November 2008
Briefing

BUT *THAT'S* ***NOT*** FOOD!

Food Forensics

When the New Zealand Food Safety Authority (NZFSA), public health organisations and commercial clients want to know what, how and when contamination has occurred in foodstuffs - they turn to ESR's food forensics team.

Inside this issue

Cases range from the curious to the stomach churning. Dozens of times a year, someone confronts a foodstuff with unexplained taints or smells, or contamination with foreign matter such as glass, insects or even rodent droppings.

Clearly, in all such issues of food quality, it's imperative to find out what, how and when contamination has occurred. As well as supporting consumer safety and rapid response actions, the answers can help to clarify any legal liability or insurance issues. Getting the right information can also help to protect the reputation of a company and the commercial value of a product.

Delivering answers is where ESR's food forensics team comes in. The team explores cases of contamination for the NZFSA and commercial clients. Cases involve all kinds of food and food packaging – imported and local, fresh and processed, off the shelf and from restaurants/cafes.

"Food forensics is like CSI - without the bodies" – Darren Saunders, Food Chemistry Technical Advisor

"Increasingly globalised trade has ramped up the importance of monitoring and understanding food safety. For example does that food really contain pork as the label claims?" said Darren Saunders. "Did that insect get into the sauce on the shelf in New Zealand or in the country of origin? Did that hand cleanser shipped alongside that foodstuff leak, giving a dreadful taste or smell?

"The NZFSA submissions generally relate to food complaints under the Food Act 1981. We also get enquiries directly from public complaints.

The commercial work tends to come as part of a corrective action under a manufacturer's Hazard Analysis and Critical Control Points procedures. These jobs are also varied – anything from foreign objects in products to taints from packaging or printed labels," he says.

The ESR food forensic microbiology and chemistry scientists have a formidable ensemble of techniques and expertise to call on.

Protecting reputations

"There is now greater emphasis on manufacturers being pro-active in their food safety plans. ESR is an obvious choice for assisting companies with this work as we are neither the regulator nor the system auditor. We're independent scientific experts, said Mr Saunders.

"Unlike most other laboratories we also have experts in investigation rather than just in routine analysis."

ESR has more than 20 years of experience in working with the food industry to identify and trace foreign material found in food. The ESR food forensic team has up to date and comprehensive laboratory facilities at Christchurch and can undertake investigative work from anywhere.

For a manufacturer, grower, distributor or retailer facing an issue of food safety, an ESR investigation can help to minimise downtime, reduce the risk of product recall and get things back to normal as quickly as possible.

"We deliver a scientifically robust report that can be used to explain how the problem has been dealt with, including improvements in processing to prevent recurrences," said Mr Saunders. " The report is a clear demonstration for auditors and health authorities that the situation has been responded to in a professional way."

(food forensics-continued)

"We have fully equipped analytical laboratories and through our team and collaborators we can access a wider range of expertise including entomologists, botanists and zoologists", Mr Saunders said.

"We are also in the unique position of being able to utilise the facilities at the University of Canterbury and from other ESR science sites to perform particular analyses, which broadens the range of enquiries we are able to deal with. We can also call on the skills and experience of ESR's forensic scientists for further assistance."

Each year the ESR team answers hundreds of queries, including one of the more grotesque contamination issues: the dead mouse found in the food. "The common house mouse appears the world over. However, it's possible that the pollen caught in its fur can tell us where it came from."

Glass

Glass is one of the most common foreign objects encountered in food.

Glass is composed primarily of silicon dioxide along with oxides of elements such as sodium, calcium, aluminium and various metals. Using X-ray diffraction, the exact proportions can be determined.

"This can tell us whether the contamination is from domestic glassware, window glass or lead crystal, Pyrex or tableware," said Mr Saunders.

Microscopic examination of the contaminant's surface can identify the shape and purpose of the original object, helping to track where it's come from and when.

Similar techniques can be applied to geological samples such as asbestos and metallic foreign objects: is that a shard of mixing blade in that candy bar - or something else altogether? Sometimes, of course, there's a benign explanation. "What looks like glass in wine can prove to be tartaric acid crystals and merely an aesthetic issue," he said.

Monitoring **STIs** in Māori

ESR is utilising its surveillance expertise to investigate sexually transmitted infections (STIs) in Maori.

Two STIs, chlamydia and gonorrhoea, affect Maori at disproportionately high rates. Overall rates of chlamydia and gonorrhoea have increased substantially in recent years.

