Innovations

A bright future for three businesses at STFC Daresbury Laboratory

Three innovative start-up companies, each aiming to make the world a better place by addressing the world's greatest global challenges, have been awarded free access to the unique cutting-edge research facilities and expertise at STFC's Daresbury Laboratory.

PV Glaze, BiSN and Chris Underwood are all winners in a challenge run by STFC's Futures team, which seeks to exploit scientific research to find solutions to the government's grand challenges in energy, environment, healthcare and security.

The I-TAC Futures Challenge was aimed directly at any UK company involved in research and development within the global grand challenge areas. Each winner has received six months free access to their own dedicated, fully equipped laboratory at Daresbury's Innovations Technology Access Centre (I-TAC), which provides unrivalled access to more that £3m cutting edge scientific research facilities. In addition to this, the winners will have access to all of the wider benefits associated with moving on to the Daresbury Science and Innovation Campus, including STFC's scientific expertise and the business development support of the Daresbury Innovation Centre.

I-TAC Futures Challenge winners with STFC's Martin Morlidge (right)

I-TAC Manager Dr Martin Morlidge said; "*When choosing the winners, we were specifically looking for how well their businesses and ideas fit in with STFC's core challenges in environment, energy and healthcare, and also how STFC can add real value to these companies. By giving them access to our knowledge, infrastructure, scientific and business expertise we will help them to flourish into substantial, successful companies that are benefiting wider society and boosting the UK economy.*"

"*We were really impressed with the calibre of the competition entries and are excited to be welcoming each of them onto the Campus and providing them with all the support they need to get the most out of their time here.*" more

About the three winners

BiSN is a newly formed, highly technical service company serving the oil and gas industry. At I-TAC, BiSN will be carrying out a study on enhanced oil recovery, with a view to enabling better access to oil reserves which have previously been abandoned and facilitating the extraction of oil from them, resulting in more efficient use of resources. The study will allow BiSN to offer its clients a more complete service, and will put BiSN in a position to offer cutting-edge services to the worldwide oil and gas industry.

> *"Winning the I-TAC Futures Challenge will provide us with an unrivalled combination of scientific technology, expertise and contacts that we just couldn't otherwise access"*
>
> Leo Richards
> BiSN

BiSN's Leo Richards said: *"Winning the I-TAC Futures Challenge will provide us with an unrivalled combination of scientific technology, expertise and contacts that we just couldn't otherwise access. It will enable us to develop our business and take a more scientific approach to our work, allowing us to offer a more professional, complete and enhanced service to our clients."*

PV Glaze is developing a renewable energy technology using silicon based cells that can convert solar radiation into electricity. Normally opaque due to the nature of their materials, these transparent, high clarity solar modules, known as Building Integrated Photo-Voltaics, will enable such renewable energy technologies to be better incorporated into the construction of buildings, motor vehicles and agricultural greenhouses, resulting in less CO_2 in the air and less reliance on imported fuels.

David Ruchat at PV Glaze said: *"I-TAC will not only provide us with access to the kind of facilities that are normally out of reach for small companies, but also access to the wider benefits offered by the Campus such as networking with others in the solar energy industry, collaborating with contacts in the field and allowing us to overcome technological and commercialisation challenges."*

Dr Chris Underwood is working on a novel design for a Vascular Access Graft, a type of artificial blood vessel which is implanted in the arms of people who require lifesaving dialysis. Incorporating a new type of biomaterial, this product is intended to prevent some of the common complications currently associated with this procedure and the unique materials technology being used has the potential to lead to improved product designs for other cardiovascular applications as well, such as bypass grafting in the legs or around the heart. Access to I-TAC will enable Dr Underwood to make the prototypes to prove his design concept and go on to develop other related products, including some for use in the emerging field of tissue engineering.

Commenting on the prize, Dr Underwood said: *"The availability of the unique combination of resources within I-TAC will be absolutely invaluable. The medical products that we can now develop within I-TAC will lead to a better clinical prognosis for many cardiovascular procedures and make patient care overall more successful, safer and less expensive."*

New microscopic techniques help to develop improved chicken vaccines

A collaboration between BBSRC (link opens in a new window) and STFC-funded scientists has been using a new form of low energy microscopy to observe how poxviruses interact with components inside live cells. Genetically modified fowlpox viruses have been used extensively in Mexico and southeast Asia to vaccinate chickens against bird flu and the scientists hope that the technique will help them develop more effective vaccines that reduce the chances of healthy birds acting as a reservoir for influenza virus. The research was published in the December 2010 edition of the '*Journal of Virology*'.

