

Opening Session Wednesday, 9 June, 9.00-10.30



Welcome Address

Brendan Smith, TD, Minister for Department of Agriculture, Fisheries and Food, Ireland

Mr Brendan Smith TD, was appointed Minister for Agriculture, Fisheries and Food on 7 May 2008. Previously he had served as Minister for Children at the Department of Health and Children from 20th June 2007 and served as Minister of State at the Department of Agriculture and Food with special responsibility for Food and Horticulture from September, 2004.

Brendan Smith has been a full-time Public Representative and a Dáil Deputy for the constituency of Cavan-Monaghan since 1992. He also served as a Co-Chairman of the British-Irish Inter-Parliamentary Body from 2002 to 2004.

Brendan Smith has also served as a member of the Cavan Vocational Education Committee including Chairman of the Board of Management of Cavan College of Further Studies and Chairman of the Board of Management of Virginia College.

Born in Co Cavan in June, 1956, he was educated in St. Camillus College, Killucan, Co Westmeath and graduated from UCD (BA in Politics and Economics).



Introduction to IAFP and the Symposium

*Vickie Lewandowski, Kraft Foods, United States
IAFP President*



Keynote Lecture: Food Safety in a Global Market

Alan Reilly, Food Safety Authority of Ireland, Ireland

In a global market, food safety is of fundamental importance to both exporters and importers, as it is a prerequisite for market access. In recent years we have seen an increase in the volume of foods traded internationally, and a world-wide expansion in the length of the food chain. Problems that may have been localised in the past can now very quickly escalate to a global dimension. The consequences of placing unsafe food on the market can be severe for consumer health and the damage to national reputations and economic development can be devastating. The anticipation and identification of emerging risks associated with food traded internationally are challenging issues facing many national food safety control organisations. It is not practical to test all

foods at the port of entry, or for importing countries to exert controls on food production and processing in the exporting countries.

In order to ensure food safety in a global market there is a growing need to build closer links between food safety authorities internationally, to develop systems for the rapid exchange of information on routine and emergency food incidents and to build trust in national food safety control programmes. While the specific nature of risks associated with foods traded globally depends on the level of health protection considered to be appropriate in the importing country, it is imperative that the best scientific evidence is used in assessing this risk and there is a consistency of approach based upon the guidelines of the Codex Alimentarius.

It is a reality that globalisation of the food chain is likely to become more important in the future. The way forward is to have robust national food safety control systems in place that can deal with food safety issues by rapidly assessing risks, communicating and disseminating information and that can take appropriate management actions to protect consumers' health. Official national controls must be complemented by the implementation of risk-based food safety management systems at production and manufacturing level by food business operators.

Plenary Session – Wednesday, 9 June, 11.00-12.00 **Chair, Jim Buckley**



Investigation of Outbreaks: the Public Health Aspect
Margaret O'Sullivan, Health Service Executive-South, Ireland



Benefits and Risks of the Use of Chlorine-containing Disinfectants
Steve Crossley, The Food and Environment Research Agency, United Kingdom

Established methodologies for the assessment of human health risk to individual microbiological or chemical hazards in food are available. National food regulatory agencies have successfully applied these methodologies for a number of years and risk assessment methodologies have also been agreed internationally through the work of the Codex Alimentarius Commission.

However, risk assessments have historically been done separately from any consideration of the human health benefits (including the reduction of health risks). Over the last few years there have been a number of initiatives which aim to help policy makers and risk managers make more-holistic and evidence-based decisions through the development of risk-benefit analysis methods and approaches. In addition, the FAO and WHO used a risk-benefit approach for the first time in 2008 in the consideration of chlorine-containing disinfectants by

an expert consultation. This presentation will give an overview of the development of risk-benefit methodology and outline some case studies.

Parallel Session – Wednesday, 9 June, 13.30-15.00, Room 1 **Persistence and Survival of Pathogens in Dry Food Processing** **Environments**

ILSI Europe Sponsored Session

Chairs, Peter McClure and Han Joosten



Resistance of Pathogens in Dry Environments – European Perspective

Roy Betts, Campden BRI, United Kingdom

Many food products utilise some form of low water activity to enable them to be stable and achieve a longer safe shelf life. Low water activity is a well accepted and widely used hurdle, however whilst most organisms are unable to grow at low A_w values, many will survive. Indeed, not only is survival for long period possible, being within a dried matrix can actually increase the ability of organisms to survive other stresses. It is of the greatest importance that food microbiologists understand both the positive and negative issues of the use of low water activity in food preservation. Over recent years we have seen numerous recalls and outbreaks occurring throughout the world, resulting from the survival of pathogens within various low A_w products, flour, seeds, nuts, powders, peanut butter, chocolate, sesame products, herbs, and spices have all been involved. This paper will examine the issues of pathogens in low A_w environments, their survival and resistance to other processes.



Potential Control Measures to Eliminate Pathogens from Dry Foods

Rijkelt Beumer, Wageningen University, The Netherlands

Food safety nowadays starts with pre-harvest and harvest conditions, which is almost impossible in certain countries. In the post-harvest environment, food safety becomes less commodity oriented, as the food moves through processing into the distribution and retail sectors. The microbial controls applied in the post-harvest environment are often designed to be (partly) lethal (pasteurisation, sterilisation) or may be intended to limit the growth of microorganisms. The latter often used with a combination of growth limiting factors (hurdle technology).

From 1980, a number of methods have been described to detect foodborne pathogens, and to decrease the microbial contamination of various food products. Numerous studies have been published on the effect of preservatives and new techniques on these organisms, in combination with Hazard Analysis Critical Control Point (HACCP). Moreover, an army of risk assessors tries to formulate Food Safety Objectives in order to reduce the burden of food borne diseases.

