SCIENCE FOUNDATION IRELAND

DISCOVERY TO DELIVERY

the story so far

In the late 1990s, Ireland was shifting upwards, and so were living standards. But our research and engineering capacity were not keeping pace. In 2000, Science Foundation Ireland was established to address the gap. The goal? To develop the enterprise agenda by increasing research capacity in life sciences and information & communications technology (and more recently, energy) by 2015.

The rationale behind SFI's mission is clear: good scientific research generates the knowledge and human capital that enables enterprise to climb the value chain. In turn this generates more higher-quality jobs, products and services that command higher prices on export markets and enhanced living standards

Over the last decade, SFI has built up a community of thousands of researchers in Ireland's higher education institutes, led by hundreds of principal scientists and engineers. And with that boosted capacity has come change: Ireland has rapidly ascended the international rankings of research capability with great speed, moving from 36th in 2003 to the top 20 by 2008.

Underpinned by the solid research, engagement with industry has also grown: over 600 companies now link to SFI research groups, ranging from informal connections to collaborations that involve significant financial sponsorship. The goal of these relationships is to make those companies more competitive by transferring technology and trained people out of the labs and into the companies.

Although building a nation's scientific research capacity is necessarily a medium - to long-term activity, it is clear that this investment is already delivering for the competitiveness of firms in Ireland, well before the anticipated 2015 timeframe. The productivity of this system will accelerate over the next five years, benefiting the competitiveness of companies, big and small, in Ireland.

This document offers a sample of the people, companies and discoveries that are putting Ireland on the map for research excellence and growth of enterprise.

// SFI researchers pre-commercial outputs: an average per year // 6 spinouts // 83 patents filed // 14 patents awarded // 145 invention disclosures // 25 licenced technologies // SFI researchers have links to the companies that generated approx. 60% of recent IDA–supported job announcements // SFI supports over 35 conferences annually, involving over 2,500 international delegates, which generate an economic return to Ireland of €3.5million.

Ireland has ascended the international ranking of scientific research capability - climbing from a world ranking of

36th in 2003 to 20th in 2010

Over 600 companies are linked to SFI research groups

Ireland has scored world rankings of

8th in materials science, which is important to the semiconductor industry, and

SFI supports approximately **3,000** researchers in Ireland led by over 300 lead scientists

3rd in immunology, which is important in the healthcare industry

SFI researchers publish over **5,000** scientific papers annually

SFI researchers are engaged **in over 1,900** international partnerships in over 60 countries

1/3 of papers published are co-authored with internationally based researchers

SFI researchers secured over **€60 million** from international sources annually

SFI invests approx. **€150 million** annually in research projects

For every 1 euro invested by SFI - researchers secure 1.4 euro from other sources

SFI supports approx. **650** active research projects in Ireland

Over 300 SFI - supported researchers engage in outreach / public talks / lectures annually

sfi researchers working with Irish business

In business, having a competitive edge makes all the difference. And one way to make products or services more competitive is to innovate. SFI researchers now collaborate with more than 300 Irish small-to-medium enterprises to enhance their research and development capabilities, generate intellectual property and work on innovative solutions that can help to grow Irish business. Many of these companies are supported by Enterprise Ireland.

// A virtual sawmill - seeing the wood in the trees //

Imagine you could saw a forest without leaving your chair? Technology developed by Cork-based company Treemetrics and the SFI-funded centre 4C at University College Cork lets users non-invasively measure and virtually optimise the management of forest resources. The laser technology physically measures trees in a forest, and then software helps the user to virtually plan how the forest can be cut to get more wood from fewer trees. Treemetrics now offers measurement and 'virtual sawmill' technology to analyse forest resources quickly and accurately and is working with partners and clients around the world. www.treemetrics.com

// Early detection of osteoporosis //

The SFI-funded Biomedical Diagnostics Institute, based at Dublin City University, has teamed up with Dublin-based company, Crescent Diagnostics, to develop a novel predictive test for osteoporosis. This is a preventable bone condition, although most people are diagnosed only after they experience a fracture. The project aims to further develop Crescent's BQT® test by analysing the chemical bonds in a small toenail clipping.

// Teaching old drugs new tricks //

Irish specialty pharma company Sigmoid Pharma has a long-standing collaboration with Prof Cormac Taylor's lab at University College Dublin. Their studies, which received SFI funding, have led to Sigmoid's innovative SmPill(TM) technology being used to develop a novel product that uses an old drug and converts it into a product to treat a new disease. This product has completed a Phase II clinical trial in chronic inflammatory bowel disease.

