

Institute for Global
Food Security

We are exceptional

WELCOME

The Institute continues to grow from strength to strength and is gaining recognition both nationally and internationally for its excellence in scientific research. The growing number of international researchers wishing to come and work alongside IGFS staff is testament to this. The launch of our first MOOC in global food security is another means of connecting with a global audience in a topic of huge importance. Our strategy for this year is to further develop new and cross cutting areas of research that will have a major and positive impact on the goals of ensuring a sustainable, safe and secure supply of high quality food for the world's growing population. Advancement of our education programme to deliver leaders for the future in agriculture and food science is another important target we have set ourselves. - Professor Chris Elliott



IGFS in US-Ireland project to tackle Bovine Respiratory Disease



Dr Mark Mooney from IGFS; Dr Kieran Drain, CEO Tyndall National Institute; Professor Eric Vogel, Georgia Institute of Technology; and Dr Alan O'Riordan, Tyndall National Institute.

A new €900,000 US-Ireland R&D Partnership project involving researchers from IGFS, the Tyndall National Institute in Cork and Georgia Institute of Technology in the USA, has begun applying advanced nanosensor technology to provide low-cost, rapid testing for animal health and disease applications. The AgriSense project, led at QUB by Dr Mark Mooney and IGFS researchers Darren Gray and Niall Shields, will aim to develop diagnostic devices facilitating simultaneous testing for viral agents responsible for Bovine Respiratory Disease (BRD) infections and facilitate field-side testing of animals for the first time. BRD is recognised as

the leading natural cause of death in US and EU herds contributing annually to the loss of over 1 million animals and has an annual economic cost of up to \$2 billion to the US agri-food industry. It is envisaged that early detection and diagnosis will enable infected cattle to be isolated and facilitate tailored treatment minimising veterinary medicine use. Novel sensors developed through the AgriSense project will be fabricated on disposable plastic platforms to minimise cost. Speaking at the project launch, Simon Coveney TD, Minister for Agriculture, Food and the Marine, commented that "BRD is a highly infectious disease responsible for 30%

of deaths in stock under one-year old in Ireland and costs Irish farmers millions of euros each year in treatment and lost time to market. Affecting both beef and dairy herds, it is also a major source of lost revenue to the global agri-food industry and we need innovative ways of tackling this scourge." Commenting on the award Dr Mooney from IGFS added "This unique research partnership is an important step towards the control of BRD related infections, and will be of major benefit to farmers who incur huge losses through reduced animal performance, increased treatment costs and animal death. IGFS is fast becoming a world-leader in the development of novel techniques to improve animal health and secure food supply chain safety and participation in the AgriSense project with other world leading research centres such as Georgia Tech and the Tyndall Institute will build on existing biomarker and sensor capabilities." The US-Ireland R&D Partnership is a tri-jurisdictional programme in which the National Science Foundation, Science Foundation Ireland, Invest Northern Ireland and the Department for Employment and Learning jointly fund collaborative research programmes. IGFS will host a review of the AgriSense project during the **2nd Food Integrity and Traceability Conference** to be held in Belfast in April 2014.

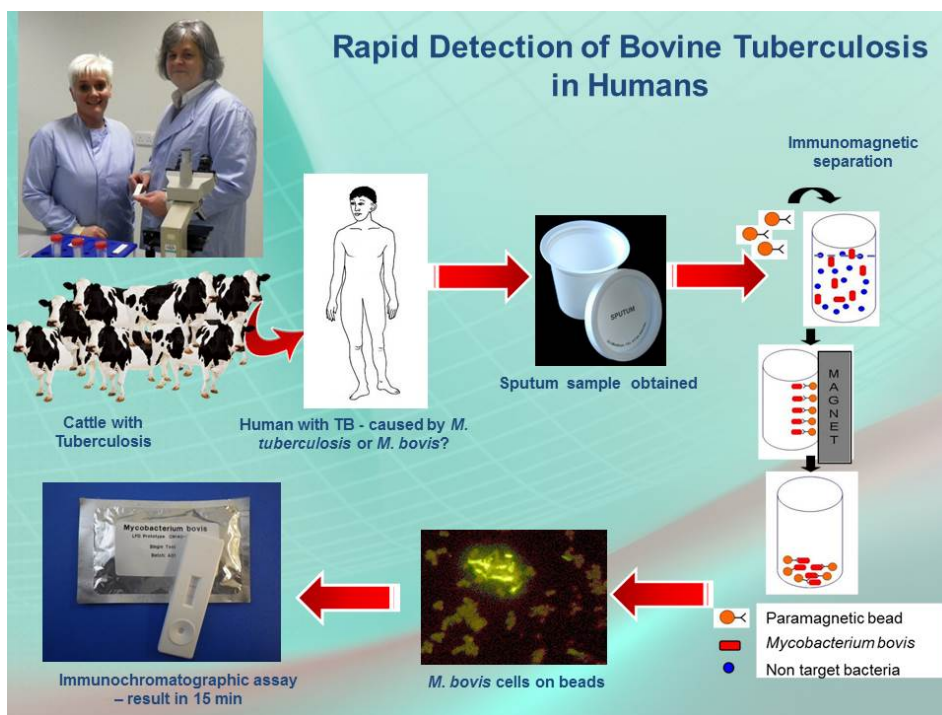
IGFS researchers awarded Gates Grand Challenges Explorations Grant