Food safety must be a paramount concern in food processing. Current standards require an integral approach that considers every step, from “farm-to-fork”, because each stage has an effect on the safety of the final product. The current way to represent this

approach is through the Food Safety Objective (FSO) concept described in equation (1), for each pathogenic microorganism at the point of consumption:

$$H_0 - \sum R_i + \sum G_i + \sum C_i \leq FSO \quad (1)$$

where:

H_0 is the \log_{10} of the initial concentration; R_i is the \log_{10} reduction caused during step i ; G_i is the \log_{10} growth resulting during step i ; C_i is the log increase due to (re)contamination during step i ; FSO is the Food Safety Objective.

At each step of production the same approach can be applied; the target to be achieved at each step is called the performance objective (PO). For the final step performed by the consumer, just prior to consumption, the value can appropriately be considered an FSO. In order to meet the FSO at the end of the chain, one can set POs along the chain to indicate the targets at earlier stages; targets that will allow the FSO to be met. In this manner responsibilities and specifications of all partners in the chain may be quantified, agreed and agreed upon and will be transparent.

Using this procedure will make it possible to identify the most effective combination of control measures (e.g., zoning, heating, radiation, gassing) for pathogens in dry products.



***Salmonella* in Low-moisture Products – United States Perspective**

Jenny Scott, U.S. Food and Drug Administration-CFSAN, United States

Although *Salmonella* cannot grow in low-moisture food products, it can persist for long periods of time and can cause illness if these foods are ingested without a *Salmonella* kill step. Several years ago the U.S. had an outbreak of salmonellosis from contaminated breakfast cereals, a product considered low risk.

We had two outbreaks from raw almonds and one from a snack food, which also had not been considered risky foods. Most recently in the U.S., we have experienced two major foodborne outbreaks from peanut butter. The most recent outbreak was followed by the detection of *Salmonella* in pistachios. As a result of these events, FDA conducted inspection assignments of peanut butter and nut processing facilities, which has resulted in additional findings of *Salmonella* in a variety of nuts and in the processing environment. Processors are increasingly testing low moisture ingredients, and the finding of *Salmonella* in ingredients such as whey protein, hydrolyzed vegetable protein and soy flour has led to numerous recalls of products made with these ingredients. In some instances products found to contain *Salmonella* received a kill step, but the environment was contaminated and recontamination was not prevented. The industry needs to implement control measures for *Salmonella* in low-moisture foods, including validating kill steps and monitoring the environment to assess the potential for contamination from the environment. The U.S. FDA is taking action against products that contain *Salmonella* and against companies that are producing low-moisture food products under unsanitary conditions as evidenced by the presence of *Salmonella* in the environment.

Parallel Session – Wednesday, 9 June, 13.30-15.00, Room 2

Chemical Contaminants

Chairs, Leon Gorris and Steve Crossley



Melamine – A Wake-up Call to Strengthen Adulteration Prevention

Pascal Zbinden, Nestlé Research Center, Switzerland

Already at the beginning of the 19th century initial investigations against fraudulent practices led to the identification of toxic colouring metals in food and drinks. Nowadays, with the globalization of the raw material supply which makes difficult the control of the raw material origin together with the fights for the business and prices, food adulteration is an increasing threat. The recent Chinese melamine crisis, which led to human death, drew the attention of the whole community. This incident had global consequences and demonstrated that every partner in the value chain, suppliers, manufacturers, retailers and governments has an important role to play in preventing fraud. All criteria for food raw materials payment are potential sources of adulteration. In addition to adulterants used to increase the yield/volume of a raw material or the level of its major constituents, several compounds are added to preserve its physico-chemical structures or as bacterial inhibitors. Furthermore, adulteration may also occur indirectly (e.g., in milk) by addition via the feed. Looking for potential milk adulterants, a long list of compounds can be identified which have already been used in the past. However, several new compounds at risk, such as protein hydrolysates from the leather industry, can be added. These changes require a quick adaptation on the way we manage the risk related to raw materials and emphasize the need for new analytical strategies to prevent adulteration and limit the number of specific analyses.



Application of the BRAFO Framework to Heat Processing Contaminants

Alessandro Chiodini, ILSI Europe, Belgium

BRAFO stands for Benefit Risk Analysis for Foods. This European Commission funded project aims at developing a framework that allows quantitative comparison of human health risks and benefits of foods and food compounds based on a common scale of measurement. It is based on the evaluation of changes in the quality/duration of life using a system weighting data quality and severity of effect, with quantification by DALY-like methodology. A methodology group brought together methodologies from several disciplines relevant to the evaluation of risks and benefits in food. This group reviewed and assembled the methodologies available. They produced a guidance document that describes a tiered ('stepwise') approach for performing a risk and benefit assessment of foods. This process starts with a pre-assessment and problem formulation step to set the scope of the assessment. This includes defining two scenarios for comparison in the assessment: the reference scenario, and an alternative scenario. The approach consists of 4 tiers. In many cases, a lower tier assessment using simple methods may be sufficient to show a clear difference between the health impacts of the two scenarios. In other cases, increasingly sophisticated methods are used at higher tiers until there is sufficient certainty for decision-

making. The development of the risk-benefit framework was expedited by its use on a number of selected examples (e.g., fish, folic acid, acrylamide...) that showed that the BRAFO methodology is applicable to different kind of foodstuff and food components. It is intended that this framework is sufficiently transparent to serve as a reference for the harmonisation of the evaluation methods used within the European Union and more widely in international evaluations.



