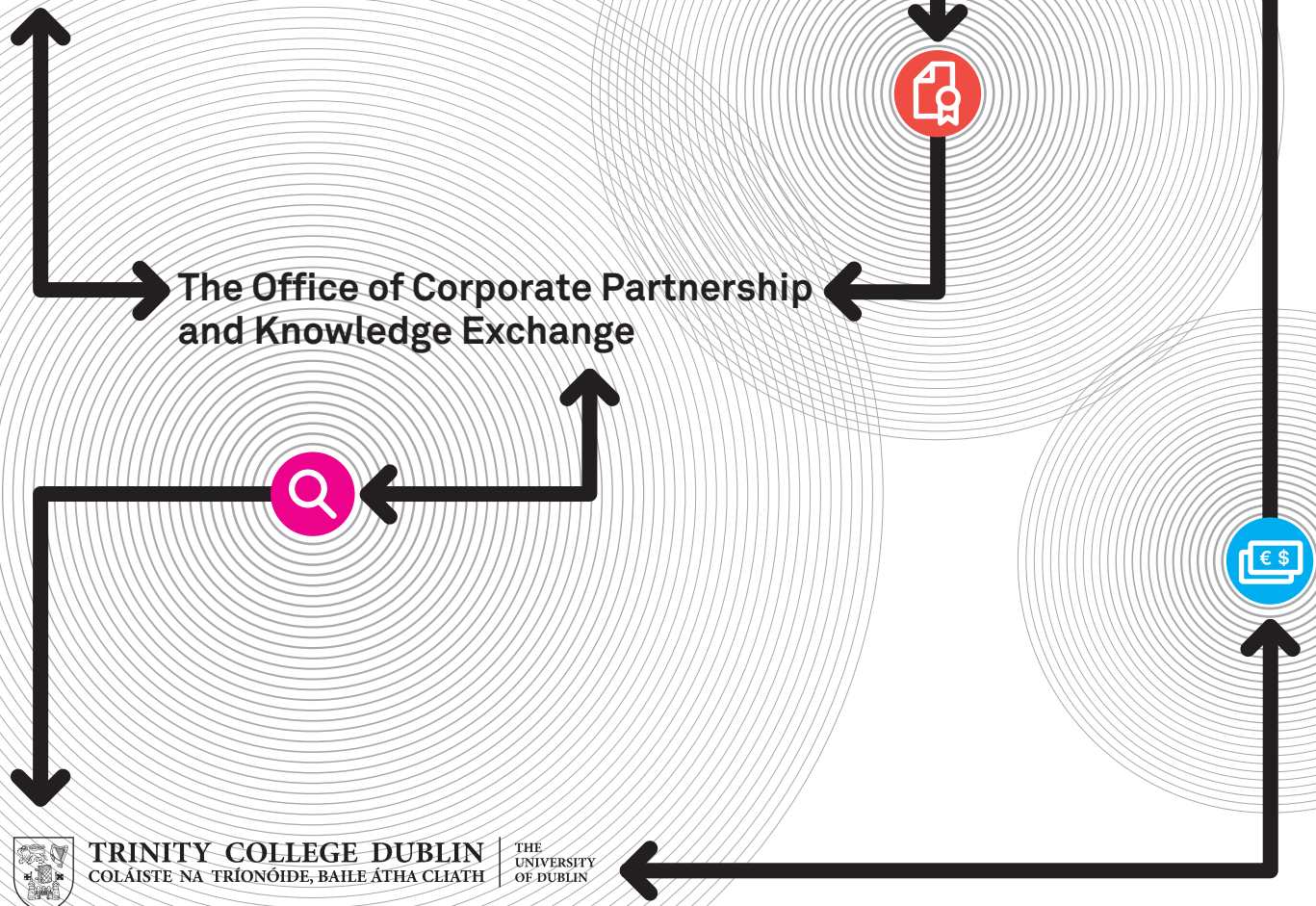


Trinity Partnering with Industry





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Welcome from the Director



Trinity has always understood the value of great ideas that create disruptive technologies which benefit society and the Irish economy. Trinity research has been the starting point for many pioneering Irish companies like Iona Technologies, Havok, Identigen and Opsona Therapeutics. Trinity research has also supported technologies which have transformed how people live and the choices they make e.g. the nicotine patch.

Trinity research is recognised as world leading. Trinity is the highest ranked university in Ireland and in the 2013 Leyden University rankings it was placed 9th in Europe and 42nd globally for its research performance.

Many of our research areas, including materials science, immunology, cancer research, the digital humanities, computer science, genetics; are ranked in the top 1% globally. Trinity has more ERC researchers, the European benchmark for excellence, than any other Irish institution. Trinity was awarded more FP7 funding than any other Irish institution. Trinity over the last five years has spun out more companies and had more equity investment in those companies than any other university.

Trinity simply represents to industry the best that academic research can offer. It is an international touch point for research excellence.

Trinity has successfully connected its research excellence to industry and has engagements with over four hundred companies. As part of our new Innovation

and Entrepreneurship strategy Trinity has looked at international best practise for managing and growing company engagement. We want to develop close partnerships with industry; to proactively meet the needs of industry and to establish business friendly and straightforward mechanisms for engagement. The Office of Corporate Partnership and Knowledge Exchange (OCPKE) is being established to achieve these goals.

The OCPKE brings together all the parts of the university that are required for a deal to be completed with industry. This centralisation of function, coupled with new dedicated business development staff, will ensure that the pathway for industry to engage is simple, flexible, professional and proactive; and that any challenges can be acted upon in a decisive manner.

If you are a company looking to engage in a research project, a business looking to license some technology, an entrepreneur looking for your next venture, a venture capitalist interested in new innovations, a company wishing to access our world leading infrastructure or just an interested party there is now one front door to Trinity. This front door will be welcoming and comes with an upfront commitment to make your engagement with Trinity both fruitful and effective.

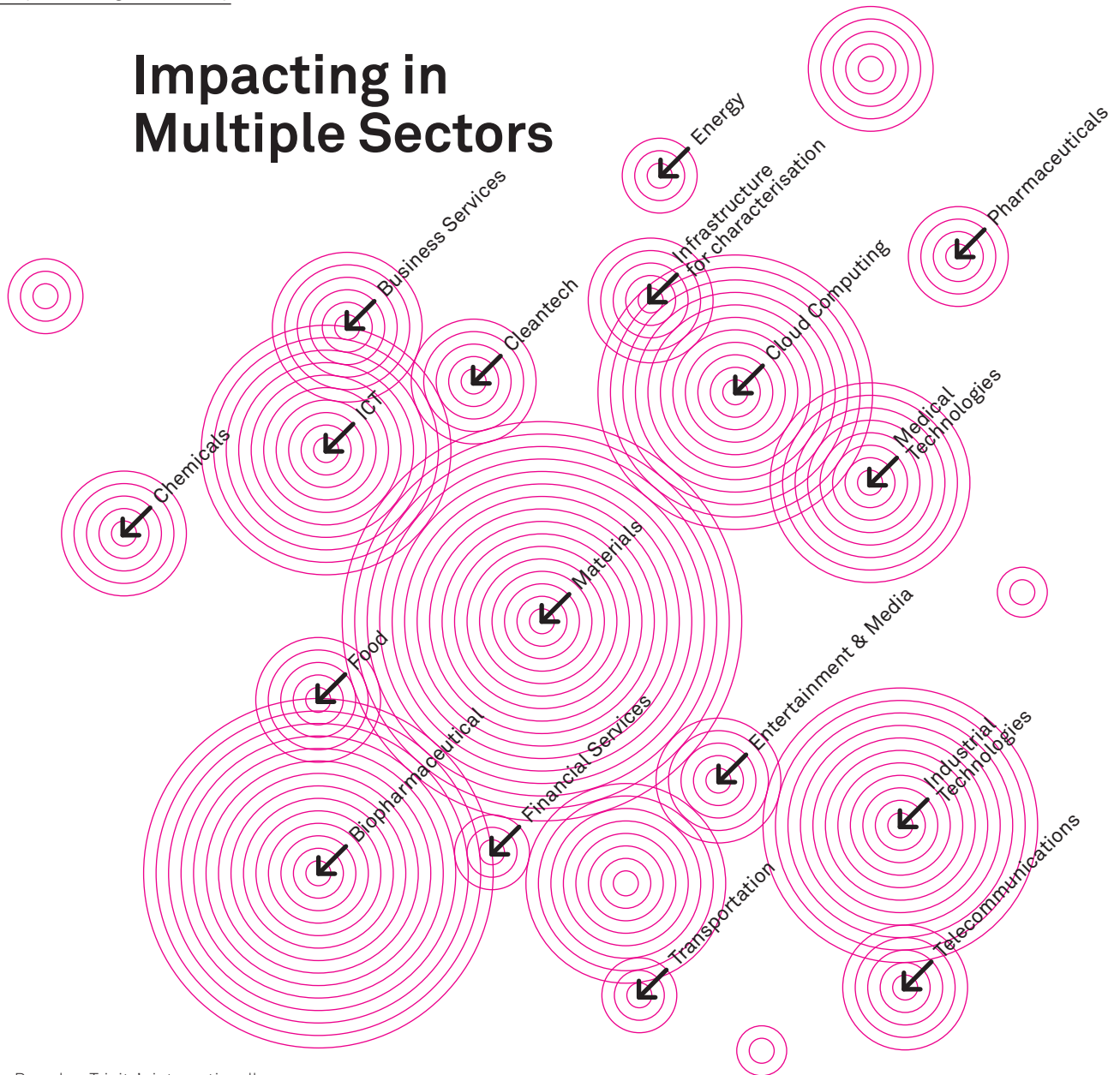
Trinity is open for business and is committed to being a reference for excellence not just for the quality of our research but for the quality of our partnerships.