// Tackling superbugs //

Researchers at the SFI-funded Alimentary Pharmabiotic Centre in University College Cork and Teagasc Moorepark have found a new antimicrobial agent, Thuricin CD, that can kill the antibiotic-resistant bacterium *Clostridium difficile*, which poses a major problem in clinical and healthcare settings. The new antibiotic may also reduce the risk of disease recurrence, compared with that of broad-spectrum antibiotic treatment, because it spares the normal gut bacteria that help to limit C. *difficile* growth. Thuricin CD was discovered by screening more than 30,000 bacteria isolated from the human gut and the technology was licensed to Irish biotechnology company Alimentary Health.

// How to cut down on false alarms //

An advanced surveillance technology that can identify if an alarm has been triggered by human activity will greatly reduce the thousands of false alarm calls received by Gardaí each year and will help ensure precious Garda resources are not drawn away from other work or emergencies. Irish company Netwatch has partnered with a team of researchers from SFI CSET CLARITY: Centre for Sensor Web Technologies to develop the new alarm - reduction system, which uses applied imaging technologies to decipher the alarm images received at the Netwatch Communications Hub.

// Bringing machine translation to the cloud //

For companies seeking to internationalise, machine translation offers a relatively quick and cost-effective way to make product and service information available in foreign languages. However, machine translation requires significant computing power, which can be difficult for translation companies to access. Dublin start-up Xcelerator has raised €1m in funding for a new cloud-based statistical machine translation product that means companies supplying translation services don't need to worry about computing power or special hardware. With its origins in data-cleansing work by the SFI-funded Centre for Next Generation Localisation (CNGL), KantanMT allows clients with little or no experience or knowledge of machine translation to build their own machine- translation engines and translate documents, all from a simple Web interface. Founded in 2012, Xcelerator has already created 10 high-value jobs for Ireland.

sfi

driven by people and scientific excellence

Good science is down to good scientists. SFI has built a community of around 3,000 researchers in Ireland. Here are just some examples of the researchers that drive scientific excellence in Ireland.

// Testing for the speed gene in horses //

While looking at genes in thoroughbred racehorses, Dr Emmeline Hill at University College Dublin identified important genetic information relating to racing performance. Her discovery led to the development of a 'speed gene' test to help match horses with courses and to inform breeding and training decisions. Irish company Equinome, founded on this discovery, now uses the test to provide services to the global bloodstock industry.

// Tackling disease - through the immune system //

The immune system - and particularly inflammation - is a hot topic in medical science, because when it goes awry it's thought to feed into several types of disease. Prof Luke O'Neill at Trinity College Dublin has made several breakthrough discoveries in the area, including how a protein building up in the pancreas can trigger inflammation in the organ and increase the risk of diabetes. He also helped to identify a gene, Mal, which determines how a person will fare if they contract malaria, and his findings on molecules called Toll-like receptors in the human immune system are now being used to develop new ways to help patients after organ transplants and to treat chronic auto-immune conditions. Prof. O'Neill is one of the co-founders of Dublin-based Opsona Therapeutics.

// How to build bone //

You might take your skeleton for granted, but you'll soon know if something goes wrong with it. Bone grafting puts healthy bone or synthetic material at sites of disease or damage to help recovery, but it's an invasive procedure and it can take time to recover. Prof Fergal O'Brien at the Royal College of Surgeons in Ireland has developed a new bone graft substitute, HydroxyColl, based on products found naturally in the body. The material recruits the body's own regenerative mechanisms and encourages bone to repair, then it biodegrades over time to leave the regenerated bone in place. HydroxyColl is one of a number of products from Prof O'Brien's lab that are being commercialised through a spin-out company, SurgaColl Technologies.

// No need to wince for this injection // Hate jabs? Then you'll love the silicon 'microneedles' developed by Dr Anne Moore and Dr Abina Crean at University College Cork and colleagues at Tyndall National Institute. The tiny needles, which are etched into a patch that simply gets placed onto the skin, can painlessly deliver agents such as vaccines. As well as being kinder to the needle-phobic, the approach could help roll out vaccines in remote and developing areas as the patches are easy to ship, store and dispose of. In May 2012, Ireland hosted the Second International Conference on Microneedles, a major global conference for industry and research in the area.

Parsing is a cornerstone technology that facilitates language understanding, machine translation, sentiment analysis and information extraction from search engines. The DCU team combines expertise from the SFI-funded Centre for Next Generation Localisation (CNGL), the National Centre for Language Technology, and CNGL industry partner Symantec, in collaboration with Université Paris 13.