Migration of Chemicals from Packaging Materials into Food
*Steve Crossley, The Food and Environment Research Agency,
United Kingdom*

Parallel Session – Wednesday, 9 June, 15.30-17.00, Room 1
**Underpinning Food Safety Through Veterinary Public Health Initiatives –
The Story of *Salmonella* Agona**
Chairs, Seamus Fanning and Cliodhna Foley-Nolan



**Links between Veterinary Public Health and Food Safety – How
to Prevent an Outbreak**
James Buckley, Cork County Council, Ireland

VPH is defined as the sum of all contributions to the physical, mental and social well being of humans through an understanding and application of veterinary science.

Food safety is the product of complex interactions between environmental, cultural and socio-economic factors. Animals are hosts/vectors/reservoirs for many emerging and important foodborne diseases including those caused by verocytotoxin-producing *E.coli*, *Salmonella* spp. and *Campylobacter* spp.

Microorganisms originating from animal sources, i.e., *Salmonella* Agona strains and *Listeria* spp. in particular, may readily adapt in hostile environments and survive, proliferate and transmit in planktonic or biofilm formats. Controlling and preventing zoonotic disease outbreaks is a multi-disciplinary and multi-faceted endeavour. VPH is particularly needed to develop and implement guidelines for surveillance, diagnosis, and control of these diseases in animals, animal tissues and the environment.

VPH expertise can link directly to the following primary components of foodborne disease surveillance:

- Investigation of outbreaks associated with events and establishments
- Pathogen identification and characterisation
- Determination of risk factors for infection/contamination
- Environmental monitoring

Molecular sub-typing methods, such as PFGE, can help with diagnostic epidemiology and identification of factors predisposing to enhanced virulence within individual groups of pathogens. These criteria may improve the specificity of the case definition and may help to identify the likely source of an outbreak.

VPH guidelines on bio-security for food animal production/ processing systems, may contribute to the prevention of zoonotic disease outbreaks.



Public Health and Consumer Issues Associated with Systems Failures

Patrick Wall, University College Dublin, Ireland

The complexity of the modern food chain with global sourcing of ingredients and co-mingling of components from different destinations in finished product means that, when an adverse event occurs, recalls can be difficult and identification of the original source of the contaminant problematic. A company's reputation and brands are often only as secure as the standards of its weakest supplier and the most robust food safety management systems can come under pressure if sufficiently challenged.

If food is internationally sourced and distributed so also is the media however information, or misinformation, travels much faster and the media is open for business 24 hours per day 7 days per week. With the increasing use of new channels for communication such as social networks on the internet, twitter and SMS texts no story will remain untold for long. Both company reputations and consumer confidence are easily eroded. Being associated with a scare in the early stages even if subsequently the company is proven to be an innocent party can have serious commercial consequences.

Food poisoning can be a mild illness for a robust adult but for a frail elderly person, an infant, or somebody suffering from some concurrent morbidity, it can be a life threatening illness so food has to be safe for the weakest customer consuming it. Increasing amounts of food consumed outside the home and a lack of knowledge of the risks associated with food handling and preparation in many domestic and commercial kitchens means that a company's products may be at risk of insufficient cooking, cross contamination or poor chill chain control.

An increasingly litigious society and the power of the forensic microbiologist mean that systems failures can have legal consequences as well as commercial ones. Crisis management is just damage limitation and the emphasis has to be on prevention with systems constantly being reviewed and updated.



Antibiotic Resistance in the Food Chain

John Threlfall, Health Protection Agency, Centre for Infections, United Kingdom

Antimicrobial resistance was recognised as a potential problem for the treatment of diseases caused by enteric bacteria in both humans and food production animals as long ago as the 1960s. Concern about the origins of resistance in such strains, and the possible role of antibiotics in food animals, particularly calves, contributed significantly to the formation in 1968 of the "Swann Committee", tasked with investigating the contribution of

antibiotics in food animals to the development of resistance in zoonotic enteric pathogens. The recommendations of the Swann Committee culminated in the withdrawal of antibiotics as growth promoters in the UK and in due course in the European Union. Nevertheless, resistant strains have continued to proliferate, and at present there are increasing problems not only with a global increase in the occurrence of strains with multiple resistance, but also with the emergence of resistance to antibiotics regarded as 'first-line', or 'critical'.

Salmonella enterica has been regarded as the 'definitive' enteric pathogen in respect of antimicrobial resistance, particularly in relation to its ability to acquire a variety of resistance genes by plasmid acquisition, to develop resistance to certain key antimicrobials by mutation, and also because of the zoonotic reservoirs of many serovars. For the last four decades, the history of multiple resistance in *Salmonella enterica* in the UK has been dominated by three major clones of *S. Typhimurium*, namely definitive phage types (DTs) 29, 204/204c/193 and 104. The most recent epidemic, of multiresistant (MR) *S. Typhimurium* DT 104 (= MR DT 104) with resistance to ampicillin, chloramphenicol, streptomycin/spectinomycin (SSp), sulphonamides and tetracyclines (= ACSSpSuT) has been associated with the 43 kb chromosomally-integrated island SGI-1 in which resistances are contained in a 16 kilobase region. In recent years SGI-1 has been identified in a range of *Salmonella* serovars, which is indicative of horizontal transfer. There has been speculation that SGI-1 has resulted in increased virulence of host organisms and although not proven evidence is accumulating that organisms possessing SGI-1 have enhanced pathogenicity in a nematode model. DT 104 is not the only salmonella organism with multiple resistance and throughout Europe and worldwide emergent multi-resistant monophasic strains of *S. enterica* with the basic antigenic formula 1,4,[5],12:i:- have been associated with a number of human infections since the mid-1990s. Within European countries, two clonal lines of such have emerged over the last two decades. One such clonal line emerged in Spain in the late 1990s and exhibits plasmid-mediated resistance to a range of antimicrobials. In this clonal line resistance has been mediated by unusual plasmid containing resistance genes located within a class 1 integron and also the *spvA*, *spvB* and *spvC* *S. Typhimurium* plasmid virulence genes. The second clonal line has become particularly common in several European member states since 2000. This strain is characterized by chromosomally-encoded resistance to ampicillin, streptomycin, sulphonamides and tetracyclines (= R-type ASSuT) and has been associated with pigs and pig products. The organism has caused numerous infections in humans and has also been responsible for several outbreaks, in some cases with fatalities.