Using Health Research Council funding, ESR is undertaking a feasibility study that focuses on laboratory data and aims to improve the processes for the collection of ethnicity data related to these infections in the Bay of Plenty.

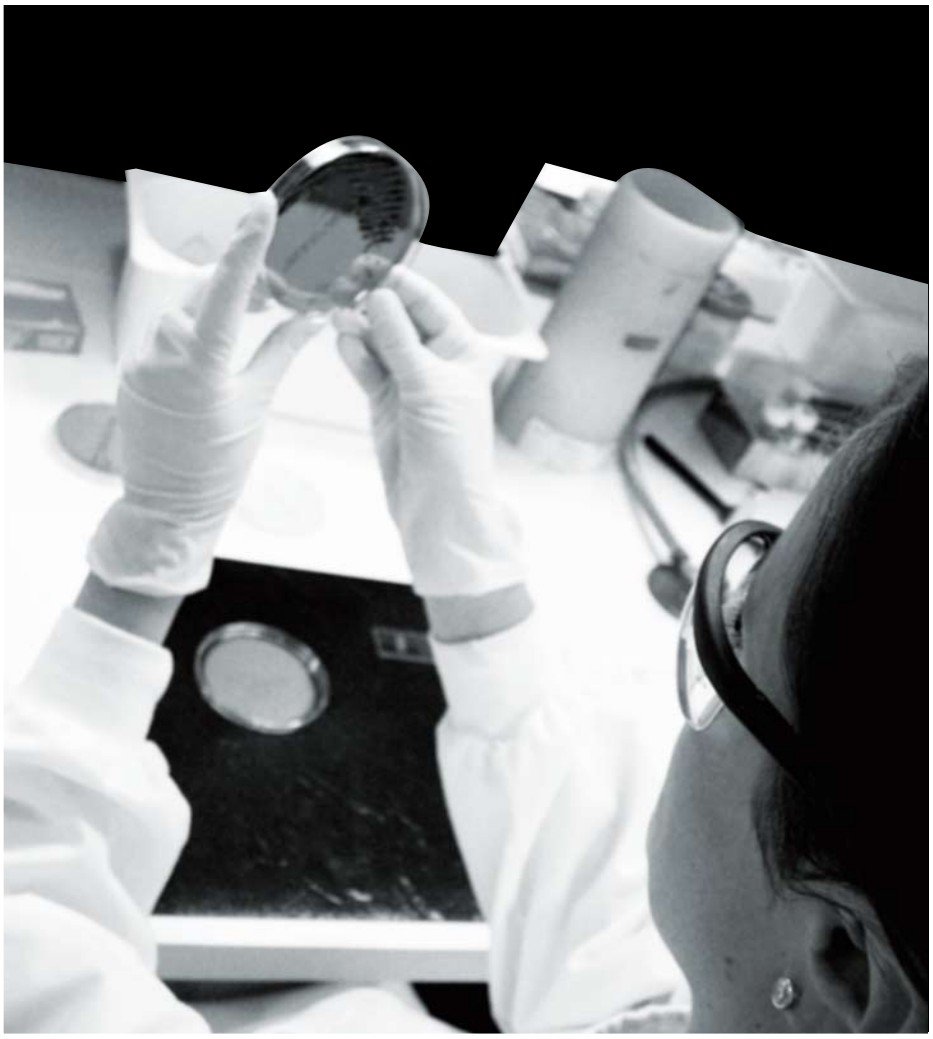
The information gathered will give a more accurate view of how Maori are affected by these two infections, help improve surveillance processes and provide valuable data to inform planning for sexual health services.

- Surveillance of STIs in New Zealand is based on voluntary data from specialist Sexual Health Clinics, Family Planning Clinics, Student Youth Health Clinics and laboratories.
- Chlamydia trachomatis infection is the most commonly diagnosed STI in New Zealand.
- From 2003 to 2007 the number of chlamydia and gonorrhoea cases diagnosed at sexual health clinics by 19.4% and 55.5%, respectively

  Young people remain at high risk of STIs. In
- Sexual Health Clinics, when 72.0% of chlamydia, 61.6% of gonorrhoea, 43.2% of genital herpes and 62.3% of genital warts cases were aged less than 25 years.
- Annual and quarterly STI surveillance data can be accessed at www.surv.esr.cri.nz.

Reverse genetics

produces influenza vaccine virus



ESR scientists have recently trialled a new technique that creates an influenza vaccine virus in less than three weeks compared with the traditional method, which takes several months.