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driven by people and scientific excellence

// SFI - Understanding the Relationships Between Words // Dr Jennifer Foster and colleagues at Dublin City University proved that they are masters of automatic language analysis by winning an international parsing competition organised by Google. The DCU team beat other world-class institutions to win the prestigious SANCL 2012 Shared Task competition with their parsing system. Parsing – the science of automatically analysing the syntactic structure of sentences – enables computers to understand how words in a sentence relate to each other.

// A full circle and measurable economic return from SFI investment //

The return on investment from research is multi-faceted and includes trained graduates, job creation, new enterprises and partnering with industry. Prof. Mike Coey was one of the first SFI PI award holders. At the time of his first award in 2001 Prof. Coey had just established a company - Magnetic Solutions. Since then he has continued his career and established an internationally renowned laboratory on magnetic materials and devices. This has been recognised through many international and national awards, and Prof. Coey is a Fellow of the Royal Society and an international member of the National Academy of Sciences in the US. In recent years Prof. Coey has developed a strong research programme with Intel and importantly has introduced Intel to new magnetic technology.

As a result Intel have hired graduates from his group and transferred the technology to a manufacturing development programme in the US. In order to scale up the technology learned from Prof. Coey they needed to procure new capital equipment. The globally leading supplier of this instrumentation was the company Prof. Coey had founded a decade earlier - Magnetic Solutions. Magnetic Solutions is now scaling its operation and plan to employ an additional 20 people. In addition Intel Capital has invested in Magnetic Solutions - supporting its growth and Irish indigenous industry.

Ireland's export-led sectors have been not only weathering the recession but in some cases have been thriving. In the life sciences (pharmaceuticals, biotechnology and medical technologies) and ICT, many of the top global names have a presence in Ireland. Life sciences and information technology are some of the growing commercial sectors where SFI-funded research is helping to attract investment and drive innovation.

// supporting growth sectors in ireland

// Matchmaking pharma companies with analytical expertise //

Gaining contracts from global pharma businesses is a competitive business, and the portal ATTLAS aims to help Ireland make those deals. It provides the pharmaceutical industry with a one-stop information source detailing all of the facilities, equipment and analytical services available across all of the Irish Higher Education Institutions. Developed by the Solid State Pharmaceutical Cluster (SSPC), which is hosted by the Materials and Surface Science Institute at the University of Limerick, the portal aims to provide better connectivity between the pharmaceutical industry and higher education institutions in Ireland, with a view towards retaining some of the significant contract analysis business that this industry is currently sending abroad. The Cluster also analyses mechanisms that allow pharmaceutical solids to be produced with predefined characteristics, and the objective is to rationally design solid-state pharmaceutical materials to meet the demands of advanced formulation and drug delivery systems. The Cluster collaborates with companies such as Pfizer, Roche, Schering-Plough, Clarochem Ireland Ltd, MSD Ireland, Eli Lilly, Janssen Pharmaceutical Ltd, GlaxoSimthKine, Bristol Myers Squibb, and UCB Pharma.

// Getting medicine to where it counts //

A drug is little use unless you can get it to where it needs to work in the body. It should also be convenient to take so that patients comply. The SFI-funded Irish Drug Delivery Network brings together expertise at University College Dublin, the Royal College of Surgeons in Ireland, University College Cork and Trinity College Dublin to work with industry (e.g. companies like Genzyme Ireland, Sigmoid Pharma and Arch Therapeutics) on making drug delivery more effective and patient-friendly. Strengths within the cluster include replacing injected medications with oral or inhaled versions to make them easier to take and more effective.

// Boosting analytical techniques in Irish industry // The Irish Separation Science Cluster, led by Dublin City University, is linking with companies to provide research opportunities and training in advanced analytical techniques. Such skillsets are applicable to the pharma, agricultural and environmental sectors, among others. Meanwhile, at CRANN in Trinity College Dublin, the Advanced Microscopy Laboratory offers industry access to world-class facilites and expertise for analysing industrial and biological materials that can help them develop innovative products and processes.

// Faster, cost-effective network communications // The Photonics Systems group at Tyndall National Institute in Cork works with major international companies – including British Telecom - to discover ways of speeding up and simplifying how information is moved over optical networks. The aim is to support future cost-effective and high-bandwidth connections.

// supporting growth sectors in ireland

// SFI - Where Technology Meets the Clinic // Ireland's medical technology sector is one of the great success stories of the 21st century. We are one of the largest medtech exporters in Europe - second only to Germany. Many of the biggest global names have a presence here, the indigenous sector is thriving and overall medtech employs around 25,000 people directly in Ireland.