Of particular importance for human health since the early 2000s have been changes in the behaviour of extended-spectrum β -lactamase (ESBL)-producing *Enterobacteriaceae*, not only in the UK but also in Europe, with dramatic shifts in the prevalence and types of ESBLs. CTX-M ESBLs have become dominant, with much greater penetration into *Escherichia coli*, and with many infections in 'complicated community' patients. The epidemiology among producers and the enzyme type produced varies with country, with group 9 (CTX-M-9 and -14) enzymes dominant in Spain and group 1 enzymes (particularly CTX-M-15) dominant in the UK. Animal husbandry, with an emphasis on poultry production with high antibiotic consumption and, as a result, high selection pressure, has been suggested as potentially important for the emergence and spread of transferable β -lactamases.

Extended-spectrum cephalosporins, along with fluoroquinolones and aminoglycosides, are also recommended for the treatment of salmonellosis in vulnerable patient groups and in cases of invasive infection. ESBL-producing *Escherichia coli* and *Salmonella* spp. resistant to ESBLs have been detected in France and Italy since 1989 and 1990, respectively. Subsequently there has been the proliferation in European countries of *Salmonella* isolates containing ESBL enzymes with the ability to hydrolyse and confer

resistance to cefotaxime (= CTX-M). CTX-M ESBLs have been identified in at least 9 European countries in a diversity of serovars, in isolates from both cases of human infection and from poultry. Serotypes containing CTX-M ESBLs include; Virchow; Enteritidis; Typhimurium; Mbandaka; Oranienburg; Bovismorbificans; Stanley. CTX-M ESBLs identified include: CTX-M-1; CTX-M-2; CTX-M-3; CTX-M-5; CTX-M-6; CTX-M-9; CTX-M-14; CTX-M-15; CTX-M-17/18; and CTX-M-57. In most cases the CTX-M enzymes have been located on high molecular mass transferable plasmids. The most common serovar with such CTX-M ESBLs has been Virchow, with isolations from both poultry and humans in several European countries including Belgium, France, Spain, Turkey and the UK. Different CTX-M ESBLs have been identified, but CTX-M-9 has predominated. Strains with CTX-M ESBLs are frequently resistant to other antimicrobials, and such genes may also be present on CTX-M plasmids. Also of concern is the increasing proliferation of strains of *Salmonella* of a variety of serovars with transferable resistance to quinolone antibiotics. In some cases this has resulted in an increase in the level of resistance to fluoroquinolones to therapeutic levels. Co-transmission of plasmid-mediated resistance to both β -lactamases and quinolones has been demonstrated, which is clinically important as co-selection of resistance by use of either agent may occur. A further concern has been the identification of strains of *S. oranienburg* from a hospital outbreak of salmonellosis in Poland in 2002 possessing a plasmid coding for resistance to aminoglycosides (armA) and which also encoded a blaCTX-M-3 cephalosporinase. To date plasmid-mediated resistance to quinolone antibiotics in UK *Salmonella* isolates has not been reported in isolates from food-production animals.

Campylobacter is the most-commonly isolated pathogen from cases of food-poisoning, not only in the UK but also in many European countries. As with salmonellosis, antibiotics are not recommended for treatment of uncomplicated campylobacteriosis. Nevertheless, should treatment be required, macrolide antibiotics such as erythromycin, and fluoroquinolones are the drugs of choice. In this respect data for human isolates of *C. jejuni* and *C. coli* from Denmark, the UK, the USA, Italy, Finland, the Netherlands, France and Spain have demonstrated increases in the incidence of resistance to fluoroquinolones from <1% to between 10% (UK) and 80% (Spain) in the 1990s and early 2000s (Enberg et al., 2001). More recent data from the UK demonstrated an increase in the incidence of fluoroquinolone-resistant isolates of *C. jejuni* from cases of human infection from 10% in 1993–96 to 21% in 2003. As poultry is generally regarded as a primary reservoir for *Campylobacter*, the use of fluoroquinolones in this food animal was considered an important contributory factor.

The events documented above have again led to speculation about the role of antimicrobials in animals bred for food in contributing to the development and spread of such strains. This has culminated in the 2008 report from the Chief Medical Officer, who has stated that in addition to the substantive use of antibiotics in human medicine, antibiotics are also used in large quantities on animals, thereby adding to the threat of resistance. Following on from this observation, he recommended that there should be a ban on the use of certain types of antibiotics (quinolones and cephalosporins) in animals, in order to protect their activity in humans. Whether such a ban can be implemented unilaterally is debatable, but the comments in the report do highlight increasing concern about the use of certain key therapeutic animals in livestock.

Parallel Session – Thursday, 10 June, 9.00-10.30, Room 1

Surveillance and Ecology – Supporting Food Safety

Chairs, Vickie Lewandowski and John Threlfall



Applying Molecular Approaches to Control *Cronobacter* in the Manufacturing Environment

Seamus Fanning, University College Dublin, Ireland

Enterobacter comprises a heterogenous group of bacteria within the *Enterobacteriaceae* family with several distinct species being recognised. Following a recent taxonomic revision, a new genus, *Cronobacter*, was devised that is synonymous with *Enterobacter sakazakii*, and which currently consists of five distinct species and one genomospecies.