It is the first time in New Zealand that 'reverse genetics' has been used to make a vaccine virus for a human disease. Vaccine viruses are harmless viruses used by manufacturers to make flu vaccines.

Dr Richard Hall, who works at ESR's new science centre at the National Centre for Biosecurity and Infectious Disease - Wallaceville, has been working on the new techniques.

"The influenza vaccine comes from a protein taken from a vaccine virus. This has always been done by growing vaccine viruses in chicken eggs. It is a lengthy and random process in which only one of the many results will be suitable as the right vaccine virus. It currently takes six to eight months to make a vaccine for a new flu virus."

Reverse genetics involves collecting the genes from the outside of a pandemic virus and from the inside of a harmless virus. These are introduced to a cell culture where they merge to become the vaccine virus.

"New Zealand doesn't currently make or plan to make human vaccines. However, the vaccine viruses can be used to make diagnostic reagents, which can be used by any laboratory in tests that identify specific viruses in patients. Generally, you need a version of a virus to match against to be able to diagnose an infection correctly."

Investigating vaccine development

Developing and expanding capability in reverse genetics technology could be crucial in the event of a major flu pandemic.

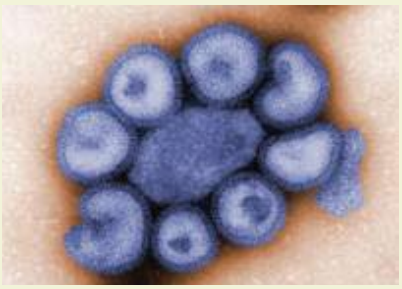
Capability funding has been used to set up the methodology within ESR and train scientists in the methods and controls associated with reverse genetics.

There are no plans to generate a vaccine for avian or pandemic influenza in New Zealand. However, the limited number of vaccine producers worldwide, and the length of time required to produce a vaccine have prompted ESR to investigate the requirements for a New Zealand facility in the event of a pandemic.

Reverse genetics is performed routinely in a number of laboratories around the world. ESR has been collaborating with international influenza experts, New Zealanders Dr Robert Webster and Dr Richard Webby, at the St Jude Children's Research Hospital, Memphis, to learn about these techniques.

- Project Leader Dr Phil Carter said, "The research will enable ESR to provide the government with appropriate advice on vaccine production in the event of a pandemic. It also provides the basis for new areas of research within ESR."
- Reverse genetics is faster and more effective at making influenza than the classical method. A 'seed' strain is created in a rational fashion by selecting which genes should be used. The 'seed' strain can then be used in large-scale commercial manufacture of actual vaccine preparations.
- ESR scientists have made a prototypic vaccine 'seed' strain called 'influenza PR8 virus' through reverse genetics.
- The technique is being undertaken at the National Influenza Centre at ESR's new science centre located at the National Centre for Biosecurity and Infectious Disease – Wallaceville.

One of ESR's international collaborators on reverse genetics, Dr Richard Webby, presented in Christchurch at the Sixth Biosecurity Summit on November 4. His talk was entitled: "Lessons from influenza." Are we well served by New Zealand's science to deliver new technology and approaches to Biosecurity?



To make a vaccine virus, a harmless 'sheep in wolf's clothing' virus is made. It has the external surface of a harmful virus but is primarily made from parts of a harmless flu strain.

New partnership for biosolids research

ESR and Scion have combined research programmes to form a new partnership integrating all of New Zealand's capability in biowaste research.

Biowaste is the organic biodegradable part of New Zealand's municipal, commercial and industrial waste stream, including biosolids and other biodegradable materials.

ESR Programme Leader Dr Jacqui Horswell said that, "With increasing pressure to find sustainable solutions for land and water degradation, new beneficial uses are being sought for nutrient - rich domestic and industrial biowaste.

"Biowaste could be used to rehabilitate contaminated and unproductive land and to build soil quality. However, central and local government and communities need more robust and scientific information to assess the potential benefits and the negative environmental effects of using biowaste.

"For the past 10 years ESR and Scion have operated separate biosolids research programmes. Joining the programmes sees New Zealand's scientific expertise in this field maximised and means we can provide a more comprehensive and integrated science service to central and local government regulators and land users.

"Properly managed biowaste is a sustainable resource that has the potential to provide valuable physical, biological and chemical attributes. However, there can be constraints to biowaste re-use because the level and nature of contamination vary and our knowledge of its contaminant potential is incomplete," she said.