Dr Ananya Jeshtadi, from Dr Mike Skinner's group at Imperial College London, carried out the study as part of the BBSRC Combating Avian Influenza initiative, which aims to increase understanding of how avian influenza interacts with its animal hosts in order to control its spread more effectively.

Dr Skinner said: "*The current generation of fowlpox-based vaccines are really good at stopping chickens from getting ill when they come into contact with flu but they don't always stop the birds from getting infected. Because of this, around a quarter of vaccinated birds still act as carriers of the disease and pass it on to others. Our hope is that we can engineer a new vaccine that makes this much less likely.*"

Since being introduced in Mexico in the mid 1990s, fowlpox-based vaccines have become an important weapon in the fight against avian influenza (more than 2 billion doses have been used) and are currently being used as part of a massive campaign to protect some 5 billion poultry in China. The so-called 'recombinant vaccine' is based on a fowl pox virus that has been modified to display an influenza protein on the surface of the infected cell. The immune system of a vaccinated chicken is primed to respond to the influenza protein, meaning that the bird can successfully combat flu when subsequently exposed to it. With recombinant vaccines, farmers can also test whether chickens have been given the vaccine or have been exposed to the influenza virus, which is less easy with flu-based vaccines.

Dr Skinner continued: "*The problem with current influenza vaccines is that they don't stimulate the part of the immune system that would normally clear out any infected cells when the chickens are exposed to flu. What we hope is that this work will enable us to identify factors in the fowlpox-based vaccines that prevent chickens from mounting responses to eliminate infected cells. Once we know what these are, we may be able to develop an improved vaccine that would counter this problem of vaccinated chickens harbouring the virus.*" more

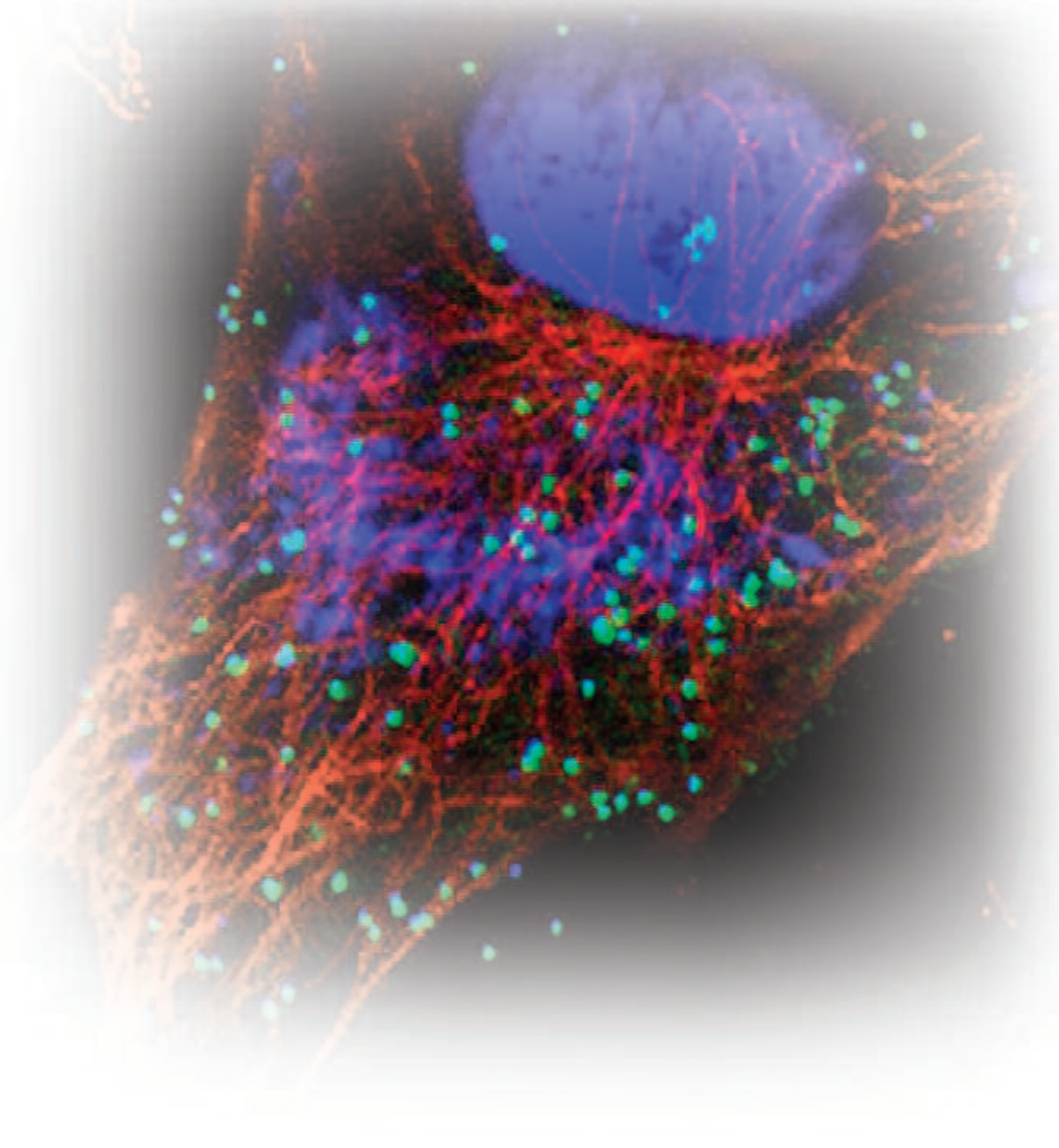
New microscopic techniques help to develop improved chicken vaccines