Cronobacter spp. (formerly know as *Enterobacter sakazakii*) is recognised as an important foodborne pathogen, especially by the manufacturers of powdered infant formula (PIF). Clinical cases of infection have been epidemiologically linked to contaminated batches of PIF and cross-contamination following infant formula preparation.

This bacterium presents a significant challenge to all PIF manufacturers. The industry has been actively engaged in efforts to eliminate this organism from their production settings. Correct identification of *Cronobacter* is an important first step towards the development of appropriate protocols to control the ecology of the PIF manufacturing environment. Standardised molecular sub-typing techniques have long been regarded as useful tools to aid our understanding of microbial ecology, along with the broader epidemiology of the members of the *Cronobacter* genus. Over time, these approaches can demonstrate the dynamic colonisation events that arise in response to hygienic measures being applied. Persistent colonizers, when identified and further investigated, may reveal those phenotypes consistent with their survival status.

In this presentation, the application of pulsed-field gel electrophoresis (PFGE) as applied in a PIF manufacturing environment will be described. Developments towards establishing a standardised PulseNet-based protocol in collaboration with the Centers for Disease Control & Prevention (CDC) and other laboratories, will be described. Finally some of the benefits of using a PFGE protocol, integrated along with the routine hygienic management practices will be illustrated.



Tracking Norovirus

Erwin Duizer, RIVM, The Netherlands

Noroviruses are currently recognized as one of the major causes of gastroenteritis and are a major foodborne pathogen. Human noroviruses are considered exclusively human pathogens. Zoonotic transmission of norovirus is not believed to significantly contribute to the vast number of norovirus infections occurring every year worldwide and in all age groups. Until recently, detection of noroviruses in faecal patient samples was restricted to few specialized laboratories and detection of norovirus in foods was

even more limited. Nowadays, molecular detection of norovirus is widespread, EIAs and even bedside tests have become available and methods to detect these viruses in different food matrices and water are being performed in specialized laboratories.

The improved detectability is completed with molecular typing (see the norovirus quicktyping tool at www.fbve.nl), which is collected in a database together with epidemiological data to study the transmission and emergence of norovirus strains. The most prevalent strains in the general population belong to genotype II.4 and primarily spread through person-to-person transmission. In foodborne norovirus outbreaks, a relatively high fraction of the viruses detected belong to different genotypes, reflecting different routes of contamination. This insight can now be used to direct effective use of time and money in studying outbreaks for which foodborne transmission is believed to be involved (<http://www.noronet.nl/fbve/databases/>). In addition, retrospective analysis of the databases increased the number of detected international foodborne clusters by 450%.

To date, several food commodities have been ranked by WHO/FAO as high risk food for foodborne infections and outbreaks. The virus-commodity combinations selected were norovirus and hepatitis A virus (HAV) in shellfish, fresh produce and prepared (ready-to-eat) foods. The appreciation of the relevance of foodborne viruses is currently being formalized by the preparation of guidelines for viral food safety in the Codex Alimentarius.



Tracking *Campylobacter*

Jacob Roland Pedersen, Lantmannen Danpo A/S, Denmark

Lantmännen Danpo A/S (Danpo) is a Danish slaughterhouse of broilers which process approximately 170,000 birds per day. Danpo is part of the largest broiler industry in Scandinavia, Lantmännen Kronfågel Holding, which operates in Denmark and Sweden.

Danpo has been leader in the battle against zoonosis during the last decades in Denmark. Working closely together with the Veterinary authorities, Danpo has produced the first not-cooked chicken products marked as free of *Salmonella* and *Campylobacter*.

The results are made during long and intense focus on risks of infection from soil-to-table, close surveillance of flocks and sanitation when problems occur. The battle is still ongoing.

Parallel Session – Thursday, 10 June, 9.00-10.30, Room 2

Decision Support Tools for Food Safety

Chairs, Leon Gorris and Ann Marie McNamara



Emerging Decision Support Tools for Food Safety in the United States

Lee-Ann Jaykus, North Carolina State University, United States

The importance of food as a vehicle of disease transmission to humans is undisputed. However, given the vast array of potential hazard-commodity combinations, prioritization of which combinations deserve the greatest input of resources and/or the most timely intervention, can be a daunting task. Risk ranking, sometimes referred to as comparative risk assessment, can be a useful tool in the establishment of regulatory program priorities and identification of critical

research needs, especially when faced with competing risks. Such models vary in complexity from simple, qualitative exercises to more complex semi-quantitative and even fully quantitative approaches. In this presentation, we will review a variety of food safety risk ranking models which have been developed in the past decade, pointing out various strengths and weaknesses. We will then discuss in greater detail specific risk ranking approaches which are under development in the U.S. and their potential uses for prioritization purposes.



Decision Support Tool for the Control of *Salmonella* and *Campylobacter* in Poultry

Sarah Cahill, Food and Agriculture Organization of the United Nations, Italy

Making risk assessment more accessible to both risk managers and food control authorities with limited resources to invest in developing their own risk assessment models is a critical element to ensuring that more food safety measures are based on an appropriate assessment of risk. The development of a decision support tool for the control of *Salmonella* and *Campylobacter* in poultry aims to contribute to this need. Moreover, it also is being developed in conjunction with Codex guidelines for the control of *Salmonella* and *Campylobacter* in chicken meat and therefore, when both are complete, can be used together by risk managers to select appropriate control measures based on risk and also demonstrate their impact relative to other control measures.