Replenishing soils – biodegradably

NZ's primary industries depend on the top 15 centimetres of soil. Due to intensification, degradation, contamination, urban expansion and erosion, New Zealand loses huge amounts of high-quality, versatile soils each year.

Around 200-300 million tonnes of New Zealand's topsoil are washed out to sea every year. This is 10 times more than anywhere else in the world.

Soil scientists are pinning hopes on building soil by returning biowastes to the land. However the uniqueness of NZ soils, agricultural practices and community require NZ-specific solutions to biowaste re-use.

Ten years of biosolids research

Biosolids (sewage sludge) are an unavoidable end product of modern wastewater treatment systems. Biosolids contain plant nutrients and organic matter and their beneficial recycling to land is an accepted agricultural practice in many countries. However, they can also carry contaminants such as heavy metals and pathogenic organisms, so their agricultural use is heavily regulated.

For the past 10 years ESR scientists have been undertaking research into the safe and beneficial use of nutrient and carbon-rich biosolids on land.

A variety of field trials have been established to look at the effects of metal contaminants and what influences the survival of pathogens when biosolids are applied to land.

The research has specifically targeted the most concerning metals found in biosolids: copper, nickel and zinc, investigating their effects on the soil microbiota, in particular Rhizobium, which is important in New Zealand pastoral systems as the symbiotic relationship between white clover and Rhizobium provides an agronomically important source of nitrogen input into soils. It is also one of the most sensitive soil microorganisms to the toxic effects of heavy metals.

The first field trial was established in 1998 and almost 10 years worth of data has been collected from this site. Both pasture and forestry field trials have been established.

Principal Scientist Dr Tom Spier said while it is still too early to make any firm recommendations, results from the first few years of sampling are indicating, that in most instances, the New Zealand biosolids guidelines for soil limit concentrations are protective of many of the soil biological indices measured.

"All our work is suggesting that symbiotic nitrogen fixation is one of the most sensitive indicators of 'heavy metals' toxicity in soils."

The programme has also been assessing the factors influencing the survival of pathogens in land-applied biosolids.

"We have found that biosolids can enhance the transport and survival of pathogens in soils, and there is potential for the contamination of food crops and surface and ground waters by run-off of pathogens from land-applied biosolids.

"Our results have enabled us to make recommendations of best practice for applying biosolids to minimise public health risks. These include applying them in warmer, drier months where die-off is increased and run-off and leaching risks are decreased.

Research to counter disease threats from climate change

The emergence and spread of infectious diseases outside historical ranges is becoming one of the major international health issues associated with climate change.

ESR is leading a three-year collaborative research project to support central, regional and local authority responses to the potential infectious disease risks posed by climate change.

Project Leader Dr Virginia Hope said that despite the public health implications, only a few studies internationally have attempted to identify and quantify the possible infectious disease risks as a consequence of climate change.

By drawing on the resources, databases and international networks of the three Crown Research Institutes involved, ESR, Landcare and NIWA, and working with a range of stakeholders, the research project will develop a Health Analysis & Information for Action resource system.

"It will provide scientifically robust methods and tools to enable authorities to develop appropriate responses to infectious disease threats related to climate variation and change," Dr Hope said.

The system will enable users to:

- make predictions about the infectious diseases that will be of key concern to human health in the future
- predict changes in the occurrence levels of these infectious diseases owing to climate change and variability
- Identify the communities and population groups most likely to be at risk
- recognise the infectious diseases predicted to threaten specified communities and population groups.

The project involves wide collaboration nationally and internationally, including Massey and Waikato Universities, New Zealand medical practitioners and experts from the World Health Organization. It is funded by the Ministry of Research Science and Technology Understanding and Adapting to Global Environmental Change Portfolio Fund.

ESR at the forefront of recent international forensic science symposium

A strong representation of ESR staff participated in the 19th International Symposium on the Forensic Sciences, in Melbourne, Australia. The theme of this conference was 'Domestic Crime to International Terror: Forensic Science Perspectives', reflecting the great diversity of crimes that often require forensic expertise.

The conference is held every two years and covers a wide range of disciplines, including biological and chemical criminalistics, pathology, toxicology crime scene, and drug analysis. This year there was a particularly strong focus on counter-terrorism forensic science, with keynote speakers attending from the United States, Australia and the United Kingdom. This provided an ideal opportunity for ESR to further inform our CBRE (chemical, biological, radiological, explosives) science capability being developed in response to these new and emerging security threats.