SFI supports commercially relevant research and innovation in medical technology and collaborates with industry in medtech through a number of centres. They include the Biomedical Diagnostics Institute based at Dublin City University, which is developing innovative ways to detect and monitor conditions such as cancer and cardiovascular problems. The Network of Excellence for Functional Biomaterials at NUI Galway is also driving innovation by developing materials that can improve healing and regeneration in the body.

// SFI researchers connecting Irish companies to Europe //
SFI has always encouraged and incentivised its researchers to participate in European funding programmes - winning non-exchequer funding and connecting Irish research internationally. An important additional benefit from these engagements is the connection of Irish companies with European funding. As an example researchers at CRANN have won €15million in EU funding over the last three years. And within the same awards five Irish based companies have obtained €2.3million euro of non-exchequer funding to support their growing research activities. Importantly they have also developed relationships with key suppliers, partners and end-users. SFI researchers are an important component in connecting Irish industry with Europe.

research

sfi putting ireland on the map through research

As science, technology and engineering take on the major challenges facing society, experts from different disciplines and from around the world are working together. SFI-funded researchers are working at home and with international teams to tackle some of the big questions and they are putting Ireland on the scientific map. SFI researchers are involved in over 1,900 partnerships with researchers in over 60 countries.

// A window on brain seizures in babies //

Seizures or 'fits' are the most common neurological emergency encountered in the neonatal intensive care unit (NICU) - they are caused by problems such as lack of oxygen around the time of birth, haemorrhage and meningitis.

But here's the problem: seizures can be very difficult to detect in newborns, and there may be no obvious outward signs that the baby is experiencing one, making intervention or treatment difficult.

The only accurate tool for diagnosis is EEG monitoring, a measure of electrical brain activity, but newborn EEG interpretation is a highly specialised skill and few experts are available.

Prof Geraldine Boylan, who directs the Neonatal Brain Research Group (neonatalbrain.ucc.ie) at University College Cork, has been carrying out research with engineering and computing collaborators into automating EEG interpretation so that seizures can be detected reliably in the NICU.

Cork is also part of an EU-wide project, NEMO, www.nem-oeurope.com. This project aims to find better treatments for seizures in babies and will incorporate some of the automated EEG technologies developed in Cork. This will help ensure that seizures are detected rapidly and timely decisions can be made for treatment.

// Searching for the successor to silicon in electronics //

Researchers from Tyndall National Institute are working with the University of Texas at Dallas, Queens University Belfast and Dublin City University to explore the use of new semiconductor materials with the potential to create more energy-efficient transistors for ICT. More efficient gate oxide materials would not only support further miniaturisation but also improve the battery life of portable devices.

// Cheaper, faster patent translations //

The Centre for Next Generation Localisation (CNGL) at Dublin City University is a partner on PLuTO (Patent Language Translations Online), an EU project that aims to facilitate patent searches and filing in different countries by translating information into the relevant languages. Working with the European Patent Office, CNGL is using its state-of-the-art translation engine, MaTrEx, to reduce the typically expensive and time-consuming translation burden for companies seeking patent validation.

// We are mapping Ireland - with data // There's no shortage of data in the world today, and the emerging field of 'geocomputation' aims to make that information more useful by capturing, visualising, analysing and modelling data linked to points in space. The approach can extract useful information about a multitude of important topics, including health service provision, coastal flooding and trends in crime. Leading the charge in Ireland is the National Centre for Geocomputation at NUI Maynooth, which is now regarded as one of the top geocomputation centres in the world. SFI has funded the Strategic Research Cluster in Advanced Geotechnologies (StratAG), which is based at NUI Maynooth and involves Trinity College Dublin, Dublin Institute of Technology and University College Dublin. Geocomputation looks to provide decision makers in public bodies and private industry with high quality information from spatial data – data linked to points in space - from which they can make important decisions. Research at the National Centre for Geocomputation and StratAG includes projects as diverse as developing in-car navigation systems that can update drivers in real time about road conditions, more 'intelligent' cities and carving up Ireland into more useful spatial units to improve data collection and analysis.

Why is the sky blue? Why can't we breathe underwater? How do flowers know when to bloom? Can we travel to Mars? Children are sometimes described as natural scientists – they are curious, they ask simple questions that cut to the chase on complex problems and they delight in the natural workings of the universe. Keeping that spark of curiosity alive is an important function of education, and SFI supports many initiatives to encourage children, their teachers and the wider public to engage with science and engineering.

sfi - supporting science education

// Discover Science & Engineering (DSE) //

DSE – getting more science to schools and beyond. DSE, which is managed by SFI, aims to increase interest in science, technology, engineering and mathematics (STEM) among students, teachers and members of the public. Key annual events to inspire awareness and interest include Science Week Ireland, which has been running since the mid-1990s and now hosts more than 500 events annually, and St Patrick's Festival Big Day Out.