Dr Stan Botchway of the STFC Rutherford Appleton Laboratory who developed the advanced microscopy technique and worked on the study said: "*The type of microscopy we used to study the viruses interacting with the chicken cells is particularly valuable for several reasons. For example, by using near infra red laser light we are able to see deeper into cells and tissues and observe them for a long time, even over days without damaging them. This allows us to observe how all of the different proteins interact without disturbing the process by firing high energy lasers at them. Also, the technique doesn't require us to extract the proteins from the cells before we determine the protein interaction, which is the method used in nearly all laboratories currently*."

Improved vaccination against bird flu is especially important because the current H5N1 type is both highly contagious and has a high mortality rate in birds. It is widely estimated that at least 200 million domestic birds have either died or been culled as a result of H5N1. H5N1 virus also presents a risk to human health. Over 500 cases have been identified in people, resulting in 300 deaths. Most of the cases so far have been in rural Asian populations where cases may be under-reported and there is an ongoing fear that the virus may evolve the capacity to spread from person to person causing an influenza pandemic.

A vaccine which is able to block transmission would be especially beneficial in the UK where 25% of chickens are free-range. It is often necessary to house free-range chickens indoors when a serious communicable disease has been detected within a defined radius. Such a vaccine would increase the likelihood that a flock could remain outside during outbreaks of influenza.

Pox virus infecting avian cells - image captured using confocal microscopy in the Central Laser Facility (Credit: STFC and Oxford Brookes University)



RSE/STFC Enterprise Fellowships 2011

Applications are invited for potential entrepreneurs, who have the backing of a host institution, to commercialise the fruits of STFC funded research. The closing date is the 6th May 2011

This one year RSE/STFC Enterprise Fellowship is designed to give the fellow time to develop the commercialisation idea and the training to develop their personal business skills. Fellows will also be paired with a mentor from business giving them a valuable insight and connection to the business world. The aim of the scheme is to make both the technology and the fellow more competitive in business.

Applications will need to show that there is an STFC technology that has the potential to be a viable commercialisation opportunity and that the prospective fellow has the commitment to develop and utilise their business skills.