Dr. Diarmuid O'Brien

Dr. Diarmuid O'Brien
**Director Trinity Research & Innovation,
Trinity College Dublin**

**Office of Corporate Partnership
and Knowledge Exchange**

Impacting in Multiple Sectors



↑ Based on Trinity's internationally recognised research strengths the Office of Corporate Partnership and Knowledge Exchange facilitates industry academic collaborations across multiple sectors

How to work with Trinity

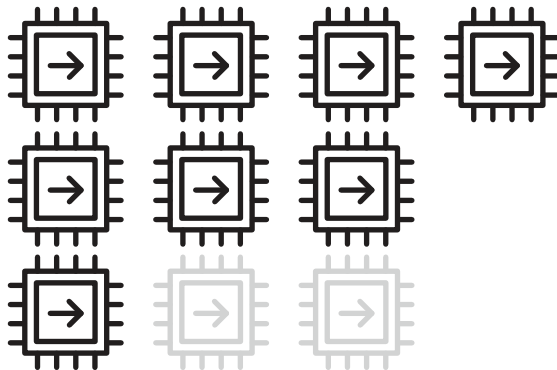
Methods of Engagement

Enterprise Ireland	Science Foundation Ireland	Direct Industry Support	European Union	IDA	Higher Education Authority
Technology Centres	SFI Investigators Programme	Contract Research	Framework Programme	Securing FDI	Delivery of Infrastructure Access
Innovation Partnerships	SFI Industry Fellowships	Rapid Materials Analysis	Partnering with Leading Institutions	Promoting Irish Research Excellence	Enabling Fundamental Research Base
Innovation Vouchers	SFI Research Centres	Local Manufacturing Support	Leveraging EU Funding	Showcase the 'Best in Class' Technologies	Foundation delivery of core research
Technical Feasibility Study	SFI Research Centre Spokes Programme	Consultancy	Networking Opportunities	International Company Engagement	
Commercialisation Fund	Tech Innovation Development Award (TIDA)	Specialist Training	Service Agreements	Technology Centre	
	SFI Strategic Partnerships		Horizon 2020	Training Support	
	SFI Short-Term Industry Visiting Fellowships		Recruitment, Placement & Exchange		

↑ Trinity will help companies navigate the complicated funding system to identify the right opportunity for the proposed partnership

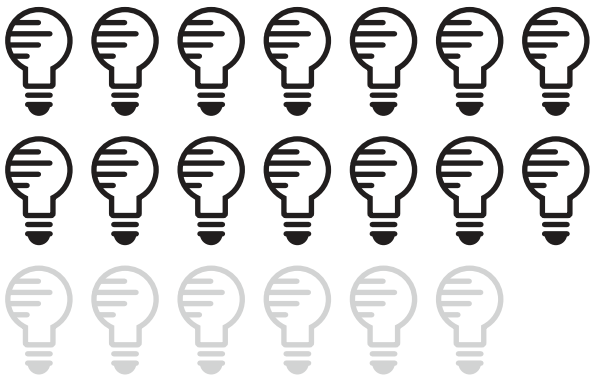
ICT Exporters in Ireland

Trinity collaborates with 8 out of the top 10



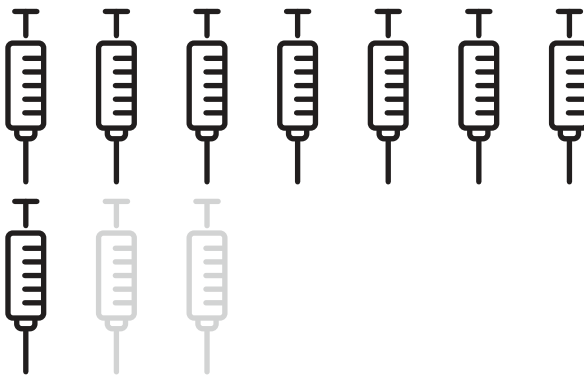
Global innovative companies

Trinity collaborates with 14 of the top 20



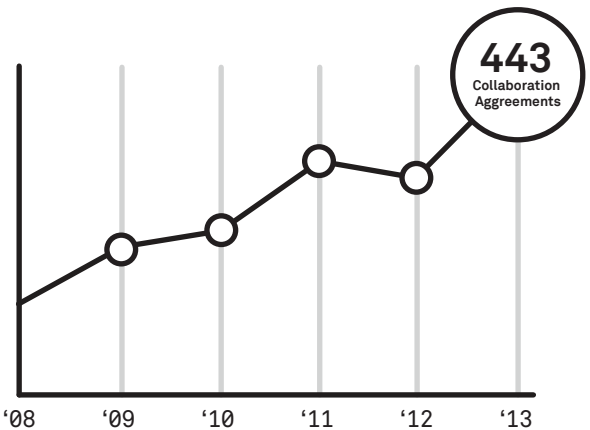
Medical device companies

Trinity collaborates with 8 of the top 10



Collaboration Agreements

Trinity reached 443 collaboration agreements between 2008-2013



10 Reasons to Work with Trinity

Trinity is committed to supporting industry — from SMEs to MNCs, from short term projects to long term on-going collaborative projects. In a national or international context, we work collaboratively with industry stakeholders and agencies to share infrastructure and expertise, tackle industry relevant research challenges, problems, or address grand challenges.

→ **Innovation Approach**

Delivers an Open Innovation approach – simple, flexible, professional and proactive engagement with industry.

→ **Research Programmes**

Provides an opportunity to work with other large and small companies in collaborative research programmes.

→ **Human Resource Model**

Delivers a scalable human resource model, giving access to highly trained scientists and engineers.

→ **State of the Art Equipment**

Provides access to state of the art equipment with expert analysis and results interpretation.

→ **Dedicated EU Funding**

Offers dedicated EU funding specialists and a platform for EU project development.

→ **Research Funding**

Provides a platform for researching new commercial applications and developing intellectual property.

→ **Partnering with and Servicing Industry**

Provides a fast turnaround on Innovation projects and is committed to partnering and servicing industry.

→ **Flexible Solutions**

Provides flexible solutions from training, to analysis to collaborative research programmes.

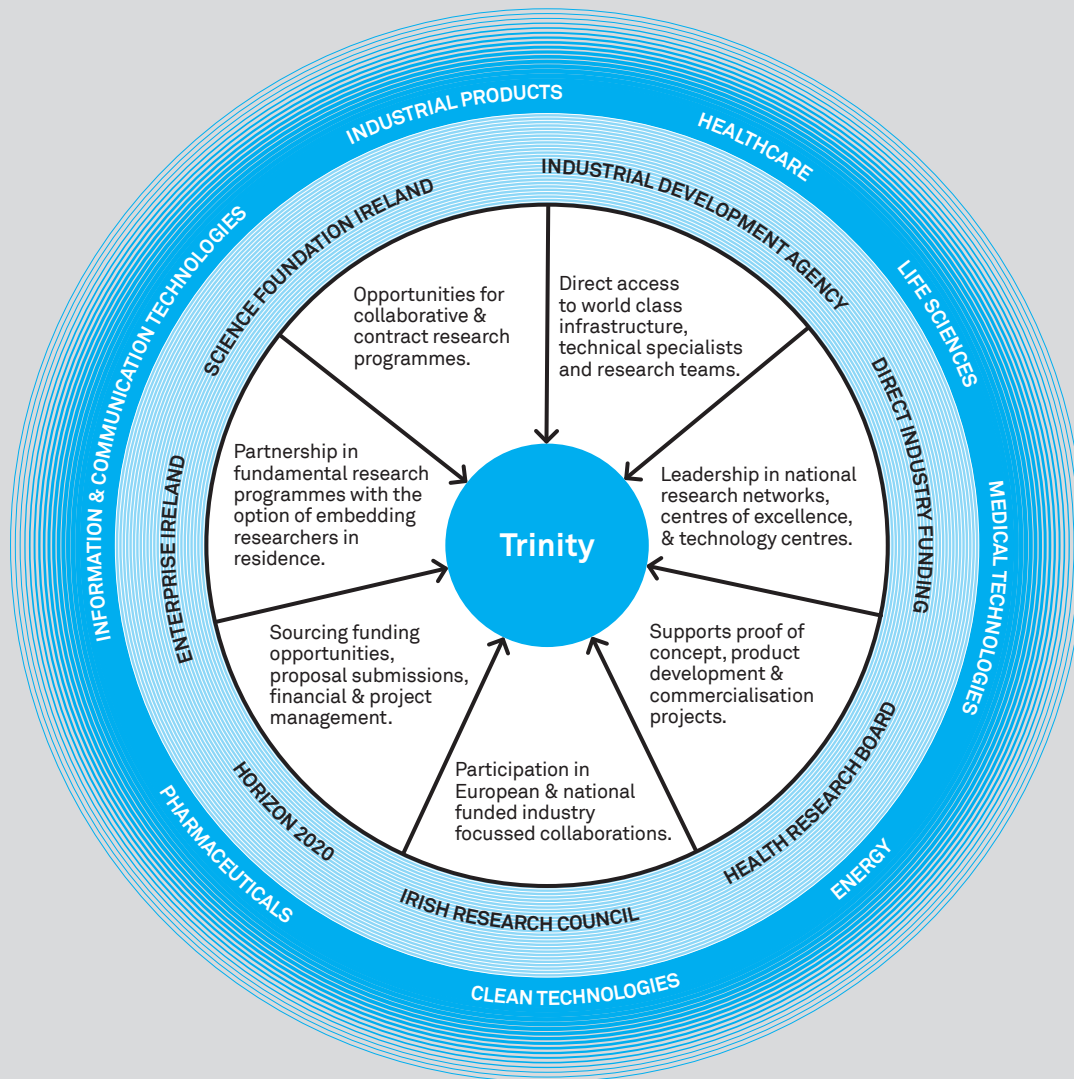
→ **Licensing Opportunities**

Has an active pipeline of licensing opportunities for industry to license.

→ **Industry Partners**

Has a proven track record of working with over 400 industry partners in Ireland and internationally.

Working with Industry



Thomas Swan & Co. Ltd

Industry Challenge

Thomas Swan is a leading independent manufacturer of performance and speciality chemicals, manufacturing over 100 commercial products and exports to over 80 countries worldwide.

Graphene is well recognised as the wonder material of modern science and was the focus of the Nobel Prize in 2010. It has unique properties and is both the strongest and most conductive material known to man. Potential applications for graphene are wide ranging and include next generation electronic devices, mechanically strengthened plastics and new thermoelectric materials.

Production of pristine, high quality graphene on an industrial scale is a significant challenge to industry. The development of a graphene manufacturing process is the latest venture for Thomas Swan's Advanced Materials Division which already manufactures industrial grades of single-wall carbon nanomaterials.

Trinity Value Add

Thomas Swan has funded an industrial focussed research project collaborating with Trinity Professor Jonathan Coleman in CRANN, Trinity's Nanoscience Research Institute, utilising Prof Coleman's expertise in the field of graphene production to develop methods to produce high quality pure graphene on an industrial scale.