ESR Police Programme Manager Dr Jill Vintiner, who attended the conference, was impressed with the quality of the plenary presentations, oral papers and posters. Particular highlights for her included sessions on the forensic use of closed circuit television in the United Kingdom as a tool for investigating terrorism cases, and the techniques used to identify individuals from mass graves in the former Yugoslavia.

Dr Vintiner said that conference participation is very valuable to ESR. "This conference is an excellent forum for keeping up to date with the latest developments in forensic science, and identifying new technologies that we can adapt and apply to New Zealand forensic casework."

ESR's staff presented papers and posters on a wide variety of topics, ranging from analysis of 'Party pills' to unknown white powder identification, and the use of Low Copy Number DNA profiling in New Zealand. Dr Rachel Fleming gave a keynote lecture on her research investigating new techniques for the definitive identification of body fluids.

The quality of research being carried out at ESR was recognised an award to Ms Shelley Kemp, from the University of Otago who won a 'best poster' award for her ESR co-supervised research on sharp object damage on new and degraded apparel fabrics. Ms Nicole Walker, now a Senior Document Assistant for New Zealand Police, also won the 'best new practitioner' award for her research into distinguishing between expirated blood and impact spatter, work that she carried out while a student at ESR.

ESR Science Leader Dr Steve Cordiner, who co-supervised Nicole's MSc research project, was pleased for her. "It's good to see a young forensic practitioner carrying out novel research and gaining recognition from the wider forensic community. The results of the research have proved particularly valuable to us in the field of bloodstain pattern analysis, and have added to ESR's international reputation for leading-edge contributions to this specialist science area."

Coming to the table

dialogue on future food technologies

Can we expect to have our genes analysed so that we know which foods will ensure we live long, healthy lives?

Are there future biotechnologies that we will want to use in relation to our food? These are two of the questions being asked by scientists from Crop & Food Research and ESR in a new four-year project, funded by the Foundation for Research, Science and Technology.

The research will explore with the food industry and the public the types of food technology they find acceptable so that investment in food research and food research projects themselves can be better targeted.

ESR Science Leader Dr Karen Cronin said that the research will benefit from the unique partnership between social and biophysical scientists and the collaboration with government and industry stakeholders.

"What we ate 20 years ago and what we could be eating in 20 years time will be vastly different. Our research aims to investigate social, cultural and consumer responses to emerging future food technologies including nanotechnology, genetically modified and functional foods."

"It will break new ground in international social science research by trialling an innovative form of 'deliberative dialogue'. This involves early discussions between businesses, government, scientists and consumer groups so that everybody can see how each other views the new food technologies and their possible effects on people, the environment and economic development in New Zealand."

Scientists and food companies will then have time to address any concerns before products reach the market.

ESR social science and systems researchers will primarily be involved in investigating the social context of developing technologies.

Integrated research for sustainability

Complex issues usually involve people and organisations with multiple and conflicting viewpoints. ESR's Integrative Research for Sustainability (IRfS) Group is a multi-disciplinary team that assists other agencies and groups to explore and plan for multiple viewpoints.

The integrative approaches recognise the need to include different agencies, policy agendas, stakeholders, communities, disciplines and evaluation measures.

Programme Manager Alistair Sheat said they work to provide a 'bigger picture' understanding, leading to the identification of sustainable solutions or management strategies.

The Group covers three broad, interrelated areas of research: healthy communities, sustainable development and science, technology and society.

"We have a strong outcomes focus, working in partnership with decision-makers to identify policies and actions that take into account multiple issues, perspectives, scales and time dimensions.

"That way nasty surprises can be minimised."

The team has expertise in public and environmental health, systems thinking and modelling, participatory action research, sociology, environmental policy, kaupapa Māori and bicultural research, operations research, management, psychology and water science. The Group also works with a variety of biophysical scientists across ESR.

Ngā tohu o te ora

A new Health Research Council - funded project 'Ngā tohu o te ora: traditional Maori wellness outcome measures' aims to identify the health improvement outcomes sought by traditional healers.

ESR researchers will work with traditional Maori healers and rongoa practitioners from throughout the country to develop a set of traditional Maori wellness outcome measures that define the range of outcomes of care sought by traditional healers. The project will improve the ability of traditional healers/whare oranga to participate within the mainstream health arena by contributing to understanding of the evidence base that underpins traditional Maori Healing.