Dr Linda Stewart and Dr Irene Grant will pursue an innovative global health and development research project, titled 'Rapid Detection of Bovine Tuberculosis in Humans' following the award of a Grand Challenges Explorations (GCE) grant from the Bill & Melinda Gates Foundation.

GCE funds individuals worldwide to explore ideas that can break the mould in how we solve persistent global health and development challenges. Drs Stewart and Grant's project is one of more than 80 Grand Challenges Explorations Round 11 grants announced by the Bill & Melinda Gates Foundation.

To receive funding, Dr Stewart and Dr Grant and other Grand Challenges Explorations Round 11 winners demonstrated in a two-page online application a bold idea in one of five critical global health and development topic areas that included development of the next generation condom, agriculture development, and neglected tropical diseases.

Dr Stewart and Dr Grant are both microbiologists in the Food Safety group at the Institute for Global Food Security in the School of Biological Sciences. The focus of their recent research has been the development of rapid diagnostic tests for the detection of microbiological food chain contaminants including *Mycobacterium bovis*. This bacterium is



the major cause of zoonotic tuberculosis and it is indistinguishable clinically or pathologically from tuberculosis caused by its close relative, *Mycobacterium tuberculosis*. The extent of human tuberculosis caused by *M. bovis* in the African context is unknown but is suspected to be higher than elsewhere.

Differentiation between these two bacteria is important in order to direct antimicrobial therapy; however, the currently used methods involve expensive molecular techniques which are not widely available in the developing

world. Dr Stewart and Dr Grant have recently developed a rapid, easy to use immunochromatographic assay which has the ability to differentiate between *M. bovis* and *M. tuberculosis*.

This assay will be assessed for its applicability to rapidly detect *M. bovis* in sputum of TB patients and could potentially facilitate monitoring for zoonotic TB, thereby directing treatment and reducing drug resistance, morbidity and mortality.

IGFS researchers published in the International Journal for Parasitology



A recent paper authored by Dr Alan Trudgett, and co-authored by Dr David Timson, Dr Liz Hoey, Dr Gerry Brennan and Professor Ian Fairweather, on liver fluke tubulins made the front cover of the December 2013 edition of the International Journal for Parasitology.

The International Journal for Parasitology is considered one of the more prestigious journals in the field and the published paper deals with molecules which may be involved in drug binding and were previously hypothesised to be involved in drug resistance. However, the data in the paper very strongly suggest that alterations in these tubulins are not involved in resistance. The work also showed that tubulin isotype expression varies with life cycle stage.

The full citation for the paper is as follows: Fuchs M, Ryan LA, Chambers E, Moore CM, Fairweather I, Trudgett A, Timson DJ, Brennan GP & Hoey EM (2013) Differential expression of liver fluke β -tubulin isotypes at selected life cycle stages. International Journal for Parasitology. 43, 1133-1139.

The paper is available to view online by clicking on the following link: **Differential expression of liver fluke β -tubulin isotypes at selected life cycle stages**

Farm animal welfare research

'Sustainable intensification' is the term du jour in agricultural circles. If we are going to feed a growing global population in an environmentally-sustainable manner then we need to think big. Back yard farming alone will not suffice. But does intensive farming necessarily mean compromises in animal welfare? There is no doubt that genetic selection for increased productivity can predispose animals to health and welfare problems, but some of these problems can be overcome by good management.

One of the key research themes of the farm animal welfare team at the Institute for Global Food Security (IGFS) is to identify best management practices for highly selected animals. The broiler chicken is a case in point. Over the last few decades its growth rate and feed conversion efficiency have increased substantially due to genetic selection. However, these improvements in productivity are sometimes accompanied by leg health issues and lameness. In addition to being painful and constituting an animal welfare issue, lameness also leads to increased culling and production losses.