Thomas Swan has placed a processing engineer in CRANN for two years. This ensures the programme is continually aligned to the company's strategy and also provides Thomas Swan oversight on the full portfolio of research within CRANN allowing them to ascertain if these technologies would be of value to the company.

This partnership is a model for how world leading technology developed by academia can be identified and commercially exploited to provide both economic and societal benefit.

Critical Trinity Enablers

- Materials, knowledge and expertise
- Synthesis, processing and advanced characterisation of nanomaterials
- Mechanical, optical and electrical testing of nanomaterials
- Training of industry staff and the transfer of commercially valuable knowledge
- Advanced microscopy for materials characterisation

Engagement Type

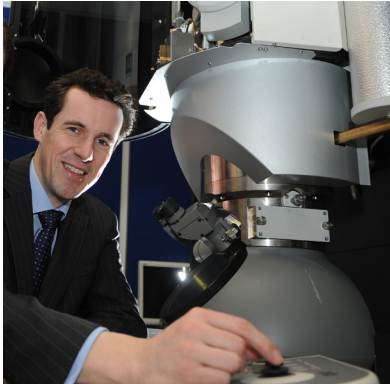
A direct industry funded project which gives the company a strong voice in collaborative or contract research projects and bypasses the need to wait for funding calls.

Impacts

An extremely successful project expected to deliver a scaled-up production process to Thomas Swan under licence in 2014. Because of the high quality of the graphene produced by this process, it is likely that this will allow Thomas Swan to become one of the largest global suppliers of high-end graphene.

“Our partnership with Trinity has resulted in a new globally leading process for the scalable production of graphene. The outcome of this research will be the availability of high quality graphene in large quantities for the first time. This major breakthrough opens up significant new commercial markets for our business; and demonstrates the power of partnering with world leading research institutions”

Harry Swan, Managing Director, Thomas Swan



Monford AG Systems Ltd.

Industry Challenge

Monford AG Systems develops innovative hardware and software solutions for measuring and recording agricultural activity, specifically in the area of natural feed measurement, combining mapping and wearable sensor technology, to measure grass growth.

Trinity College and Monford have developed the GrassOmeter — a device that measures and records grass growth, providing farmers worldwide with a solution to measure, manage and optimise grass production. Glanbia are using the technology on Irish farms to prepare the dairy industry for the end of milk quotas by accurately predicting the amount of yield per hectare. This allows farmers to manage feed requirements more accurately. The product is a great example of convergence and innovation.

“A term that captures how creativity and innovation spread is “when sparks fly”. For us the “spark” was a chance conversation with John Whelan of Trinity’s Technology Transfer Office and a suggestion to apply for an Innovation Voucher. That spark has now ignited a global effort to improve farming worldwide, with a team bringing together the designer of the original Mac, investors in New Zealand, manufacturers from Ireland, the US and China and farmers and grass experts from all over the world. Without the spark from Trinity the GrassOmeter would never have happened.”

Steven Lock, CEO & Founder, Monford AG Systems

Critical Trinity Enablers

The GrassOmeter uses ultrasound to measure grass height as the farmer walks around a field with the device mounted to his/her boot. The measurements are triggered by a nine point orientation sensor, mapped with GPS, and sent to the farmer’s smartphone using Bluetooth, where an app will carry out all the calculations. This innovative solution which was further developed by Jerrold C Manock, designer of the original Apple Mac, who is the lead designer of Monford’s GrassOmeter technology is faster, more cost-effective, and more user-friendly than traditional methods.

Engagement Type

Monford was awarded two Enterprise Ireland Innovation Vouchers worth €5,000 each to work with Trinity researchers to develop the initial GrassOmeter prototype. Further support and advice was given by Prof Mike Jones of Trinity’s Botany Department.

Impact

Monford AG Systems Ltd has secured €1.25m investment to enable it to bring the GrassOmeter to market in 2014.



Cellix Ltd.

Industry Challenge

Over 3.2M new cancer cases and 1.7M cancer-related deaths are registered in Europe every year. Current diagnostic methods are not sensitive enough, limiting the potential for early disease identification. Earlier detection and more precise diagnosis of disease will provide patients with the correct therapies at an earlier stage in the disease development. New innovations in nano medicine can help to reduce morbidity and mortality in the 21st century by the early detection, monitoring and fast treatment of chronic disease. The NAMDIATREAM project aims to provide new knowledge and expertise for biomedically relevant applications in the early diagnosis and imaging of cancer.

Cellix Value Add

Cellix Ltd which spun out of Trinity in 2006 has greatly benefited from participation in the FP7 NAMDIATREAM pan-European consortium in terms of research expansion into cancer diagnostics and screening. The company has also benefited from the collaborative nature of the work carried out with the Multinationals and high-tech SMEs around new nanotechnological solutions.

Trinity Value Add

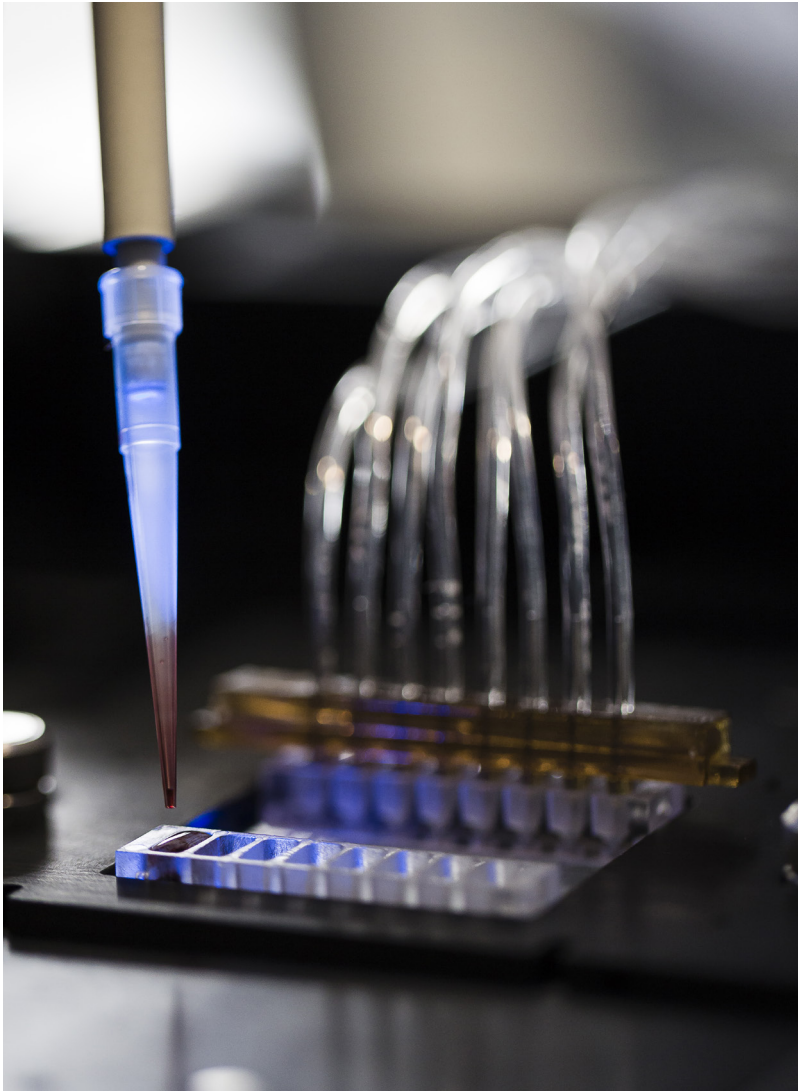
NAMDIATREAM was formed to develop a nanotechnology based toolkit to enable early detection and imaging of molecular biomarkers for the most common cancer types, as well as permitting the identification of early-stage onset. The project is built on the innovative technology concepts of super-sensitive “lab-on-a-bead”, “lab-on-a-chip” and “lab-on-a-wire” nano-devices. Prof. Yuri Volkov in the School of Medicine & CRANN coordinates the consortium and brings expertise in the areas of nanotoxicology and nanomedicine. Prof. Coey, School of Physics and Prof. Gun’ko from the School of Chemistry bring expertise in magnetic sensor and functionally labelled nanoparticles and nanowires.

Critical Trinity Enablers

The programme is built upon the extended range of clinically accepted multimodal nanomaterial for plasmonic, photoluminescence, non-centrosymmetric and multimodal magnetic materials. New facilities have been created with the specific focus to translate NAMDIATREAM nanodiagnostics and nanomedicine outcomes into industrial products.

Engagement Type

EU FP7 project under the Nanosciences, Nanotechnologies, Materials and new Production Technologies area. NAMDIATREAM is a €13m project of which €3.9m will be directly invested in Ireland. It brings together an international consortium of 7 high-tech SMEs including Irish SMEs Cellix Ltd and Radisens Diagnostics Ltd, 2 multinational companies (Becton Dickinson, Europe and Nikon Instruments, France), 12 academic institutions and 1 technology transfer company. Researchers from the School of Medicine and CRANN, Trinity’s nanoscience research institute, are leading the technical programme and have overall responsibility for coordinating the consortium programme.



“Through the NAMDIATREAM project, Cellix has developed a relationship with BD and the resulting expertise which Cellix has gained in the field of flow cytometry is proving commercially important in terms of Cellix’s engagement with OEM customers for defined applications”
Vivienne Williams, CEO, Director and Founder, Cellix

Alkermes Inc.

Industry Challenge

Alkermes Inc. is a leader in innovative medicines that address the unmet needs and challenges of people living with debilitating diseases of the central nervous system (CNS), such as schizophrenia, addiction and depression. To assist with moving medicines more rapidly from discovery to development, Alkermes Inc. is establishing new partnerships and leveraging established science as a key strategy.

Trinity Value Add

The O'Mara laboratory, based in the Trinity College Institute of Neuroscience (TCIN) has extensive expertise in neurobiology and neuropsychology of learning & memory, and stress & depression. The O'Mara research group employs a combination of *in vivo* multi-electrode neurophysiology, behavioural analysis, molecular biology and pharmacological intervention to investigate the function of brain systems implicated in memory function and dysfunction and in psychiatric disease, particularly major depressive disorder.