The tool allows the consideration of control measures in three main areas, i) primary production, ii) processing and iii) distribution and preparation. Each of these areas is subsequently broken down into a series of steps and those relevant to the user can be selected for the assessment. The assessment can be undertaken for either one or both pathogens. An input at each of the relevant steps, in terms of prevalence and/or concentration of the pathogen of concern, is at the discretion of the user. This means that if the user has data specific to his/her situation this can be inputted to the model. If not, relevant data from the literature can be substituted or assumptions can be made. The output is expressed in terms of relative risk. The tool aims to be user friendly and rapid in terms of its outputs. It is one of several tools being developed by FAO/WHO to make microbiological risk assessment more accessible and timely.



Using Risk Rangers in Food Safety Decision Making

Leon Gorris, Unilever, SEAC, United Kingdom

Many expert tools and decision systems have been developed in recent years to assist in different aspects of food safety management. Well known are software packages for predictive modeling of microbial growth and inactivation that can be used to simulate the potential of pathogenic microorganisms to survive and proliferate in foods. Software systems dedicated to making risk-assessment and risk-management approaches publically available have been established under the auspices of FAO and WHO and in the context of Codex Alimentarius guidance for food safety management. The small software system referred to as Risk Ranger and developed at the University of Tasmania several years ago, offers a number of interesting possibilities as judged by the recent uptake of the system in research and publications on microbiological food safety management. Risk Ranger can be used to

estimate the public health risk in a country associated with a particular pathogen associated with a food product or food context. The public health output is a relative risk level. Different “what-if” scenarios can be determined and as a whole can be ranked to evaluate the impact of mitigations and the importance of individual risk contributing parameters. The system uses transparent pre-defined default values and value ranges for the various parameters, but tailored values can be chosen as well. Uses of Risk Ranger include the establishment of risk profiles for food product categories and to risk rank pathogen/product combinations such that a priority listing is made to guide decisions of further action. Risk Ranger is also proposed to be of value in the context of Hazard Analysis Critical Control Point (HACCP) planning. Different aspects of the utility of Risk Ranger will be reviewed in more detail in the presentation.

Parallel Session – Thursday, 10 June, 11.00-12.30, Room 1 Pathogens Update

Chairs, Wayne Anderson and Geraldine Duffy



Non-O157 Shiga Toxin-producing *E. coli*: Role in Human Disease and Detection in Foodstuff

Alfredo Caprioli, Istituto Superiore Di Sanita, Italy

Shiga toxin-producing *Escherichia coli* (STEC) are foodborne pathogens causing severe human infections. In 2008, 3159 cases of VTEC infection and 146 cases of hemolytic-uremic syndrome were reported to the European Centre for Disease Control and Prevention. 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 are referred to as enterohemorrhagic *E. coli* (EHEC). EHEC causes attaching and effacing lesions (*eae*) on the intestinal mucosa and are characterized by a low infectious dose, requiring very sensitive methods for food testing. Standardized methods are available for STEC O157, while for serogroups other than O157 the issue is still under debate. A strategy directly targeted to a restricted number of STEC/EHEC serogroups has been recently proposed by the European Food Safety Authority (EFSA) in its scientific report on the “Technical specifications for the monitoring and reporting of VTEC on animals and food” (*EFSA Journal* 2009; 7: 1366). 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.



***Mycobacterium avium* subsp. *Paratuberculosis* (MAP) – Occurrence, Detection and Inactivation in Foodstuffs**
John Donaghy, Agri-Food and Biosciences Institute, Northern Ireland

Mycobacterium avium subsp. *paratuberculosis* (MAP) is unequivocally pathogenic to animals, being the etiologic agent of Johne's disease – an intestinal inflammatory disorder showing similarities to human Crohn's disease. Much controversy surrounds the zoonotic potential of MAP and its role (if any) in Crohn's disease.

In most countries where MAP surveillance is performed, the disease is present in commercial livestock that supply dairy and meat products. Raw cows' milk may be contaminated with MAP through systemic milk infection or faecal contamination. Many studies have indicated the presence of MAP in raw milk and others have detected viable MAP in retail milk and other dairy products. The dissemination of the disease to animal organs/tissues also represents a route of transmission of MAP to the food chain. Limited studies have reported the isolation of MAP from lymph nodes and organ tissue from MAP-infected cattle.

Thermal inactivation studies have shown conflicting results. Under certain conditions, MAP has been shown to survive milk pasteurization although the process may achieve at least a 4 to 7 log reduction. MAP declines only slowly during cheese-making and ripening and various levels of inactivation have been demonstrated using high pressure processing (4–6 log reduction at 500MPa), UV radiation (< 1 log reduction at 1000mJ/ml) and pulsed electric fields (5.9 log reduction at 2,500 pulses, 30kV/cm).

Detection methods for foodstuffs have involved both culture and molecular approaches. Culture methods are normally preceded by decontamination followed by protracted culture in media. Less conventional liquid culture methods such as BACTEC, MGIT, TREKK and FastPlaque assays have also been devised for MAP detection in foodstuffs. Classical and real-time PCR assays are widely used for MAP detection in dairy products with the insertion element IS900 and f57 being the predominant genetic targets to date.