Meanwhile SciFest is a strategic partnership between Intel Ireland hosted through Institutes of Technology where almost 3,000 students can display their projects at fairs and win awards. The Discover Sensors project works directly with 185 teachers in 34 post-primary schools to promote inquiry based science teaching and learning (IBST&L) - www.discoversensors.ie is host to a large range of teaching resources all based on a framework of IBST&L including formative assessment workbooks for Junior Certificate Science topics.

DSE partners with the European Space Agency. The European Space Education Resource Office (ESERO) at DSE is fueling interest among young people in STEM by supporting teachers to use Space exploration in their teaching at both primary and second level and supporting Ireland's increasing involvement in the space industry. Awareness and interest in STEM subjects and engineering is also promoted through a strategic partnership with Engineers Ireland and their STEPS programme, (www.steps.ie). STEPS delivers curriculum and learning support to both teachers and students in maths and science and drives many career awareness initiatives including Engineers Week and the Smart Futures volunteer effort.

// DSE online - encouraging science //

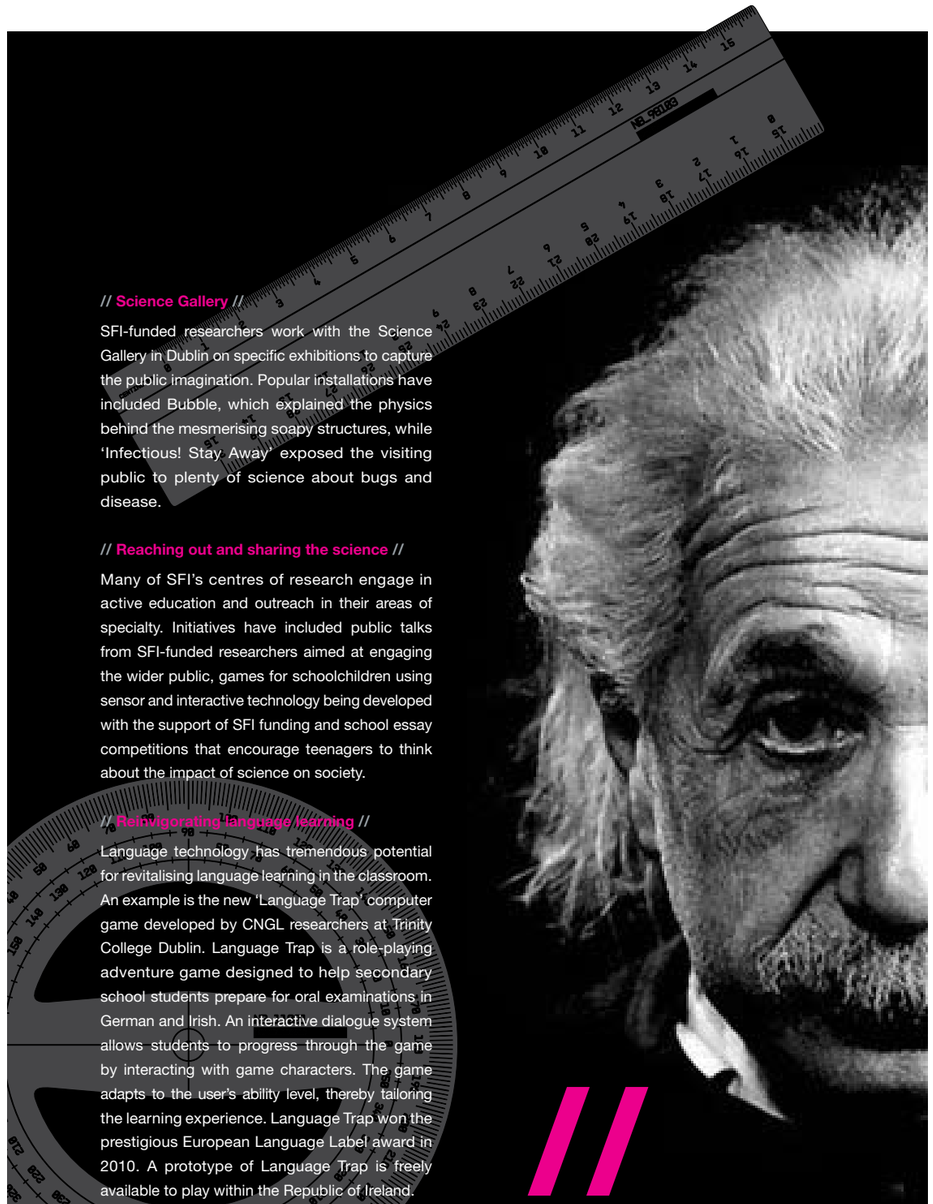
Online, DSE brings science to students through initiatives such as Greenwave.ie, where teachers can take part in projects to log the arrival of spring growth across Ireland and discoversensors.ie, which brings hands-on explorative learning in the classroom using sensors. And for those students looking to pursue a career in science, technology or engineering, www.SmartFutures.ie will point them in the right direction. With lots of online resources, this campaign is supported by industry partners such as Microsoft and Abbott. And for those students looking to pursue a career in science or engineering, mysciencecareer.ie can point them in the right direction. DSE also encourages students at primary school to explore science, maths and engineering using a fun hands-on approach demonstrating the relevance to everyday life. DSE Discover Primary Science and Maths programme supports include teacher training, lesson plans, awards and online resources at www.primaryscience.ie

