management guidance and national authorities are reviewing and updating their existing programs to address these risks. FAO and WHO are working with internationally experts to provide advice and guidance in his area. However, so far it is clear that there is no unique and simple solution to managing the risks associated with microbiological hazards in fresh produce. While technological advances can contribute to the solution, this problem has required managers to go back a look at how and where we grow fresh produce as well as what we do with them post harvest. Managing the risks associated with a product that is grown in a natural and vulnerable environment, much of it for raw consumption is a challenge which requires a multisectoral and multidisciplinary approach.

Risk Assessment for Food Allergens: Developments, Issues and Implications

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Over the last two decades, IgE-mediated food allergy has been recognised as an important public health issue, affecting up to 4% of the population. Mandatory declaration of common allergenic ingredients has improved the protection of allergic individuals. However, the inadvertent presence of allergenic substances represents a serious risk because of the possibly severe consequences of exposure to very small amounts of allergen. Complete elimination of allergenic residues is often impracticable and limited to a few specific allergens. Allergen control must therefore start from a thorough assessment of the risk associated with residual allergenic material in order to define the measures to be taken. Increasing amounts of data on individual thresholds of reactivity have opened the way to statistical dose-distribution modelling approaches to characterise the risk from defined amounts of allergen. These approaches have provided a firmer basis for sound, evidence-based decision-making in relation to risk management. They also offer the basis for an informed debate about how to minimise risk, leading to the definition of regulatory or management thresholds which would help both allergic patients and industry. Combined with data on the distribution of allergenic residues in products, they can also be used to generate quantitative estimates of risk and evaluate risk reduction measures. However consensus is still lacking on how to interpret this new knowledge in the overall risk assessment context. A key issue remains how to validate the prediction models, drawing conclusions from studies in clinic patients that can be generalised to the whole allergic population.