Interventions in Poultry Production/Processing to Reduce the Burden of Campylobacters on Poultry Meat

John Moore



New Insights into the Ecology of Virulent Strains of *Vibrio vulnificus* and *Vibrio parahaemolyticus*

Lee-Ann Jaykus, North Carolina State University, United States

The *Vibrionaceae* are environmentally ubiquitous to estuarine waters. Historically, the importance of *V. cholerae* is well established, but two other species (*V. vulnificus* and *V. parahaemolyticus*) are increasingly recognized as important human pathogens that are transmitted by the consumption of molluscan shellfish. However, not all strains of *V. vulnificus* and *V. parahaemolyticus* are created equal. In this presentation, we will describe how “virulent” and “avirulent” strains of *V. parahaemolyticus* and *V. vulnificus* are discriminated from one another. We will then discuss how these virulence profiles vary as a function of temperature

(seasonality) and how this variation is likely to be associated with human disease. The potential role for global climate change on the epidemiology of the pathogenic *Vibrio* species will also be covered. These pathogens provide a unique food safety challenge, including substantial genetic diversity which leads to unpredictable evolution patterns and associated human disease. Candidate control options being considered in the U.S. will be identified in the context of a risk-based management strategy.

Parallel Session – Thursday, 10 June, 11.00-12.30, Room 2

Emerging Food Safety Issues

Chairs, Vicki Lewandowski and Margaret Patterson



Addressing Emerging Issues of Food Adulteration and Authenticity

Adrian Charlton, The Food and Environment Research Agency, United Kingdom

Food authentication is often associated with the protection of traditions and trade through the verification of food-labelling claims, whilst its role in a food safety context is less widely appreciated. Food adulteration is primarily motivated by unscrupulous suppliers wishing to return a short term profit by mislabelling goods. However, the implications of food fraud are far more widespread than simply defrauding the purchaser.

Recently, milk products were adulterated with melamine and the products mislabelled in relation to their protein content, a practice that was clearly financially motivated. The fraud resulted in several fatalities in children who were exposed to adulterated infant formula. Similarly, the use of dyes to enhance the colour of products such as saffron was an adulteration designed to improve the saleability of goods by enhancing their appearance. The increased public exposure to a range of potent carcinogens was merely a bi-product of the fraud. Other issues such as the addition of protein from cows and pigs to chicken products pose ethical and religious questions.

Some of the issues that have been faced in recent years will be presented along with the science of food verification. This presentation will also consider some of the analytical challenges that we face in addressing emerging issues so that unknown risks in the food that we eat can be effectively managed.



The WHO Initiative to Estimate the Global Burden of Foodborne Diseases: The Example of Echinococcosis

Paul Torgerson, University of Zurich, Switzerland

The World Health Organisation is currently leading an initiative to estimate the global burden of foodborne disease. A major objective of this study is to provide UN member states with evidence as to the major causes of foodborne disease, in terms of human morbidity, disability and mortality and their relative importance in the different WHO regions. The major groups of foodborne diseases have been identified as chemical contaminants of food and infectious diseases – the latter principally divided into diarrheal and parasitic diseases. In addition, methodology to assign source attribution of chemicals or pathogens is being developed and studies on specific representative countries will also be undertaken. One study that has been completed under this initiative is an estimate of the

global burden of alveolar echinococcosis (AE). AE is a potentially fatal human disease caused by the larval stage of the fox tapeworm *Echinococcus multilocularis*. Humans can become infected with this parasite by consuming food contaminated with tapeworm eggs. This study indicates that there are approximately 18,000 deaths globally per annum caused by *E. multilocularis* and over 600,000 Disability Adjusted Life Years lost. Up to one third of this may be due to the consumption of contaminated food. The example of echinococcosis will be used to illustrate the aims, scope and methodology of the global burden of foodborne diseases initiative.



Allergen Control and Management: An International Regulatory Perspective

Steven Rizk, MARS North America, United States

A food allergy is an immune-system response to a food that the body mistakenly believes is harmful. Over the past 20 years there has been an apparent increase in prevalence and severity of food allergies.

Evidence suggests that true food allergy affects about 2–4 % of adults and 2–8 % of children in most markets. These food allergic reactions can take on a number of symptoms ranging from relatively mild hives or rash to severe anaphylactic shock or even death. Although people can be allergic to any of over 160 foods, in most markets there is a list of 8–10 that account for greater than 90% of all food-allergic reactions. There is no cure for food allergies. Specific avoidance diets are the only reliable method for the reduction of adverse reactions. Therefore, food-allergic consumers must rely upon food labels and information provided by the food industry to effectively avoid adverse reactions. This presentation will provide an overview of food allergens, a discussion of global allergen lists, a comparison of international labelling regulations as well as elements that should be considered as part of a company's allergen management plan.

Parallel Session – Thursday, 10 June, 14.00-15.30, Room 1 **Rapid Methods and Method Validation: Perspective and Needs in the Modern Food Industry**

Chairs, Stefano Colombo and Ann Marie McNamara



Selection Criteria for Rapid Methods

John Marugg, Nestlé Research Center, Switzerland

Microbiological testing remains an important tool in the verification of HACCP, and the number of required analyses is increasing. Since release of ingredients and end products is in most cases, directly linked to obtaining negative analytical test results, detection methods need to be quick, easy and reliable. Furthermore, for the monitoring of production environments it is important to know about potential problems as fast as possible, to implement corrective measures that may have an impact on ongoing production processes.

The development and commercialization of rapid methods has been expanding over recent years. As a result, many laboratories within food manufacturers like Nestlé have been confronted with increasing pressure from manufacturers and suppliers to accept their methods, kits, or systems. Nestlé's selection process for rapid methods includes evaluation of the needs for specific, rapid methods within the company, and assessment of their technical performance as well as work-load and cost considerations.