// SFI and Young Scientists //

SFI engages with the annual BT Young Scientist and Technology Exhibition by maintaining a public stand and offering an award to the project that most advances research in the areas of science and / or engineering supporting sustainable energy and energy efficient technologies. The yearly event draws hundreds of projects from primary and secondary school students around Ireland.

// The Olympics - of analytic skills //

The Centre for Next Generation Localisation (CNGL), a SFI-funded university-based research consortium located at DCU, UCD, TCD and UL organises the All-Ireland Linguistics Olympiad. CNGL invites transition-year and 5th-year students in Ireland with an interest in languages to use their analytical skills to learn about linguistics and participate in this fun competition, with a view to representing Ireland in the International Linguistics Olympiad.



// Science Gallery //

SFI-funded researchers work with the Science Gallery in Dublin on specific exhibitions to capture the public imagination. Popular installations have included Bubble, which explained the physics behind the mesmerising soapy structures, while 'Infectious! Stay Away' exposed the visiting public to plenty of science about bugs and disease.

// Reaching out and sharing the science //

Many of SFI's centres of research engage in active education and outreach in their areas of specialty. Initiatives have included public talks from SFI-funded researchers aimed at engaging the wider public, games for schoolchildren using sensor and interactive technology being developed with the support of SFI funding and school essay competitions that encourage teenagers to think about the impact of science on society.

// Reinvigorating language learning //

Language technology has tremendous potential for revitalising language learning in the classroom. An example is the new 'Language Trap' computer game developed by CNGL researchers at Trinity College Dublin. Language Trap is a role-playing adventure game designed to help secondary school students prepare for oral examinations in German and Irish. An interactive dialogue system allows students to progress through the game by interacting with game characters. The game adapts to the user's ability level, thereby tailoring the learning experience. Language Trap won the prestigious European Language Label award in 2010. A prototype of Language Trap is freely available to play within the Republic of Ireland.

sfi research linking with multi-nationals

The SFI research community has linkages to more than 240 multi-national companies, ranging from the informal to the contractually based. The majority of these companies are IDA Ireland clients based in Ireland. Here is a selection of just some of the relationships SFI - funded researchers have built up with major multi-national corporations.

Intel has strong links with SFI research centres. The Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN) is working with the company on research for its future technologies and products - including a collaboration with Prof. Mike Coey on the use of magnetic nanomaterials for storing data more efficiently. Intel is funding directly a number of research programmes at CRANN and has placed seven full-time researchers at CRANN. Intel also has a collaborative programme with Tyndall National Institute to investigate next-generation materials, devices and technologies. The work could have a profound impact on future electronics. The agreement is the first of a kind for Intel in Ireland and establishes a direct collaboration between Tyndall and the heart of Intel's technology research group in the US. Dr. Paul Hurley, Senior Staff Researcher and Head of High-k Research at Tyndall, and Professor Jim Greer, Head of Electronics Theory and Graduate Studies at Tyndall, have been recognised by Intel with 2012 Intel Outstanding Researcher Awards. Professor Greer and Dr. Hurley are the only two researchers outside the USA to receive this inaugural award. The award was created to recognize truly outstanding contributions by researchers funded by Intel's Semiconductor Technology Council and associated Strategic Research Sectors (SRS).

// Cisco //

Communications networking giant Cisco is working with SFI CSET the Digital Enterprise Research Centre in Galway on ways to improve internal collaboration in companies, looking to create the next wave of enterprise social networking tools for the workplace of tomorrow.