Critical Trinity Enablers

Extensive technical expertise in the areas of learning and memory, mechanisms of brain repair, drug action in the CNS and synaptic plasticity

- visualising *in vivo* neuronal activity
- defining distribution of bioactive agents in CNS
- imaging human brain during learning and memory
- models of neurodegeneration
- *in vivo* models of secondary depression; organic disorders of memory
- invasive neuromodulation of the CNS, specifically *in vivo* recording and deep-brain stimulation
- *in vivo* neurophysiology in freely-moving/anaesthetised rat (field potentials/action potential recordings of single neurons/neuronal ensembles)
- neurobehavioural assays (automated water, radial, open field; object exploration, odour discrimination, etc.)
- brain biomarker assays (BDNF; prostaglandins), radioimmunoassays, neurohistology

Engagement Type

The Alkermes Inc. — Trinity research services engagement is a direct industry funded project. Advantageously, this arrangement allows the company to benefit from academic expertise for the purposes of their specific research focus, without any IP ownership restrictions. The research program is driven by the industry party with significant technical and scientific input from the academic.

“Leveraging existing state-of-the-art neurological techniques and scientific expertise advantageously strengthens our drug development profile and allows for rapid critical go/no-go decisions to be made”
Dr. Dan Deaver, Vice President of Non-clinical R&D,
Alkermes Inc.



Welocalize Inc.

Industry Challenge

The \$25 billion language services industry can reap billions in cost savings by identifying and removing inefficiencies that creep into the translation supply chain. In recent years, Welocalize, one of the world's largest language service providers has increased its use of machine translation (MT) to improve translation efficiency.

Translators vary in their ability to leverage MT to improve translation speed, and current computer aided translation tools cannot measure overall efficiency, making accurate MT assessment difficult. Welocalize collaborated with the CNGL Centre for Global Intelligent Content, a Science Foundation Ireland (SFI) funded research centre, to develop a tool that could measure and improve translation productivity.

Trinity Value Add

CNGL Researchers at Trinity and Dublin City University partnered with Welocalize to develop the iOmegaT Translation Productivity Test-Bench, which gathers and analyses translator activity data and calculates the effect of machine translation on translation speed. In 2011, working closely with CNGL researcher John Moran, Welocalize deployed the project onsite at its Dublin offices.

This automated approach for collecting speed data is a major improvement on current localisation industry reporting practices. iOmegaT helps to evaluate MT suitability and identify translation issues, while reducing translators' onerous daily activity reports.

Critical Trinity Enablers

- Powerful combination of industry know-how and scientific excellence
- Multidisciplinary expertise across four of Ireland's leading universities
- Track record in delivering timely innovations for corporate partners
- Global pioneers in language technology and intelligent content innovation

Engagement Type

Industry Membership of SFI Centre for Science, Engineering and Technology (CSET), which provides direct input into collaborative research projects and preferential access to intellectual property. Commercial roll-out of the iOmegaT Testbench is facilitated by a SFI/Enterprise Ireland TIDA award.

Impact

- Welocalize uses iOmegaT speed data to calculate MT cost-benefit analysis, measure the success of MT programmes, and aid translators in defining fair pricing for post-editing
- iOmegaT is one of three language technology projects that CNGL is developing in close collaboration with Welocalize in order to enhance the translation supply chain



“Collaboration between Welocalize and the CNGL has already generated significant research outcomes. We firmly believe that our productive relationship with the CNGL will accelerate industry advancements in order to revolutionise the industry.”
Smith Yewell, CEO and Founder, Welocalize Inc.

Sigmoid Pharma Ltd.

Industry Challenge

Sigmoid Pharma Limited is a specialty pharma company with a mission to create meaningful new therapies for unmet clinical needs in gastrointestinal and immunological diseases and disorders. A key Sigmoid goal is the development of oral vaccines. A significant advancement in oral delivery systems is required to facilitate the development of a new generation of non-living oral vaccines. Sigmoid's proprietary Single-multiple Pill (SmPill®) enables the combining of antigenic and adjuvant materials within an emulsion to permit the development of oral vaccines. The SmPill® - enabled vaccines have the potential to significantly enhance immunity against antigens from enteric pathogens. Through iterative product and technology development Sigmoid seeks to have a competitive position in the field, and to make the possibility of a new generation of oral vaccines a reality.

Trinity Value Add

The Lavelle research group, based in the Trinity Biomedical Research Institute (TBSI) has internationally recognised expertise in the design and evaluation of adjuvants and delivery systems for mucosal and injectable vaccines, with the infrastructure in place to efficiently execute this work. In particular, the group have significant experience in the evaluation of innate and adaptive immune responses induced by mucosal adjuvants and in dissecting the underlying mechanisms of adjuvanticity. Our expertise in evaluating adjuvants and antigens and the measurement of mucosal immune responses have been key to facilitating a successful collaboration.

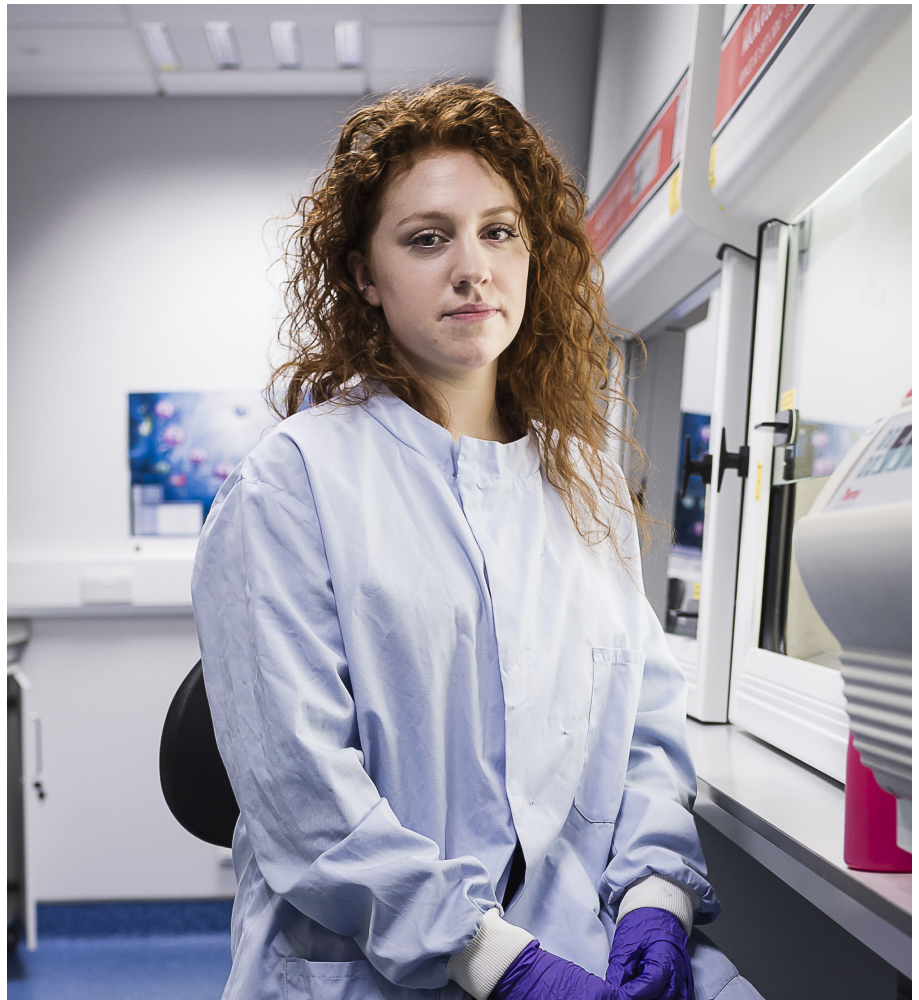
Critical Trinity Enablers

- Expertise in the design and evaluation of adjuvants and delivery systems for mucosal and injectable vaccines;
- Expertise in *in vitro* and *in vivo* assays to determine activation of innate immunity;
- TBSI has outstanding infrastructure to allow comprehensive evaluation of the induction of mucosal immunity by vaccines including excellent animal holding facilities, access to state of the art flow cytometry, confocal microscopy and imaging facilities.
- A network of world class collaborators in the field of mucosal vaccines allowing access to candidate antigens, adjuvants and challenge models.

Engagement Type

Sigmoid collaborates with Trinity on an ongoing basis, through the Lavelle Research Group, availing of State funded schemes such as; the Irish Research Council's 'Enterprise Partnership Scheme' and the Enterprise Ireland 'Innovation Partnership Program'. Sigmoid also engages with Trinity in direct contract research services and as a FP7 partner (Helicovaxor, ADITEC).

“SmPill® is an innovative and broadly applicable technology. To date, through collaborating with the Lavelle group, the potential of SmPill® to enable oral vaccination has been proven. Extending the collaboration with the Lavelle group will allow Sigmoid to support its existing intellectual property portfolio, further characterise various vaccine formulations, complete pre-clinical development, and create new academic collaborative as well as commercialisation opportunities.”
Dr. Ivan Coulter, CEO, Director and Founder, Sigmoid



Vitalograph Ltd.

Industry Challenge

Vitalograph is recognised as the world leader in spirometry for major respiratory health areas such as Asthma and COPD. Compliance with inhaled medication (inhalers) and adherence to a therapeutic regimen can be challenging for many patients and is particularly critical in clinical trials data collection. There is a need to monitor correct technique and dosing for accurate assessment of the patient's response.

Trinity Value Add

Prof. Richard Reilly of the Trinity Centre for BioEngineering developed the Inhaler Compliance Assessment (INCA) device specifically to address the need for inhaler monitoring in asthma and COPD. Prof. Reilly's team are leaders in the field of eHEALTH with capabilities in computer software algorithm development, electronics, device design and connectivity. The INCA device provides integrated acoustic analysis for inhalers and can report the key parameters from the point-of-use back to the clinician.

Critical Trinity Enablers

Located within the Trinity Biomedical Sciences Institute (TBSI), the Trinity Centre for BioEngineering (TCBE) is capable of effective translational R&D with technical infrastructure and access to clinicians and hospitals. Validation studies on the INCA device involved collaboration with RCSI (Consultant Prof. Richard Costello) at multiple sites throughout Ireland including the Trinity Wellcome Trust-HRB Clinical Research Facility at St. James's Hospital.