The evaluation and validation of rapid microbiological methods requires a standardised and systematic comparison, as described in ISO16140-2003, to reference and standard methods (e.g., ISO/CEN/BAM methods). Nestlé's selection process relies on official validation studies by recognized validation bodies like Microval, AFNOR, and AOAC, but where necessary, the studies are complemented with internal data on specific Nestlé products or ingredients. Additional criteria for selecting rapid methods include fast time to results, cost efficiency (in terms of equipment, reagents, personnel, waste disposal), minimal training for technicians, compatibility with normal lab organization, sufficient capacity/throughput, multifunctionality (adapted for *Salmonella*, *Listeria*, etc.) and robustness.



Rapid Methods Needs in a Global Dairy Company

Emmanuel Mallo, Lactalis, France



Diversified Rapid Testing in a Multi-product Food Company

Jan McClure, Unilever, United Kingdom



Rapid Methods: A Meat Industry Perspective

Frank Vandendriessche, Imperial Meat Products, Belgium

The necessity of carrying out microbiological analyses in a meat processing plant is highlighted. The advantages of a company lab versus the use of an external (independent) lab are discussed and an example of the performance of a company lab is presented. A decision tree to justify the choice for a Rapid Microbiological Method is discussed. This is illustrated based on the company's justification to opt for bioMérieux Tempo as a Rapid Method in the company lab.

Parallel Session – Thursday, 10 June, 14.00-15.30, Room 2
Global Food Safety Management Standards – Do They Work?

Chair, David Lloyd



The Certification Body Perspective on Global Food Safety Systems

Harriet Simmonds, N.B. Certification, Ltd., United Kingdom



Managing Food Safety on a Global Basis within a Multi-national Food Company

Ciaran J. Conway



The Effectiveness of Global Food Safety Systems – The Way Forward

Yves Rey, DANONE, France

Food safety is high on political and business agendas and debate has focused on the relationship between official regulations and business driven solutions. Although private standards are based on sound science and generally become the accepted industry norm, they are sometimes perceived as a barrier to trade. Or are they actually an opportunity for businesses to grow and develop? These new forms of regulation require a new reconfiguration of relationships between the state and public and private actors. Learn how the Global Food Safety Initiative is playing a role in this growing trend.

Danone is a Fortune 500 company and one of the most successful healthy food companies in the world. Its mission is to bring health through food to as many people as possible. Fulfilling this mission is a major contributor to Danone's continuous rapid growth. Danone, with 160 plants and around 80,000 employees, has a presence in all five continents and over 120 countries. In 2009, Danone recorded €15 billion in sales. Danone enjoys leading positions on healthy food in four businesses: fresh dairy products (#1 worldwide), water (# 2 on the packaged water market), baby nutrition (#2 worldwide) and medical nutrition. Listed on Euronext Paris, Danone is also ranked among the main indexes of social

responsibility: Dow Jones Sustainability Index Stocks and World, ASPI Eurozone and Ethibel Sustainability index.

Plenary Session – Friday, 11 June, 10.30-12.30

Centre for Foodborne Zoonomics Sponsored Session

Chair, Patrick Wall



Developing a Corporate Food Safety Culture

Ann Marie McNamara, Jack in the Box, Inc., United States

Developing a corporate food safety culture is a critical component for the success of any Food Safety/Quality Assurance department. And the most important requirement for this culture is a corporate commitment to safety and quality as a core value. This core value must be owned by senior management to ensure that sufficient resources are available to assess the safety/quality of products and to reward and enforce food safety practices that reflect this core value. Middle management instills the culture in employees throughout the organization. The role of these leaders is to create sound policies and practices, lead using behavior-based food safety practices, such as “leading by example,” and training employees. Employees at all levels are taught that they alone are responsible for ensuring that the food they produce is safe and of high quality for customers. Employees understand that they will be held accountable for making sound food safety decisions. Food safety as a core value needs to be a priority in every decision employees make. Practical examples for developing a food safety culture will be presented, as well as a video showing a food safety culture in action.



Food Incidents: Bacteria and Beyond

Wayne Anderson, Food Safety Authority of Ireland, Ireland

Between 2001 and 2009 inclusive, FSAI handled approximately 600 full food incidents. These ranged from those that were simply monitored to those that required active FSAI involvement. Food incidents often require the authorities to track and trace unsafe food and this is a dynamic process that expands as information becomes available. Information sources can be epidemiological, analytical or from inspections of food businesses. As affected food is tracked and removed from the market, risk communication is undertaken to protect public health. Over the last decade the role of the food laboratory in food incidents has increased. Advances in analytical chemistry and microbiological techniques allow us to pinpoint unsafe food more easily and with greater confidence. It has also made it more difficult for food companies to hide from their responsibilities.

Using four case studies this paper demonstrates how advances in laboratory techniques have helped the management of food incidents in Ireland, where they have failed to address certain re-occurring issues, how they can pin-point root causes of incidents and where they have outstripped modernization of legislation. Overall this paper illustrates the need for investment in reference laboratory services and improvements in the speed of method accreditation.



Food Safety in 2020...2030...and Beyond

Lee-Ann Jaykus, North Carolina State University, United States

Although foodborne disease has been with us since the dawn of civilization, the concept of controlling the safety of our food supply on the basis of scientifically grounded principles has been practiced for only a few centuries. Early processes such as appertization and pasteurization, the increasing use of microbiological indicators, and the critical need for maintaining the cold chain from farm to fork have done much to reduce the burden of foodborne disease in the developed world. However, our world is changing rapidly and despite our best efforts, microorganisms are creative and new ones seem to pop up in unexpected places. From *Salmonella* concerns in the 1960s to *Listeria monocytogenes* in the 1980s to *E. coli* O157:H7 in the 1990s, we always seem to have one (or more) food safety challenges on our plate. In this presentation, we will interactively attempt to look into the future to predict what will happen in our field over the next few decades. What will be the take-home message? Well, right now, it's a secret...