// Disney //

Disney Research and SFI CSET CLARITY Centre for Sensor Web Technologies are working together to explore how small body-worn accelerometers can be used to capture and reconstruct an athlete's actions. The findings stand to be employed wherever it is important to be able to reconstruct, visualise and measure human motion including in sports, film and rehabilitation.

// Symantec //

The Centre for Next Generation Localisation (CNGL) is working with Symantec - the global leader in security, backup and availability solutions - to create new technologies to enhance the quality of its multilingual customer support operations. Symantec offers customer support to customers in 40 countries in 22 languages out of its Dublin offices. Working with CNGL's language technology experts has enabled Symantec to establish a sustainable automatic translation process that produces a high level of product support for non-English speaking customers. The technology provides access to and translations of customer support information produced by Symantec itself and also online content generated by customers through Web forums and social media. This collaboration with CNGL will help Symantec to reduce the cost and enhance the quality of customer support provided to its customers around the world.

BUBBLES

Often SFI research groups are undertaking research that may impact on Irish society in ways you might not expect - from forecasting the weather to looking at the perfect pint of stout.

// SFI - Bet You Didn't Know

// The science behind the perfect pint //

As a freshly drawn pint of stout settles in a pint glass, you may notice that small bubbles in the stout sink, rather than rising like the larger bubbles do in lagers. The sinking is in part due to the small size of the nitrogen bubbles, but what wasn't known was the origin of the current that drags them down. Researchers at the SFI-funded Mathematics Applications Consortium for Science and Industry at the University of Limerick got on the case. They used computational fluid dynamics, a technique used in designing aeroplanes and Formula One cars, to calculate the fate of the bubbles. And while measuring density of stout in a cylinder, they noticed the bubbles went down the lower face of a cylinder when it was tipped. This insight led to the conclusion that the narrow-ended shape of the traditional pint glass is a key factor in the downward pull of the bubbles. The research also has applications outside the pub: understanding the flow of bubbles can help improve some industrial processes.

With support from SFI, the Irish Centre for High-End Computing (ICHEC) is collaborating with Met Éireann to develop and run both Climate and Numerical Weather forecast models. The aim is to improve the accuracy of weather forecasts, giving better predictions of extreme events such as storms and major rainfall, and to better predict the power output from turbines on wind farms. Running flood models and improved climate models help Ireland prepare for future change, to avoid loss of life and property damage.

// What makes flowers bloom? //

Dr Frank Wellmer's lab at Trinity College Dublin formed part of a team that identified genes which are switched on and off for flower development in the well-characterised plant *Arabidopsis thaliana*, or thale cress. The findings could ultimately help to improve crop yields.

sfi bringing knowledge to the wider world

Scientific findings move out of the lab in many ways and SFI researchers have been making their mark on the world. SFI researchers continue to deliver a high level of scientific publications - more than 5,000 on average per year, with a third of these involving international partners - and a high level of pre-commercial outputs per year: on average 6 spinouts; 83 patents filed; 14 patents awarded; 145 invention disclosures and 25 licensed technologies. The success stories have come from across the spectrum of disciplines funded by SFI, here are just a few examples.

// Gut Bacteria Regulate Happiness //

APC scientists have shown that brain levels of serotonin, a brain chemical associated with mood, are regulated by the amount of bacteria in the gut during early life. This research shows that normal adult brain function depends on the presence of gut microbes during development. Scientists at the APC used a germ-free mouse model to show that the absence of bacteria during early life significantly affected serotonin concentrations in the brain in adulthood.

Serotonin, the major chemical involved in the regulation of mood and emotion, is altered in times of stress, anxiety and depression and most clinically effective antidepressant drugs work by targeting this neurochemical. This research has multiple health implications as it shows that manipulations of the microbiota (e.g. by antibiotics, diet, or infection) can have profound knock-on effects on brain function. The research was carried out by Dr Gerard Clarke, Professor Fergus Shanahan, Professor Ted Dinan and Professor John F Cryan and colleagues at the Alimentary Pharmabiotic Centre in UCC.

// Layers for better plastics and computers //

Smaller, faster computers, more efficient batteries and greener plastics could be on the way if we can use tiny flakes or nanolayers of certain materials. Prof Jonathan Coleman and his team at the Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), based at Trinity College Dublin, have developed a method to split these materials into billions of such layers, making them more useful and cost-efficient. His publication record earned him a place in the top 100 materials scientists of the decade worldwide between January 2000 and October 2010, as compiled by Thomson Reuters. His position of 61, with 30 papers and 1,507 citations in materials science journals, put him within the top 0.02 per cent in the field.