Engagement Type

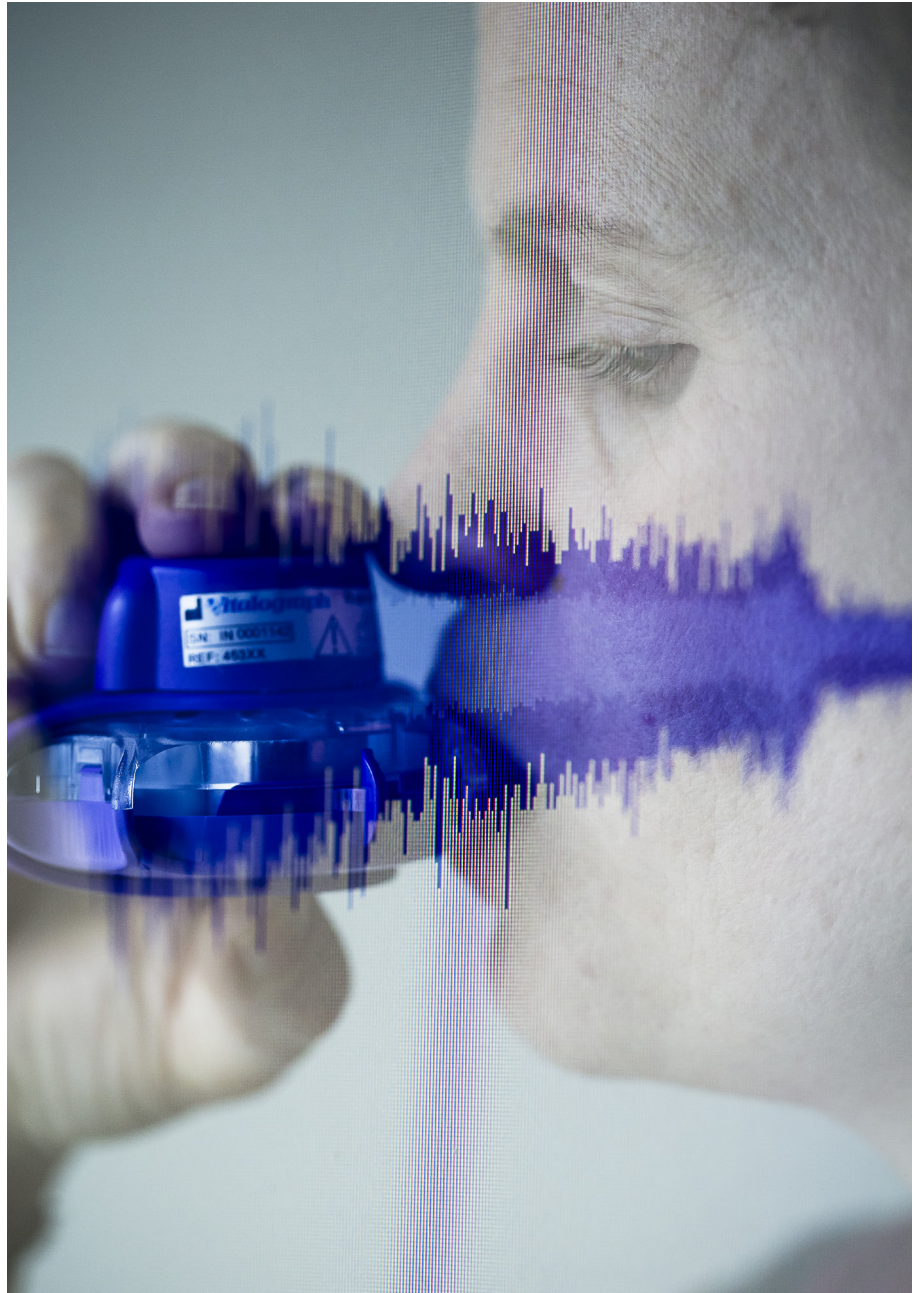
The project was initially supported by Enterprise Ireland's Commercialisation Award funding and further development resourcing was provided through a mix of grant-aid and industrial partner contributions. The Health Research Board contributed significantly to the ongoing validation studies. Trinity bundled its background IP with further IP from UCD and RCSI and transferred the package under licence to Vitalograph for commercial use giving the industry partner clear access and appropriate protection to invest and productise the technology.

Impact

Vitalograph, with operations in Ennis Co. Clare, plans to bring this product initially to the clinical trials market and then to rollout to the general prescription market. Trinity's INCA team provides a significant new product opportunity for Vitalograph plus ongoing collaborative technical and clinical support in a sector led by strong growth in clinical trial systems and connected health equipment and services.

“The licensing process was smoothly facilitated by Trinity’s Technology Transfer Office”

**Frank Keane, General Manager,
Vitalograph**



Keywords English

Industry Challenge

One of the greatest challenges facing teachers today is managing diverse learning needs, in multilingual contexts. In our classrooms today we have straight-A students, sitting next to those who cannot read or write simple texts, next to those who do not understand the language of instruction, next to those with special educational needs. On top of this, both anecdotal evidence and scientific research indicates that academic language of school poses a real challenge for all young people engaged in learning, but particularly for those with language and literacy needs. To simplify this process, Keywords English, is providing topic-related apps to do exactly that: use key vocabulary in a subject context so the learner develops both competency and fluency in a subject area. Keywords English™, is the first topic app to provide all learners with the tools to communicate fluently on science topics in both their first and second languages.

Trinity Value Add

Keywords English were able to access research outputs from the School of Linguistic, Speech and Communications Sciences led by Prof David Little. A team of language and literacy specialists deployed the techniques of corpus linguistics to curriculum materials to identify key items of language that young people need to know for each subject across the curriculum. The English language support materials the team developed were tested in 80 schools by 250 teachers and subsequently downloaded in over 110 countries.

Critical Trinity Enablers

Keywords English identified an opportunity to adapt this groundbreaking research for mobile devices and to merge the latest innovations in gaming technology with best pedagogical practice to produce an application suitable for the demands of today's learning environment.

Engagement Type

Keywords English licensed copyright material developed in the Centre for Language and Communications Studies in Trinity, specifically focusing on analysis of terminology, keywords and language structures which are necessary to pursue effective study of different subjects.

Impact

With literacy levels within our education system at crisis point, mobile devices have tremendous capacity to offer a highly personalised learning experience that can both enhance and compliment formal classroom teaching.



“As students become increasingly able to penetrate and access mobile technology, so their control grows in relation to their own learning. Our apps aim to empower students to build new knowledge on that which is already clear, comprehensible and familiar to them and Trinity College is helping us to deliver”
Joanna Norton, Founder & CEO

Intel

Industry Opportunity

Intel is one of Ireland's largest employers. It has been proactively developing the research and innovation footprint of its operation in Ireland over the last 25 years through the strong relationships it has built with academic institutions and the innovation community. Its partnership with Trinity has been multi-faceted and has contributed to many of the recent innovation successes for Intel Ireland.

Trinity Value Add

Trinity collaborates with Intel through nationally funded research centres such as AMBER, CTVR, CNGL and TRIL; public outreach initiatives such as the Science Gallery; transfer of technology through license or acquisition (e.g. the Trinity spin-out Havok) and most importantly through the provision of high quality graduates to support the growth of Intel Ireland. The partnership is also represented through the engagement of senior management on Trinity Institute Boards and Centres. Intel's commitment to innovation has been recognised as recipient of the Trinity Innovation award in 2009 and the secondment of numerous Intel researchers to Trinity.

Specific Interactions

CRANN: Intel was the founding industry partner of the CRANN Institute, an SFI CSET 2004 – 2013. Intel remains the largest partner of the newly funded SFI centre AMBER. Trinity has aligned its investment in infrastructure and new faculty around research topics which are compatible with Intel's interests.

TRIL: Intel worked with Trinity researchers, and other partner institutions, around the development of novel sensing technologies to support increased independent living for the elderly and infirmed.

CTVR: Intel is partnering with the National Telecommunications Centre on assessing different applications for its new Quark chips which have been designed in Ireland. The collaboration is feeding into the emerging business opportunities surrounding the Internet of Things.

Engagement Type

Intel have utilised diverse funding mechanisms including participating in SFI Centres, EI and IDA funding Technology Centres, IRC studentships; directly funded initiatives, FP7 and direct sponsorship of educational and public outreach initiatives within Trinity.

Impacts

The impacts of Intel's partnership with Trinity are multi-faceted and include the seeding of new leading edge research areas within Ireland e.g. nanoscience; the transfer of key technology learnings for evaluation by Intel research with a view to aiding in the development of next generation processes of advanced semiconductors, the recruitment of high quality graduates, the development of application areas for new products and the establishment of an innovation eco-system.



“The research in centres like CRANN, CTVR and CNGL directly map onto the challenges our business faces today and into the future, providing new ideas and breakthrough learnings which support our competitiveness. Importantly these centres also provide the high quality graduates we need to sustain and grow our business within Ireland.”
Leonard Hobbs, Research Program Manager, Intel Ireland



Google

Industry Opportunity

Google celebrated 10 years in Ireland in 2013. With 2,500 employees Google has become a flagship for FDI in Ireland. The choice of Dublin as its EMEA headquarters for technical, sales and operation support to customers in over 50 countries is the largest outside the US. Google engineers in Ireland have managed the infrastructure for all its products across the region from 'Search', to Google's web browser Chrome, and social networking feature Google+. Google's new Data Centre ranks as one of the most energy efficient in the world. In 2013 Google announced a new 'digital innovation centre' called The Foundry, which will bring up to 15,000 extra overseas business visitors to the city each year.

Trinity Value Add

Trinity was the first university in Europe to adopt Gmail for its students: Google provide the College's 17,000 students with Gmail, Google's e-mail application. Trinity was the first university in Europe to introduce Gmail for its student e-mail needs, allowing the College's students to retain their Trinity e-mail address for life.

Outreach Gift

Science Gallery at Trinity received a prestigious gift of €1 million from Google.org in December 2011 to develop a Global Science Gallery Network (GSGN). The gift is part of over \$100 million in total charitable giving from Google in 2011.

Computer Science Initiative for the 21st Century Classroom:

A three year, €1.5million partnership with Google aims to transform computer science teaching in Irish schools. Over 1,000 teachers will have the opportunity to access a professional development course which aims to assist second level schools in Ireland to increase the number of students getting involved in and getting excited about computer science.