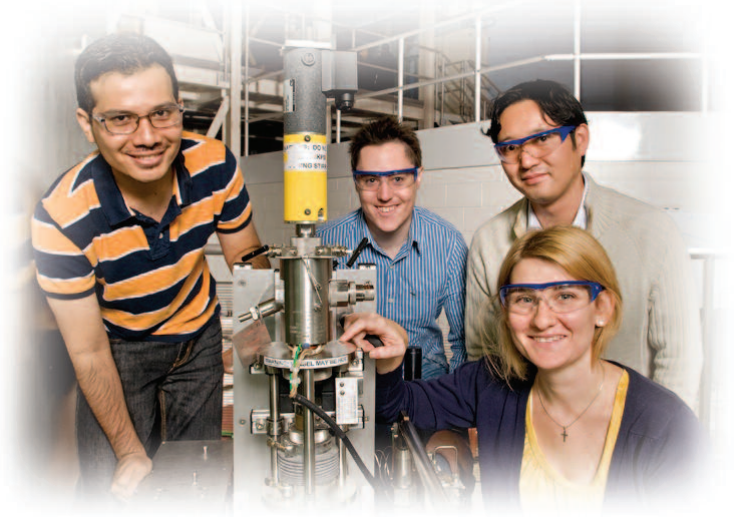
Previous fellowships include work on hydrogen storage leading to the new spinout Cella Energy, microfluidics leading to the spin out PiezoFlo, and imaging technologies which supported the Southampton university spin out Symetrica.

For further information and application forms please follow the relevant links to the RSE and the STFC and for any questions please contact Anne Fraser of the RSE afraser@royalsoced.org.uk or Rachael Jack of the STFC rachael.jack@stfc.ac.uk

Extending the life of oil reserves - Greener, cheaper more efficient oil extraction made possible at ISIS

A research team led by the University of Bristol has used STFC's ISIS Neutron Source to come up with a new way to treat carbon dioxide (CO_2), so that it can be used in efficient and environmentally friendly methods for extracting oil. These new CO_2 soluble additives can also be used to reduce the environmental damage caused by every day industrial processes such as food processing and the manufacture of electronics. The results of this work are published in the journal Langmuir.

The researchers have developed a soap-like additive for CO_2 that turns it into a viable solvent for commercial-scale enhanced oil recovery to increase the amount of crude oil that can be extracted from oil fields.



L to R: Azmi Mohamed, Stephen Cummings and Masanubo Sagisaka (all University of Bristol) with instrument scientist Dr Sarah Rogers (ISIS), with the sample pressure cell for the Sans2d instrument.

"Carbon dioxide is useful in enhanced oil recovery as it is able to flow through the pores in the rock much more easily than water," said Professor Julian Eastoe from the University of Bristol. "The additive, a surfactant, will help thicken the carbon dioxide, which is vital for this process, allowing it to flow through the rock more efficiently. There is also a useful side effect of our ability to use CO_2 in this way, as in the future the process will take carbon dioxide generated by industrial activity from the atmosphere and lock it deep underground. Getting longer life out of existing oil reserves will also give more time for research into replacements into non-carbon energy sources such as solar or hydrogen."

Minister for Science and Universities David Willetts said: "*This shows what science can do for the environment. It's why the Government has protected the science budget. In particular it shows how financing core science facilities can lead to many different projects with valuable applications.*"

Liquid CO_2 is increasingly being used industrially to replace common petrochemical solvents because it requires less processing and it can be easily recycled. The difficulty has been that in order to operate effectively as a solvent, carbon dioxide needs additives, many of which are in themselves, damaging to the environment. This new development by an international team including scientists from Bristol University led by Professor Julian Eastoe, from the University of Pittsburgh led by Professor Bob Enick and ISIS scientists Dr Sarah Rogers and Dr Richard Heenan provides a solution. The project has been funded by the UK Engineering and Physical Sciences Research Council (EPSRC) and the US Department of Energy to explore using high pressure CO_2 to extract residual oil retained in the pores of rock.

"The quest to find a chemical capable of modifying the properties of CO_2 to make it suitable for widespread use as a solvent in enhanced oil recovery has been long," said Professor Bob Enick. "*Previous advances have involved surfactants containing fluorine, which although highly soluble in CO_2, are very environmentally damaging. The new additive, surfactant TC14, contains no fluorine at all and is a harmless hydrocarbon.*" more

Extending the life of oil reserves - Greener, cheaper more efficient oil extraction made possible at ISIS

CO_2 offers an efficient, cheap, non-toxic, non-flammable and environmentally responsible alternative to conventional petrochemical solvents. Even water as a solvent for example, comes with its own set of problems; after being used to flush out oil from rocks it then requires cleaning before it can be used again, whereas liquid CO_2 can be re-used immediately.