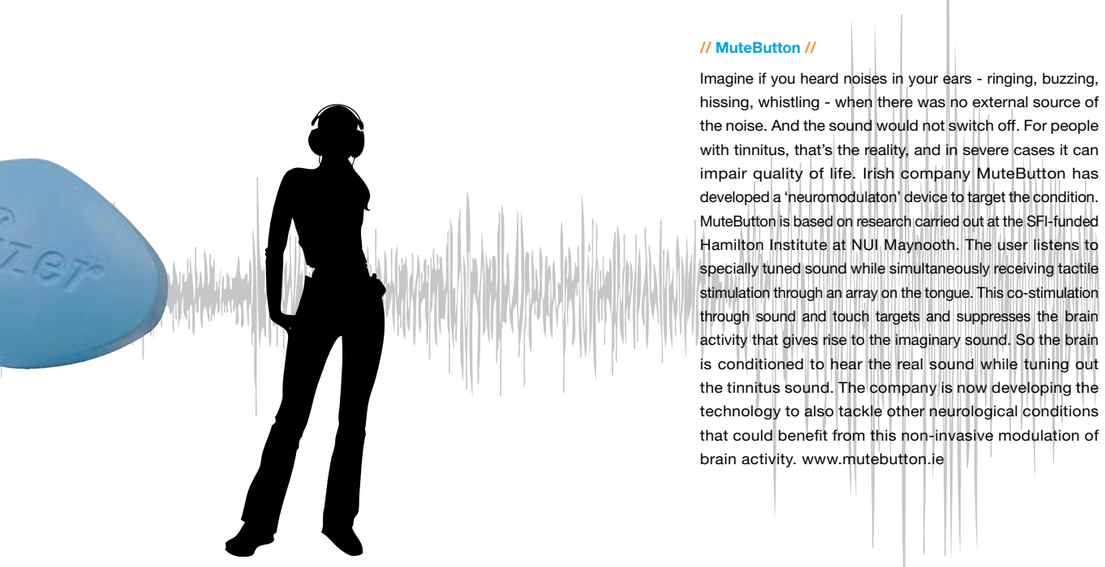
Overall, Prof Coleman has published 150 papers in international journals such as Science and Nature and has been cited almost 8,000 times.

// A new world of immune-based therapies // One of Ireland's biggest success stories in moving research out towards the clinic has been Dublin - based Opsona Therapeutics. With its origins in SFI-funded research carried out at Trinity College Dublin, Opsona has been developing and testing therapies to selectively target important molecules in the immune system called toll-like receptors that drive chronic conditions such as arthritis as well as problems of rejection after transplants. Putting it firmly on the world stage, the biotech company has also set up a large-scale collaboration with Pfizer, with the aim of discovering new agents for the treatment of autoimmune and inflammatory diseases. www.opsona.com

sfi bringing knowledge to the wider world

continued

// HeyStaks // Did you look for information online today? Was it on your smartphone or tablet device? Did you want to share the information with someone? Web search, mobile devices and social applications are huge trends that have gained pace in recent years, and Irish company HeyStaks is combining them to harness the power of 'social searching' on the move. Their technology, which grew from research at the SFI-funded CLARITY CSET, allows users to form search communities with friends and colleagues as a way to collaborate and search more effectively online. The spin-out company is based in San Francisco and at NovaUCD and raised its first round of seed funding in 2010, securing investment of 1 million euro in equity funding from the Ulster Bank Diageo Venture Fund, managed by NCB Ventures. www.heystaks.com



// MuteButton //

Imagine if you heard noises in your ears - ringing, buzzing, hissing, whistling - when there was no external source of the noise. And the sound would not switch off. For people with tinnitus, that's the reality, and in severe cases it can impair quality of life. Irish company MuteButton has developed a 'neuromodulaton' device to target the condition. MuteButton is based on research carried out at the SFI-funded Hamilton Institute at NUI Maynooth. The user listens to specially tuned sound while simultaneously receiving tactile stimulation through an array on the tongue. This co-stimulation through sound and touch targets and suppresses the brain activity that gives rise to the imaginary sound. So the brain is conditioned to hear the real sound while tuning out the tinnitus sound. The company is now developing the technology to also tackle other neurological conditions that could benefit from this non-invasive modulation of brain activity. www.mutebutton.ie

// Scientific writer, Dr Claire O'Connell, wrote the text in collaboration with SFI Researchers // Booklet designed and produced by Duffy Design //

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