Collaboration/Licensing Agreement

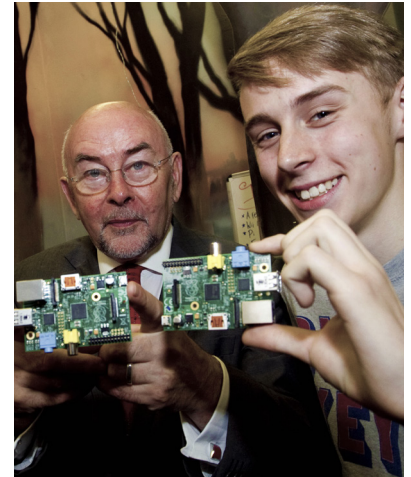
Google has recently collaborated in a number of research projects with Trinity's Department of Electronic and Electrical Engineering in the area of analysis of speech quality. At the initial stage of this research cooperation Google licensed specific Trinity intellectual property useful in the measurement of speech intelligibility.

Acquisition

Google acquired Green Parrot Pictures in 2011, an Irish company set up by Trinity's Prof Anil Kokaram that makes tools to manipulate digital video and images. The acquisition was driven by YouTube, which will use Green Parrot's tools to help users make their videos better.

Impact

With Facebook, LinkedIn, Twitter and Dropbox following suit in basing international operations in Dublin, Google's commitment to Ireland has provided an invaluable stepping stone for the country to become a global leader in the online advertising and new media sector.

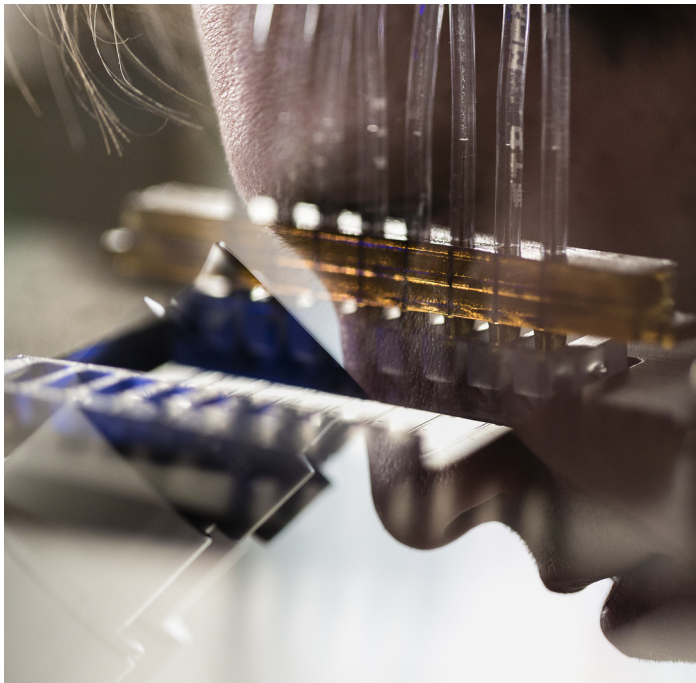


“It is fantastic to be able to point to Science Gallery as a very vivid and engaging example of the innovative spirit that we often talk of as critical to Ireland’s future.”
David Martin, Director, Geo Operations, Google

Trinity — your partner in Horizon 2020

Trinity is Ireland's leading university as measured through all of the global rankings over the last five years. Trinity is also the university which has been most successful in winning European research funding. Trinity was awarded over €80M in funding from Framework 7.

In 2014 the European Commission launched Horizon 2020; a new seven year programme with a budget in excess of €70Bn. This is the largest research programme globally and it represents a unique chance for academia and industry in Ireland to work together to win competitive research funding.



European research funding can be utilised at all parts of the innovation spectrum from early stage explorative high risk research to the later stages of translating research for the development of new products and new processes innovation. The funding can also be used to support new research jobs within companies, to develop the skills of existing researchers and to de-risk new research programmes by having the other partners and the EU share the development costs.

Projects can be used to bring together early stage research within universities; suppliers and instrumentation developers and the end commercialisation partner. For Irish companies it is an excellent opportunity to use European funding to build relationships with commercial partners and to open doors to new markets and new customers.

European funding can appear complicated and daunting to many organisations. Trinity has leading expertise in navigating the funding ecosystem to help companies identify how to engage with Europe – to identify the right funding call, to support the identification of potential partners including Trinity academics and to advise on the proposal.

Trinity wants to partner with industry to find ways we can work together to win more European funding for Ireland and to use that funding to increase the impact of research on Irish based companies.

“European projects are important for Irish companies — they connect SMEs, MNCs and Research Organisations along a value chain, bring in research funding and help find commercialisation partners.”

Diarmuid O'Brien,
Director of Trinity Research & Innovation

↑ Cellix Ltd. is a partner on the Trinity co-ordinated NAMDIATREAM FP7 project,

carrying out research into cancer diagnostics and screening.



Trinity's Track Record in FP7

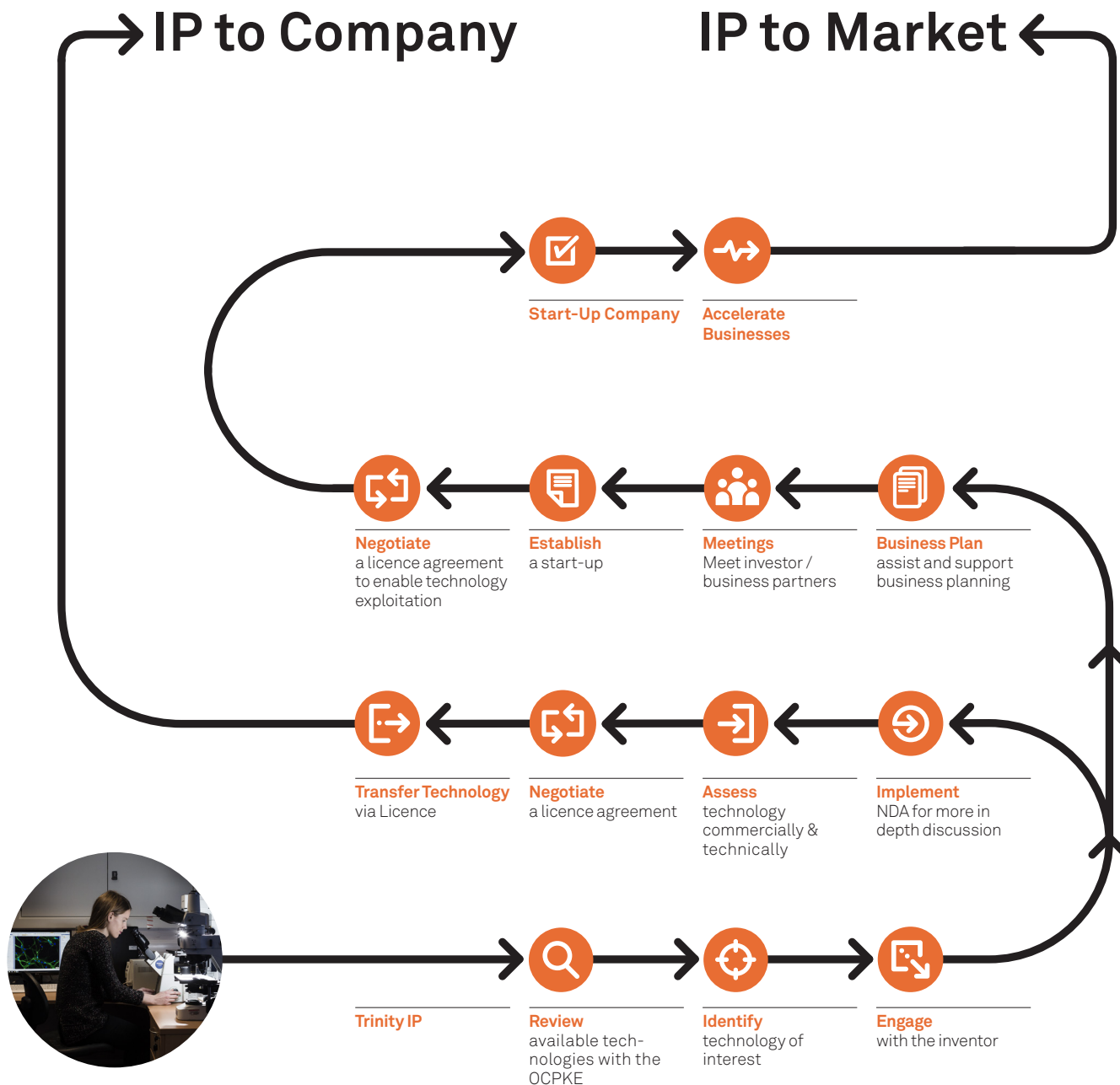
- FP7 (2007 – 2013)
- Trinity secured more EC funding and more ERC grants than any other Irish institution
- Trinity was awarded the highest proportion of grants over €1m
- Trinity was successful in 218 awards in FP7, coordinating 27 projects*
- Value of contracts > €90m
- Value to Irish SMEs > €4.7m
- Value to Irish based MNCs > €2m

Partner with Trinity in Horizon 2020

- Horizon 2020 (2014 – 2020)
- €80bn budget – 60% increase compared to FP7
- Ireland has increased its target from €600m to €1.25bn
- Trinity aims to secure awards of €150m, almost doubling our FP7 success
- Leverage Trinity's international research partner network — Fraunhofer in Germany, CEA in France, ETHZ in Switzerland
- Identifying the best funding opportunity
- Supporting SMEs participation

↑ Trinity has built an extensive network of collaborators in other major European cities.

*Data accurate as of 2013



Commercialisation

Trinity is committed to ensuring our intellectual property does not sit on a shelf and is used to transform society both socially and economically. Trinity understands that in many cases it is not the most suitable vehicle to enable this transformation of idea to impact and so we work proactively to form new companies or to license our technology to existing businesses to enable new products, processes or innovations.

Trinity, like many large institutions with deep traditions, has sometimes found it challenging to operate in a manner which meets our stated ambition to transfer our knowledge to industry in a manner which enables it have the most significant impact on society.

As part of the recent Innovation and Entrepreneurship strategy we have developed a set of intellectual property principles which make our intent clearer to all and a new Office of Corporate Partnership and Knowledge Exchange (OCPKE) which will be empowered with delivering on these principles by enabling a straightforward partnership with industry and entrepreneurs.