The paper published in the Langmuir is the first to come from Sans2d, one of seven new neutron instruments built at the ISIS second target station, a £145 million expansion to the facility completed last year. It is also one of the first to be published using data collected at the new target station.

The new additive, surfactant TC14 enables small pockets to form in the liquid CO2 called reverse micelles causing the liquid to thicken. Neutron scattering at ISIS allowed the structure of the reverse micelles to be studied in the CO2 as they formed under high pressure. The neutron instruments giving this molecular level viewpoint are often described as 'super-microscopes'.

"*Beams of neutrons are able to penetrate deep inside samples giving unique information about the location and arrangement of the micelles at a molecular level*," said ISIS scientist Dr Sarah Rogers.

"*By altering the pressure in a specially constructed experimental cell, dissolved material can easily be separated and removed leaving the carbon dioxide for the next use. It would be difficult to look at this system using any other technique as the CO2 needs to be kept under high pressure. Only under the scrutiny of neutron beams can you fully reveal its actions and properties*."

"*Experiments on Sans2d are particularly fast and accurate in comparison to some older neutron scattering instruments. This development of neutron instrument technology is part of what makes ISIS a world leading science facility*," said Professor Eastoe.

Instrument scientist Dr Sarah Rogers(ISIS), releasing CO_2 into a pressure cell at the sample position on the Sans2d instrument.

RCUK Knowledge Transfer Portal

If you are looking for funding for knowledge exchange and commercialisation activities, the STFC runs and supports a number of schemes that range from short term proof of concept funding, the opportunity to develop business skills, to larger technical and commercial development partnership schemes. Details can be found on the STFC Website in the Business and Innovation section

If these schemes do not meet your needs other funding opportunities can be found at the RCUK Knowledge Transfer Portal. This is a 'one-stop-shop' created by the Research Councils UK for those in, for example, academia, business, public, private and/or third sectors, who want to find out about Research Council knowledge transfer schemes and activities. It contains links to current knowledge transfer schemes, events, networks and training courses run by all of the seven UK research councils and provides details of how to get involved.

Methane Bubbles – what they can tell us about the impacts of global temperature changes

The arctic regions are expected to suffer the brunt of any temperature increases associated with global warming. A major change concomitant with warming is the release of carbon in the form of methane through the thawing of ice.

Photo by Michael Runtz

The thawing of permafrost (soil that is at or below the freezing point of water), threatens to release carbon into the atmosphere in the form of vast amounts of methane, a greenhouse gas some 23 times more potent in terms of warming than CO_2. The primary natural source of methane (CH_4) is microbial decay of organic matter under oxygen-free conditions in wetlands. As permafrost melts, it forms lakes which account for the majority of permafrost-derived methane emitted to the atmosphere via ebullition (bubbling). Previous studies appear to have grossly under-estimated the true rate of methane emission because random-sampling techniques can miss the ebullition sources, which occur in hotspots with little background emission. Permafrost degradation has already been linked to changes in vegetation composition, ecosystem functioning and the damaging impacts of permafrost degradation-induced subsidence on civil infrastructure.

Because there are significant uncertainties about the amounts of atmospheric methane, better measurements of this gas are needed to improve the accuracy of climate change estimates. A new research project aims to address these issues by pioneering a novel technique for measuring methane ice bubbles trapped within lake ice. As ice forms in autumn, bubbles released from lake sediments are trapped, resulting in stacks of ice bubbles separated by thin films of ice. With seed-corn funding provided through the Centre for Earth Observation Instrumentation (CEOI), the University of Cranfield is currently investigating this. more

Environmental Measurements from Space

The work uses the Synthetic Aperture Radar (SAR) backscattering technique to show the characteristics of ice-bubble mixtures. This is based on laboratory measurements of simulated ice-bubble mixtures made from artificial materials. If satellite-based SAR can provide quantitative measurements of the presence of methane bubbles, it will provide a much needed observation technique for constructing regional and pan-arctic estimates of current and future methane fluxes. Many recent pan-arctic studies show that permafrost extent is shrinking and that the upper portion of soil that thaws each summer is increasing. Some projections of permafrost melt forecast the current 10.5 million km^2 extent of near-surface permafrost will shrink to as little as 1.0 million km2 by 2100.

