

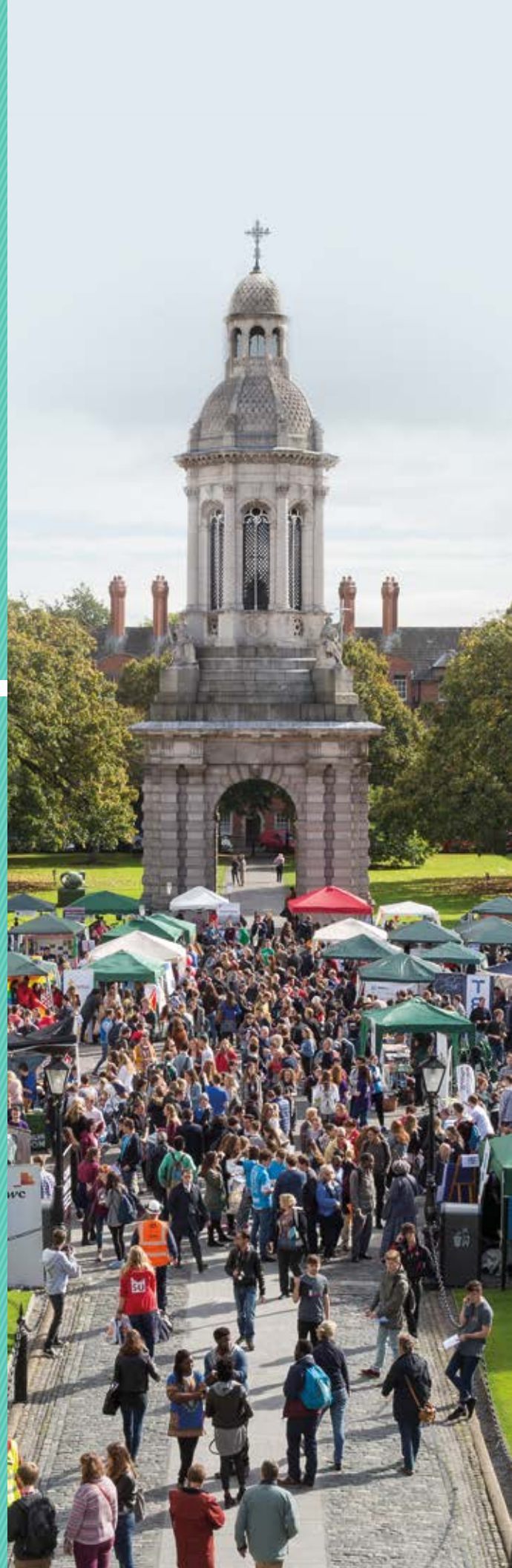


Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Annual Review

2015— 2016

DR PATRICK PRENDERGAST
PROVOST & PRESIDENT



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Introduction from the Provost

This was a key commemorative year for Ireland, and for Trinity. The 1916 Easter Rising was a pivotal moment in modern Irish history and Trinity was one of the principal locations – during Easter Week the College was turned into a hospital for the wounded, a temporary burial ground, and a barracks stationed with 4,000 troops. The Centenary gave us the opportunity to explore what happened within Trinity’s walls a hundred years ago and to fulfil our responsibility, as a centre of scholarship and learning, to critically examine the legacy of the Rising.


Public events on campus were greatly dominated by the Rising, especially around March and April. The chapters, Public Engagement and Creative Arts Catalyst, detail the lectures, symposia, exhibitions, plays and readings held in commemoration. Our commitment ran to translating the Proclamation into the 17 languages taught at Trinity, including Hebrew, Japanese, Korean, Russian and Turkish; and to holding events off-campus, including when we joined with the University of Liverpool to co-host a debate with their Institute of Irish Studies on their London campus – featuring historians from Ireland, the UK and the USA.

The academic year got off to a tremendous start with the news that Trinity is receiving the largest charitable donation in Irish history to tackle dementia. A landmark donation of €138.4 million from The Atlantic Philanthropies is helping us fulfil our ambition to become a world leader in ageing research. Co-led

by Trinity College Dublin and the University of California, San Francisco, the Global Brain Health Institute (GBHI) will train 600 global leaders over 15 years in the US, Ireland and across the world to carry out dementia research, deliver health care, and influence policies and practices.

Our chapter, Philanthropy and Alumni Engagement, details other significant philanthropic gifts. Philanthropy makes an ever more important contribution helping Trinity achieve its ambitions, and a feasibility study, carried out in 2015/16, established that alumni and friends feel a strong connection to Trinity and would like to be involved with fund-raising. In consequence in 2016/17 we are launching a Philanthropic Campaign, the very first comprehensive campaign in the College’s 425 year history. I look forward to bringing you news of this next year.

This was a year of exciting initiatives and ventures, including the launch of two pioneering strategies: the Strategy for the Library and the Strategy for Sport, ‘Raising our Game’. Both focus on what is most distinctive and intrinsic to the Trinity education. This was also the year when we continued with our far-reaching initiative to renew the Trinity Education to prepare for significant transformational changes in higher education provision in the 21st century. In the chapter, The Trinity Education Project, we detail our work to date, including agreement on a university-wide set of graduate attributes which will shape the kind of education we offer.

The image is a composite. The left side features a blue background with a halftone dot pattern. Overlaid on this is a faint, larger-scale halftone pattern of a man's face. The right side is a clear, high-resolution portrait of a middle-aged man with short, graying hair, wearing a dark suit jacket, a white shirt, and a yellow tie with a dark pattern. He is smiling slightly and looking towards the camera. The background behind him is a blurred outdoor setting with a building.