There are eleven guiding principles but the spirit of the principles is clear: Trinity wants the knowledge created by its research used for the good of society, it wants to partner with companies best placed to exploit its technology and it is not focused solely on the financial value of the transfer but on the holistic benefit of the partnership including on-going research collaboration, the employment of its students, the recognition of the research excellence provided by Trinity and the successful translation of our idea to the market place.

Trinity wishes to be an innovation enabler for industry; a catalyst which uses our infrastructure, world leading researchers and our ideas for the benefit of all.

Trinity wants its research resulting in new knowledge which has real impact for society and a significant pathway to achieve this goal is engagement with industry and the entrepreneurship community.

Licensing

Trinity has a very experienced team in its OCPKE to support intellectual property and licensing. Over the last five years Trinity has managed the protection of over 290 inventions and has successfully completed over 70 license agreements with companies. This deep experience will ensure industry will find a professional team who have license templates for all situations which will ensure that all discussions will result in a fair and equitable license which is completed efficiently.

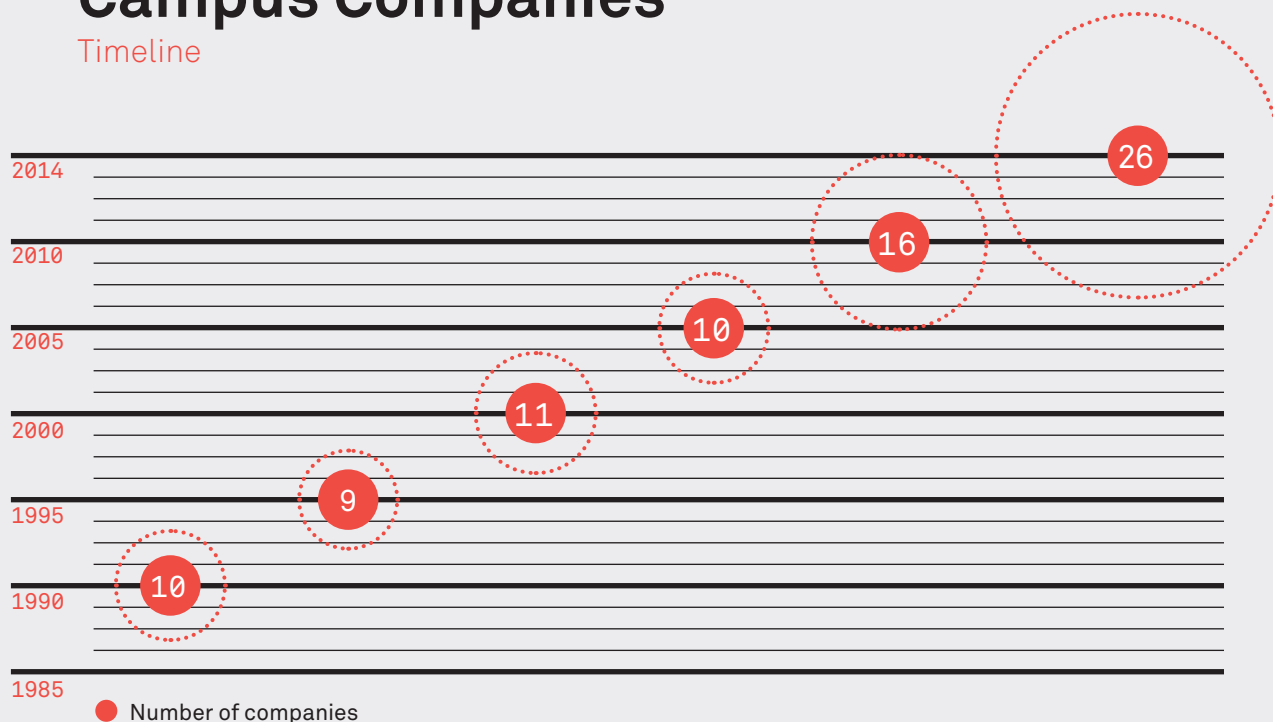
Start-up companies

In the last five years Trinity has created over 38 campus companies across the main sectors of medical devices, pharmaceutical and ICT. Trinity welcomes engagement with the key components of the entrepreneurial ecosystem including experienced entrepreneurs interested in a new business opportunity; angel and seed investors; the venture capital community and potential senior management.

Trinity is open for business with all businesses. Our strength in research and intellectual property can be your strength — supporting the growth and increased competitiveness of your business.

Campus Companies

Timeline



Spin-outs 1985 – 90

- ERA-Maptec Ltd
- Authentik Language Learning Resources Ltd
- Broadcom Eireann Research Ltd
- Navan Resources Ltd
- Biotrin Ltd
- Insight Statistical Consultancy
- + 4 more

Spin-outs 1990 – 95

- Scientific Resources Ltd
- Atrium Productions Ltd
- Iona Technologies Ltd
- X Communications Ltd
- Unimed Plc
- Magnetic Solutions Ltd
- + 4 more

Spin-outs 1995 – 00

- The Institute of European Food Studies
- Identigen Ltd
- Genable Technologies Ltd
- Telekinesys Research Ltd (trading as Havok)
- Eneclann Ltd
- Wilde Technologies Ltd
- + 6 more

Spin-outs 2000 – 05

- Allegro/Deerac
- Eblana Photonics Ltd
- Haptica Ltd
- MV Technology Ltd
- Cellix Ltd
- Opsona Therapeutics Ltd
- + 4 more

Spin-outs 2005 – 10

- Creme Software Ltd
- New Game Technologies Ltd
- EmpowerTheUser Ltd.
- Solvotrin Therapeutics Ltd
- Miravex Ltd
- Biocroi Ltd
- + 10 more

Spin-outs 2010 – 14

- Adama Innovations Ltd
- Synergy Flow Ltd
- Xcelerit Computing Ltd
- Trimod Therapeutics Ltd
- Bioracle Ireland Ltd
- Software Radio Systems Ltd
- + 20 more



IONA

Founded in 1991 by Dr. Christopher Horn, Annrai O'Toole, and Dr. Sean Baker, IONA began life as a campus company in Trinity and had headquarters in Dublin, Boston and Tokyo.

IONA specialised in distributed service-oriented architecture (SOA) infrastructure. IONA products connect systems and applications by creating a network of services without requiring a centralized server or creating an IT stack. Iona was one of the top 10 software companies in the world had the fifth-largest IPO in Nasdaq history. In 2008 it was IONA was acquired by Progress Software for about \$162 million.



Opsona Therapeutics

Opsona Therapeutics, founded in 2004, is a biopharmaceutical company focused on the treatment of autoimmune and inflammatory diseases, and cancers.

It is actively identifying new ways to prevent and treat these diseases and has developed a unique and advanced pipeline of drugs at research locations in Dublin.

The company has completed a series of rounds of financing, most recently, €33 million was raised and investors include Novartis Venture Fund, Fountain Healthcare Partners, Roche Venture Fund and Seroba Kernel Life Sciences, BB Biotech Ventures, Sunstone Capital, Baxter Ventures, Amgen Ventures, and EMBL Ventures.



Havok

Havok, founded in 2000, is the world leader in the development and sale of real time physics and animation software to the games industry.

Set up by Trinity researchers Dr Steven Collins and Mr Hugh Reynolds from the School of Computer Science & Statistics.

Havok is working with leading customers in the commercial games and entertainment industry. Havok technologies are being used in over 500 of the best known and award-winning titles including Halo 4, Assassin's Creed® III, The Elder Scrolls® V: Skyrim™, Guild Wars 2, Call of Duty®: Black Ops II, Skylanders Giants™ and Modern Combat 4: Zero Hour. Havok was sold to Intel for €110m (€76m) in 2007.



SureWash

SureWash, founded in 2010, makes hand hygiene training and compliance much less labour intensive by combining an e-learning system with patented video measurement technology.

Developed by Dr. Gerard Lacey over 8 years in Trinity College Dublin, SureWash was trialled in Beaumont Hospital, Dublin and by the UK Dept of Health in the Mid Essex NHS Trust, UK.

Hand hygiene rates per patient day increased by 156% and compliance with technique increased 703%.

SureWash units provide interactive guidance and real-time feedback on which parts of the hand rub preparation have been completed. Compliance is automatically recorded for Audit purposes.

Direct Industry Infrastructure Access

Advanced Microscopy

- Scanning Electron Microscopy (SEM)
- Focused Ion Beam (FIB)
- Transmission Electron Microscopy (TEM)
- Helium Ion Microscopy
- Materials Characterisation and Analytics
- Electron Beam Lithography (EBL)

Polymer Processing

- Differential Scanning Calorimetry (DSC)
- Thermo-Gravimetric Analysis (TGZ)
- Dynamic Contact Angle
- Electrical Resistivity
- Tensile Testing
- GPC/HPLC/GG-MS/AA
- Laboratory Brabender for polymer processing

Photonics Lab

- Scanning Near-field Optical Microscopy (SNOM)
- Florescence Life Time Imaging (FLM)
- SNOM-RAMAN-AFM platform
- Tunable FS Laser System
- Pulsed Laser Deposition

Clean Room

- Chemical Vapour Deposition
- Thermal Evaporation – Metals/Insulators
- UV Lithography
- ICP Etcher
- Resist Polymer Spinners
- Laser Mask Writer

Metrology/Spectroscopy

- Fourier Transform Infrared
- X-Ray Diffraction (XRD)
- X-Ray Photon Electron Spectroscopy (XPS)
- Stereo Microscopy and Digital Imaging
- Atomic Force Microscopy

Biomedical

- 400 MHz and 800 MHz NMR
- X-Rays, small molecule and protein
- Mass spectrometers
- Biacore X100
- Seahorse respirometer
- Flow cytometer suite
- Confocal Microscopy suite
- Cell culturing facilities
- Transgenic unit

Mechanical Engineering

- Lathes
- Milling machines
- CNC Machining Centres
- 3D-Printing
- Instron material testing machines
- Cold spray coating

Imaging / Recording

- Philips Achieva 3T MRI – Clinical Imaging
- Bruker BioSpec 7T MRI with Crycoil – Pre-Clinical Imaging
- 128- and 64- channel Biosemi Active Electrode system for EEG
- neuroConn stimulator for transcranial brain stimulation with EEG acquisition