An indoor measurement facility has been created at Cranfield University within the Department of Informatics and Systems Engineering, in order to simulate the radar properties of ice containing methane bubbles. Dry sand is used in place of ice, as it has a very similar response to a radar wave. Voids simulating gas bubbles are created using expanded polystyrene within the sand. The work will provide an understanding of how the reflections are dependent on the size, shape and density of the bubbles. It also seeks to identify what effect the radar frequency and the angle the bubbles are viewed from has on the signal returns. A new in-house imaging technique known as tomographic profiling provides vertical slices of the radar returns through the ice volume, allowing separation of the ice and bubble signals.

Not just for bubbles ….

The main aim of this CEOI project is to establish optimum techniques for bubble identification and characterisation, with consideration to existing and future space SAR platforms. Because methane bubbles can range in size from centimetres to metres in diameter, a combination of imagery from multiple satellites working in different parts of the frequency spectrum may offer the best prospect for providing the required measurements. Knowledge of methane emissions is important in its own right, but also provides essential information on the degradation of permafrost, snow cover and freeze-thaw processes, and therefore is likely a strong indicator of climate change. As well as being of great interest to climate modelers, and to those interested in land/atmosphere interaction and exchange, this novel technique could also be applicable to other environmental applications. In addition, because it can measure scattering structure, it could also provide information on forestry canopy and layering in soil.

Further information about this technology and others funded by the CEOI can be found at www.ceoi.ac.uk. You can also contact the Project Lead - Dr Keith Morrison tel: +44 (0) 1793 785473, email:k.morrison@cranfield.ac.uk or the CEOI Director, Professor Mick Johnson: Tel: +44(0)1438 774421, email: mick.johnson@astrium.eads.net.

Industry Day 2011 – Bute Hall & Committee Rooms, University of Glasgow Thursday 10th March 2011

Join us for the annual University of Glasgow Industry Day on Thursday 10th March. Last year's event was hugely successful with many new relationships starting up, and we are delighted that these have developed into exciting collaborative research partnerships.

This year's event will again showcase key research activities from the College of Science and Engineering, and explore the many ways we can support industry and academic collaboration.

The event opens at 11am with a short presentation about the many ways to work with the University of Glasgow and a Case Study from an SME whose collaboration with Glasgow academics began at Industry Day 2010.

The exhibition will then be open until 4pm, providing you with the opportunity to meet researchers and find out how their expertise could benefit your company. The exhibition will be interactive and informal and there will be a dedicated meetings area where you can have a chat over a coffee with our researchers. Throughout the day there will be short elevator pitches covering the themes on display in the exhibition.

The exhibition will also include funders and support organisations able to provide support on the different ways that universities and industry can engage. Even if you can only spare an hour on the day, please come along to find out how you can benefit from leading edge research; exhibits will be manned and staff will be available to help you find the right contacts.

The exhibition and presentations will conclude at 4pm with a drinks reception in the Senate Room.

University of Glasgow

Industry Day Competition ££

This is your opportunity to secure funding for a new project on the spot! We want to make it as easy as possible for new relationships to get started. Tell us in one paragraph what you want to do, and with whom and there will be a prize of research funding to kick start the collaboration considered to have most promise. The winners will be announced at the drinks reception!

To register, please contact:
Jess McDonald jess.mcdonald@glasgow.ac.uk
or tel: +44 (0)141 330 3889

Further information on the Industry Day themes and participants can be found on our website:
http://www.gla.ac.uk/businessandindustry/newsandevents/industryday/

If you you identify an academic with whom you would like to arrange a one-to-one meeting, please make direct contact, or email: lynne.brown@glasgow.ac.uk for assistance.

If you cannot find a fit for your requirements please contact: lynne.brown@glasgow.ac.uk with details of how we may be able to aassist.