The welfare team has worked with the broiler industry over the last number of years to identify management factors that might ameliorate these problems. Very significantly, they've found that access to natural light through use of windowed houses encourages activity in these birds and significant reductions in lameness levels. Interestingly, provision of some "enrichment" items like perches,

or increasing the number of enrichment items, does not necessarily lead to welfare benefits for broilers. This highlights the need for evidence-based research to inform farm assurance schemes and legislation such that costly housing requirements introduced in the name of animal welfare do actually improve welfare.

Work in the farm animal welfare team is also focussed on dairy cows. The public perception of this industry is often more favourable with an image of cows and calves having a pleasant life on pasture. However, the reality is that to remain competitive this industry has also become increasingly intensive, with production coming from fewer but larger herds. Indeed, the industry is now at a point where a significant number of producers are considering a shift to total indoor confinement systems that enable more intensive dairy cow feeding and management. It has been argued that total confinement systems may be detrimental to cow welfare, particularly if grazing animals have a biological need for access to outdoor pasture. But what is the evidence?

Research by the farm animal welfare team is informing the important debate on 'indoor/outdoor' dairy cow management. In modern dairy farming there are likely to be welfare advantages and disadvantages to both confined and outdoor systems depending on how they are managed. With industry support and through consulting the global literature, scientists at IGFS are taking a holistic

approach to assessing the economic, environmental, production, and health and welfare implications of total confinement systems for dairy cows.

Knowledge is power in agricultural production, and the more information a producer has about the welfare of their flock or herd the better. The farm animal welfare team are working with local industry to develop practical measures that can be adopted by veterinarians during routine poultry visits. More fundamental work is also ongoing on the relationship between carcass-based measures and the lifetime welfare of the animal. Future work is also planned to gain greater insights into pain experienced by animals. While addressing fundamental scientific questions, this area of study will also yield practical benefits in terms of informing ethical debates into controversial practices such as tail docking.

Underpinning the research agenda of the farm animal welfare team is a need to ensure that 'sustainable intensification' is achieved in a manner that does not lose sight of, or compromise the welfare of our food producing animals.

An article by Dr Niamh O'Connell

Dr Linda Stewart awarded Partnership Collaborative Development Award

Dr Linda Stewart from IGFS has been awarded a UK SE Asia Knowledge Partnership Collaborative Development Award. This award will facilitate Dr Stewart to visit Thailand in the New Year to promote her research, consolidate existing links, and build and develop collaborative networks with researchers in both academia and industry in the field of microbiological food safety. Of particular interest will be the DNA microarray facilities and the recombinant antibody production expertise at the Thai Institute, BIOTEC, which it is hoped will be exploited in potential future collaborations and grant applications to develop novel and rapid methods for the detection of foodborne pathogens and to identify virulence mechanisms important to pathogens for their successful transference through the food chain.



Farm animal welfare scientists (from left to right): Maeve Palmer, Grace Carroll, Carley Bailie, Dr Niamh O'Connell and Dr Gareth Arnott

Queen's University in €1.6M bid to develop new animal doping test

Scientists at IGFS and the Irish Equine Centre are to develop a new way to test for illegal drugs used in horses and cattle. It will be the first animal doping test to work by detecting and monitoring the known biological effects of a banned substance, rather than the presence of the substance itself. It also has the potential to revolutionise animal drug testing by enabling the screening of large numbers of animals more quickly and efficiently than is currently possible. Scientists at IGFS will work with the Irish Equine Centre, and partners across Europe, to develop the test for banned growth promoters, hormones and antibiotics used on animals destined for the food chain and those involved in sport.

Dr Mark Mooney and two IGFS post-doctoral researchers, Dr Anna Gadaj and Dr Celina Xia, will lead Queen's involvement on this EU FP7 funded project. Dr Mooney commented that "Current testing methods focus on detecting the presence of illegal substances in animals. These tests are expensive, time consuming and have failed to keep pace with black market developments in producing, distributing and administering banned substances.

The danger is that these substances go undetected and find their way into the food chain. The new test will help mitigate that risk.

"We are developing an entirely new approach based on monitoring the physiological effects of banned drugs, rather than directly detecting the presence of those drugs. By identifying the unique biochemical fingerprints that banned substances leave behind in an illicitly treated animal's blood or urine, we will be able to quickly identify horses or cattle that have been treated with an illegal drug. "This has the potential to enable more efficient screening of larger numbers of animals than is currently possible. Any animal in which the biological response of a banned substance is detected would then be singled-out for further tests to identify exactly which illicit substances are present."