High Performance Computing and 3D Visualisation

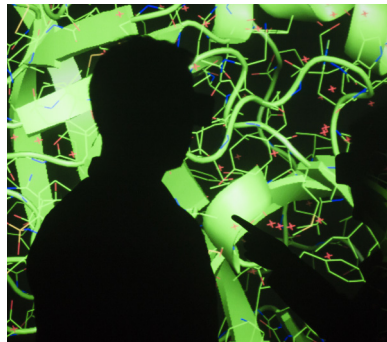
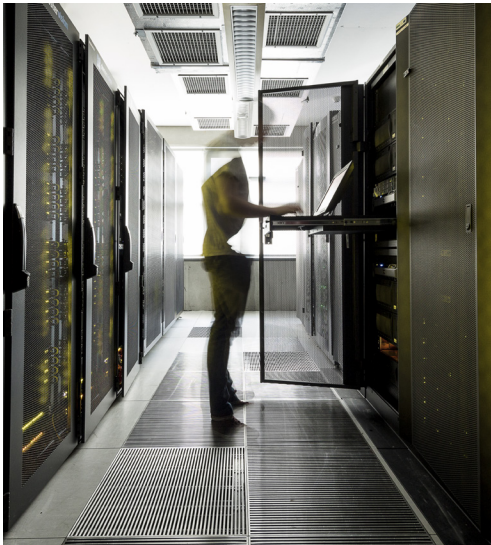
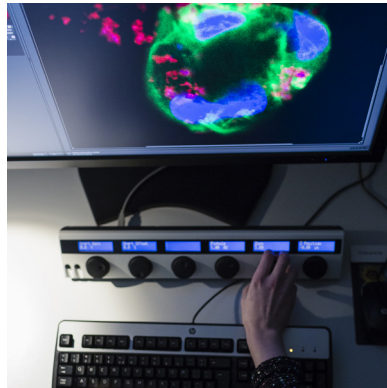
- 4000 CPU cores with 10TB of RAM,
- Storage 50TB of high-speed SAS disks
- 132TB SAN for hi-res digital artifacts
- 5.59m x 2.32m Rear Projected Powerwall
- Visualisation stereo-capable workstations

Biological

- Liquid Chromatography Suite
- High Throughput Crystallography
- Real-time PCR (incl. ViiA7)
- Ultracentrifuge
- Thermal analysis (DSC, TGA)
- Particle sizing
- UV, FTIR, NIR and Fluorescence Spectroscopy

Geology

- Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (LA-ICP-MS)
- Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)
- Powder X-Ray Diffraction
- Continuous Flow-Isotope Ratio Mass Spectrometry
- Apatite Fission Track Analysis
- Petrographic thin section manufacture



Industry has a perpetual requirement to access technologies, equipment and expertise to bolster and advance their research & development activities. The cost and availability of this infrastructure and the technical ability to understand the outputs can be prohibitive. Trinity as a national resource houses one of the largest hubs of industry accessible R&D infrastructure in Ireland. Trinity can make available some of the unique infrastructure and enabling infrastructure to industry as part of collaborative research programmes or service agreements.

Partnering with Industry to Deliver Impact

Leverage our research and expertise
to add value to your business.

€128 million

→ Research Contracts
Signed in 2013

400

→ Industry Partners

3,500

→ Researchers

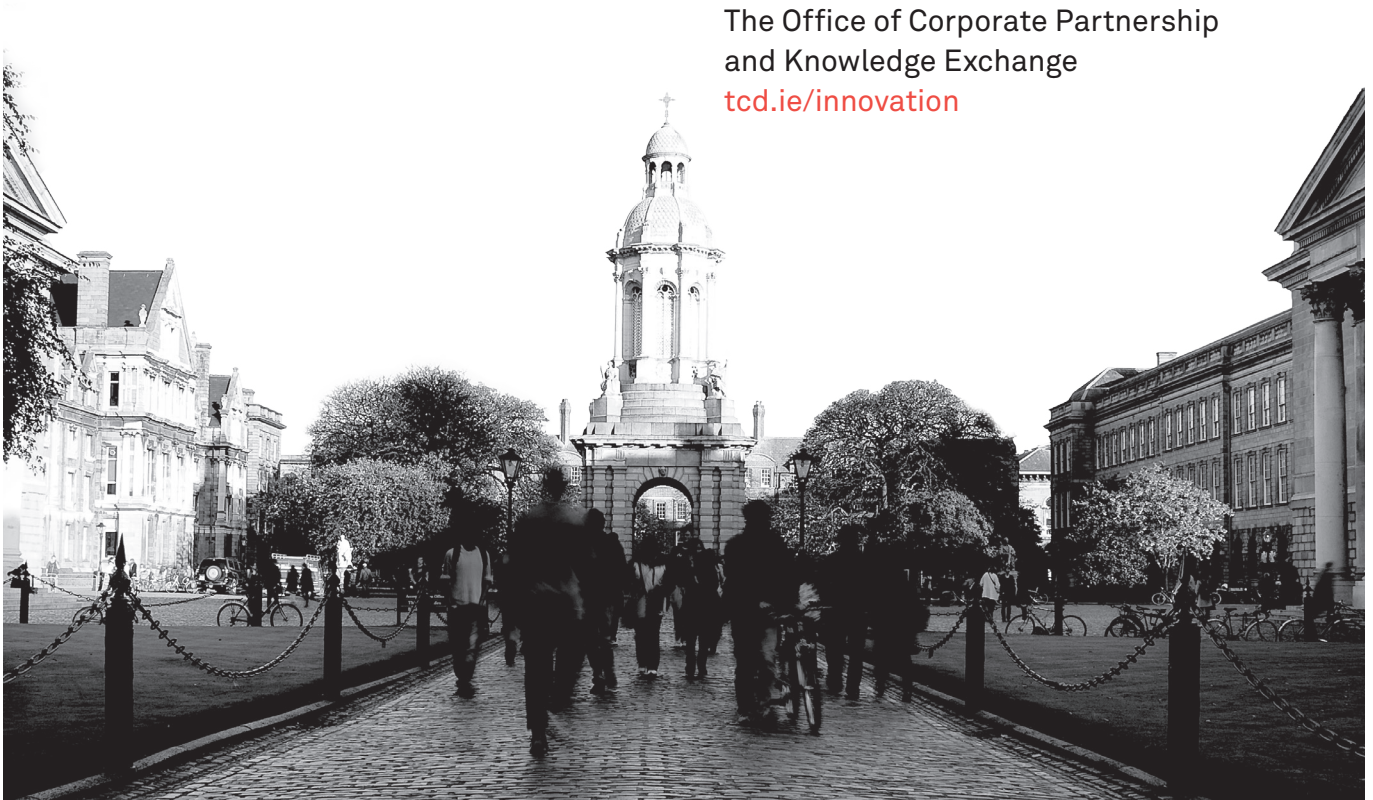
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→ In Europe for Research

One Open Door

The Office of Corporate Partnership
and Knowledge Exchange

tcd.ie/innovation



Director Trinity Research and Innovation

Senior Business Development Manager

Industry Liaison Manager

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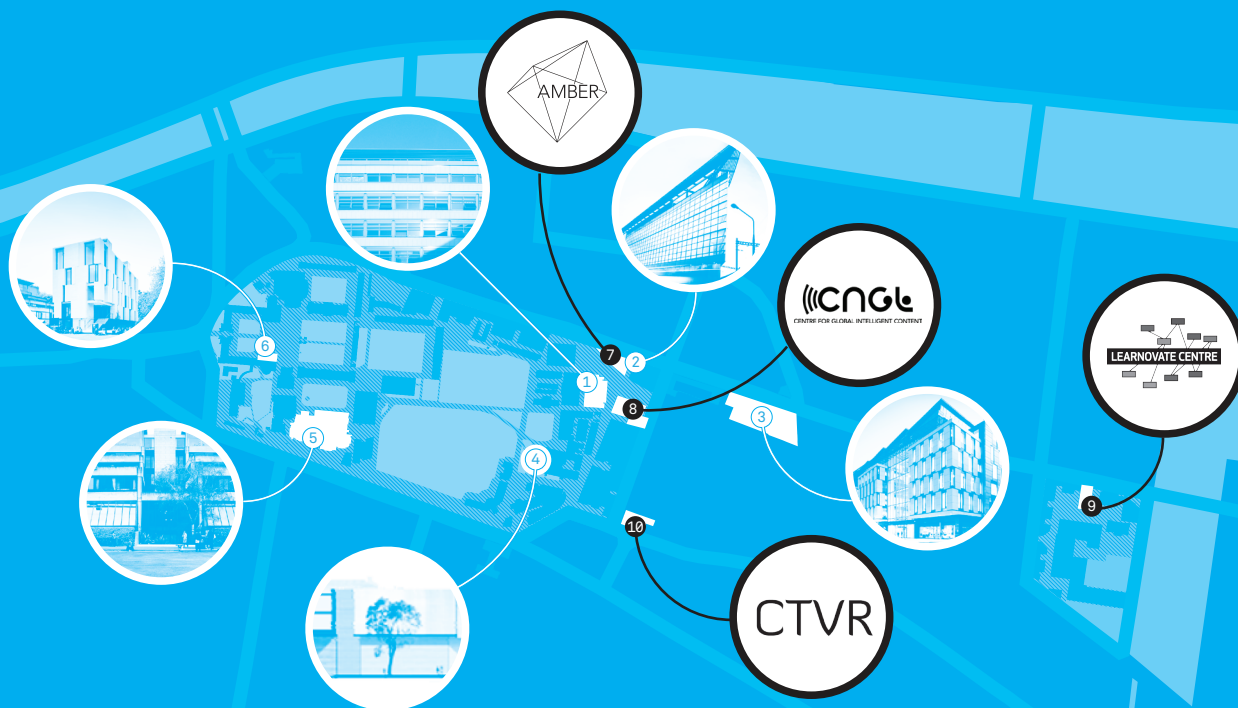
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○ Trinity Institutes (01 – 06)

● National Centres (07 – 10)

01. The Trinity College Institute of Neuroscience

02. CRANN

03. The Trinity Biomedical Sciences Institute

04. The planned Engineering, Energy and Environment Institute

05. The Institute for International Integration Studies

06. The Trinity Long Room Hub Arts and Humanities Research Institute

07. Amber

08. CNGL

09. The Learnovate Centre

10. CTVR

The Office of Corporate Partnership
and Knowledge Exchange

O'Reily Institute,
Trinity College Dublin,
Dublin 2, Ireland

www.tcd.ie/innovation

2014



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