The test will be developed at IGFS, a key player in improving global food safety, and in national and global efforts to provide the world's population with a sustainable, safe and secure supply of high quality food. The Institute's Director, Professor Chris Elliott said: "Despite

being banned for over 20 years, the use of illegal growth promoters, hormones and antibiotics is believed to still occur across parts of Europe and further afield. The criminal gangs that operate the global trade in illegal animal drugs have developed the means of avoiding detection by conventional testing methods and new ways to detect this illicit trade are urgently required."

The Irish Equine Centre, based at Johnstown in Co. Kildare, will lead the overall management of the DeTECH21 project which they hope will revolutionise the battle against doping in equine sport. Project Co-ordinator Mark Sherry from the Irish Equine Centre said: "Greater testing efficiency will lead to higher and faster detection and give the upper-hand in the battle between testers and dopers back to those upholding the law. The new test will allow testers to identify the presence of performance or presentation enhancing drugs as soon as their desired effect becomes apparent." The two-year DeTECH21 project is funded by the EU's Seventh Framework Programme for Research (FP7) managed by the Research Executive Agency under grant agreement n° [605411].

New safefood project on Irish Cheese Provenance

The IGFS team of Professor Chris Elliott, Dr Simon Haughey and Dr Rachel Hill will partner Professor Gerry Downey (Teagasc) in a new **safefood** funded project entitled Provenance Confirmation of Irish Farmhouse Cheeses (ProConCheese) commencing September 2013. The kick-off meeting was held at

Teagasc (Ashtown) on the 11th October 2013. This was well attended by representatives from organisations including QUB, Teagasc, **safefood**, Food Safety Authority of Ireland, Agricultural Institute of San Michele all'Adige (Italy), Consumer Association of Ireland, Food Standards Agency (NI), Dept. Agriculture,

Food and the Marine and Sheridan's Cheesemongers. A very interesting and informative presentation was given by Dr. Federica Camin on the PDO designation of the Italian Grana Padano cheese. Within the current project a wide variety of cheeses (bovine, caprine, ovine, hard, soft, cultured, non-cultured) from all parts of Ireland will be collected from Artisan producers over a 9-month period to cover changes due to seasonal and production effects. These will be subjected to ICP-MS and IRMS analysis to gather essential data related to the cheeses. The data collected on mineral elements and isotope ratio measurements will be used to form a databank of analytical values unique to Irish cheeses. Univariate and multivariate statistical procedures will be applied to the data to characterise these from other cheeses from abroad. The goal of this project will be to have a scheme in place to prove the provenance of Irish Artisan cheeses similar to the Italian cheese Grana Padano PDO designation.



Photograph of Artisan Cheese courtesy of Leggygowan Farm, Saintfield

Cross border co-operation on technology programme



Photograph of the award ceremony

InterTradelreland's all-island technology transfer programme, FUSION, partners companies north and south with a third-level institution providing them with the specialist expertise of a high calibre graduate working directly in the organisation to deliver a new product or process improvement project. Kildare based Irish Diagnostics has benefitted from the services of Queen's University graduate Julie Polden for the last two years. Her project focussed on developing a drug test for the equine

industry that will give testers the opportunity of being able to identify the presence of performance or presentation enhancing drugs.

According to Mark Sherry, Head of Finance and Administration, Irish Diagnostics: "Through InterTradelreland's FUSION programme we were able to take our project to the next level. Julie was a great asset to the business and instrumental in developing the project.

Working closely with Queen's University we received academic support and supervision throughout the duration of the programme. We had access to world class forensic and IT facilities in Queen's University which was all made possible by participating in the Fusion programme. The whole process was worthwhile and I would recommend the Fusion programme to any SMEs."

Pictured at the awarding of the 'FUSION Project Exemplar' are, from left to right, Professor Tom Buckley, Head of Microbiology, Irish Equine Centre; Mark Sherry, Head of Finance and Administration, Irish Equine Centre; Julie Polden, FUSION Graduate, Irish Equine Centre; Thomas Hunter McGowan, CEO, InterTradelreland; Dr Olivier Chevallier, Senior Research Fellow, Institute for Global Food Security and Jim Fitzsimons, Fusion regional consultant, InterTradelreland.

For more information on the InterTradelreland FUSION Programme go to www.intertradeireland.com/fusion

Alzheimer's Network Co-operation Group meet at Queen's University

The 4th meeting of the Network Cooperation group on Alzheimer's metabolomics took place on 6th December 2013. Funded by Alzheimer's Research UK the multi-disciplinary group is exploring whether untargeted LC-MS metabolomics approaches can improve the diagnosis of Alzheimer's disease (AD). Work by the team is also uncovering detailed changes in nutrient levels in AD patients, and it makes use of the cutting edge LC-MS facilities available within the Advanced ASSET Centre. Metabolomics is a discipline still in its infancy but it can be described in lay terms as: the profiling, sorting and interpreting of molecules on a vast scale, only made possible by recent technological advances.

Plans are also underway for a public meeting to be held in Spring 2014. Further details will follow in due course.



From left to right: Dr Xiaobei Pan (PDRA (mass spectrometry), IGFS), Mr Muhamamad Bin Nasarrudin (PhD student (lipid profiling), IGFS), Prof Pat Kehoe (Neuroscientist, University of Bristol), Dr Stewart Graham (PDRA (metabolomist), IGFS), Dr Brian Green (Senior Lecturer (Network Coordinator), IGFS), Dr Jon Dubois (Lecturer (mathematical algorithms), University of Bath), Dr Ceire Costelloe (Lecturer (bioinformatics), Queen Mary University of London), Prof Peter Passmore (Consultant geriatrician, QUB), Emma Cunningham (Registrar, Belfast Trust), Dr Bernadette McGuinness (not photographed; Belfast Trust).

Student and Staff News

Congratulations to the first group of students graduating from the new postgraduate MSc Advanced Food Safety programme offered by Queen's University and who completed their research projects within IGFS. **Maeve Shannon** from Newcastle, Co. Down received the course's Bank of Ireland Student of the Year Award from William Thompson, Agri Manager at Bank of Ireland UK who commented, "the agri-food industry is an important component of the NI and global economy and Bank of Ireland UK are proud to acknowledge through our sponsorship of this award the high-level training offered by Queen's to students who will have the skills and knowledge to contribute to the continuing development and expansion of this key sector".

Also graduating were **Colin Abernethy**, **Natcha Jankhaikhot** who received a full scholarship from the Royal Thai Government and who will return to Thailand to work for the Food and Drug Administration of the Ministry of Public Health, and **Xiaochen Yu** who is employed within the Beijing Centre for Physical and Chemical Analysis developing new molecular food detection methods supported by the Ministry of Science and Technology of China.

A manuscript, authored by **Dr Terry McGrath**, **Dr Terry Fodey** and **Professor Chris Elliott**, from IGFS featured in the 2012 Top 10 most downloaded articles in the journal *Analytical and Bioanalytical Chemistry* (ABC). The article, Biosensors for the analysis of microbiological and chemical contaminants in food, was published in 2012 and reached number 5 in the journal ranking. The journal points out that since its launch in 2002, ABC has advanced to be the most highly downloaded among all Springer journals.



Maeve is pictured receiving her award from William Thompson (right) alongside Dr Mark Mooney. She is currently continuing her studies through PhD research within IGFS

Alexandros Stratakis has been awarded an Emily Sarah Montgomery Travel Scholarship to undertake a research trip at the University of Bologna, Italy. This research trip will take place in 2014 and will facilitate the development of an efficient novel food decontamination technology based on cold plasma. The research will aim on the inactivation of food borne *Listeria monocytogenes*, which is responsible for thousands of cases of illness every year across Europe due to consumption of contaminated food as well as for the largest number of deaths from food borne disease in the UK. Therefore, providing a meaningful contribution to the improvement of consumer safety

Dr Kamela O. Alegre has joined IGFS as a BBSRC Postdoctoral Researcher. Kamela received her Bachelor's of Arts with Honours in Chemistry and Mathematics from New York University in 2006. She then moved to Barcelona, Spain and received her Diploma of Advanced Studies (2010) and Ph.D with Honours (2012) in Biochemistry, with a focus on the structural and functional characterisation of the SUMO proteases, SENP6 and SENP7. Kamela is currently working with Dr Chris Law on the structural characterisation of a bacterial multidrug efflux protein, using X-ray crystallographic techniques.

Through the Sir Walter William Adrian MacGeough Bond (application of science to agriculture), the School of Biological Sciences has offered **Danielle Calderwood** a 3 month post-PhD Fellowship to enable her to focus on the publication of high quality research papers. The fellowship was to the value of £3000.

Dr Stewart Graham will be leaving the Institute for Global Food Security after 8 years with the Institute. He has taken up a position at Beaumont Health Systems, regarded as one of the best hospitals in the United States, as a primary scientist. Dr Graham will be tasked with setting up and developing a new Metabolomics research division at the hospital with the primary aim of translating his findings into a clinical setting.

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