→ The academic year got off to a tremendous start with the news that Trinity is receiving the largest charitable donation in Irish history to tackle dementia.

01



Ensuring access to students from backgrounds under-represented at third-level is fundamental to strengthening Trinity's reputation for excellence. This was a key year for the Trinity Access Programme (TAP), now in its 23rd year. The Foundation Year, which prepares promising students for college life, is a lynchpin of TAP, and today more than 90% of young people who complete the TAP Foundation Year go on to take a degree at Trinity, where they perform as well as any other student. In a ground-breaking initiative, TAP is collaborating with Lady Margaret Hall, an Oxford college, to bring this Foundation Year to Oxford. The four-year pilot scheme starts in Lady Margaret Hall this coming academic year. I look forward to bringing you news of it.

Outreach is an important part of Trinity's mission. Through Science Gallery Dublin we help drive young people's enthusiasm for studying science and technology. We further extended our activities in this area with the inaugural year of the Trinity Walton Club. Named for our Nobel Laureate, Ernest Walton, the Walton Club is a not-for-profit STEM Education programme subsidised by Trinity and supporters, including the Bank of Ireland. The Club invites secondary school students to

attend STEM learning environments in Trinity labs on Saturdays. In May, 71 'Walton Clubbers' showcased their STEM projects and prototype solutions at an exhibition and graduation ceremony on campus.

Our mission to be a global university offering a global education received further boost this year with the addition of eight new agreements, to bring our number of non-EU exchanges with high ranking universities globally to 35. And after four years of successful collaboration with the Singapore Institute of Technology (SIT), we are now embarking on our first joint degree programme with SIT in Physiotherapy: 100 students will be enrolled from September 2016. You can read about these initiatives and more in our chapter, Trinity's Global Relations.

For the second year running, in September 2016, we received corroboration that our initiatives to encourage innovation and entrepreneurship are working: over the past ten years our graduates have founded more venture-backed companies than graduates from any other European university, according to private equity and venture capital-focused research firm, PitchBook. Trinity is the only European university in PitchBook's global Top 50 which ranks graduate entrepreneurship.

ABOVE – Among the contributors and representatives of areas included in this Provost's Review are, standing (L-R) Sally-Anne Fisher, Head of Communications; Prof Kevin O'Kelly, Dean of Students; Dr Gillian Martin, Senior Lecturer; Prof John Boland, Dean of Research; Ian Mathews, Chief Financial Officer; Michelle Tanner, Head of Sport & Recreation; Christina Reynolds, Trinity Creative Co-Ordinator, Office of the Provost; seated (L-R) Prof Juliette Hussey, Vice-President for Global Relations; Dr Patrick Prendergast, Provost; Prof Chris Morash, Vice-Provost / Chief Academic Officer; and Prof Paula Murphy, Registrar.

BELOW LEFT – Recipients of the 2016 Provost's Teaching Awards, Prof Michelle D'Arcy, Dr Shane Bergin, Prof Kevin Kelly with the Provost, Dr Patrick Prendergast.



BELOW RIGHT – Winners of the inaugural Provost's Professional Staff Awards, Tony O'Rourke, Buildings Office, Helen Thornbury, Academic Secretariat, Kathleen O'Toole-Brennan, Trinity Access Programme, Noel McCann, Campus Services, and Joe McCauley, Physics.



The pipeline for next year's PitchBook report is already strong, and Trinity and UCD have collaborated to help launch a new €60 million fund to invest in early stage companies emerging from third-level research. The fund, which will provide capital and expertise for scaling campus companies, was announced in June by Atlantic Bridge, one of Europe's top performing growth technology funds. It's aimed at early stage companies, built from world class research in all Irish third-level institutions, and focusing on software, hardware, engineering, physical sciences, life sciences and agri-food.

You can read about our initiatives to encourage innovation and entrepreneurship at staff and student level in the chapter, Innovation and Enterprise. These include initiatives in the SFI research centres led out of Trinity – ADAPT, AMBER, and CONNECT – to train highly skilled postgrads and support research in strategically important areas such as advanced materials, telecommunications, and digital content technology; as well as undergraduate initiatives like the start-up accelerator, LaunchBox. Now in its fourth year, LaunchBox has incubated over 150 students-entrepreneurs, created 40 jobs through start-ups, and raised over €3.5 million in investment.

Finally, research is, of course, the cornerstone of what we do. Here we interview six new professors – in Molecular Rheumatology, German, Bioengineering, Psychiatry, Telecommunications and Chemistry – and we hear about their exciting research. And 12 of our researchers across our three faculties detail some of their research projects – from urban multilingualism to reducing rates of caesarean section; from solar storms to developing anti-inflammatory therapies.

In December I had the great pleasure of being in Sweden for the Nobel ceremony where our graduate William C. Campbell was awarded for his work in helping to eradicate river blindness. His great breakthrough came after decades of research starting as an undergraduate in Trinity where he first developed his interest in the parasitic worms that cause river blindness. He is a symbol, for Trinity and the world, of the scholar's dedication. We salute him and all our scholars for their work in myriad fields which enhance our way of being in the world.

My great thanks to the whole community – staff, students and alumni – for another great Trinity year.

**Dr Patrick Prendergast
Provost & President**

Trinity at a Glance

Trinity is Ireland's
No. 1 University

QS World University Ranking, Academic
Ranking of World Universities (Shanghai)



→ A 424 year old university in the heart of Dublin city centre

02

Student Statistics 2016 | 2015 | 2014 | 2013 (4 year comparisons)



ALUMNI

111,272 | 107,353 | 103,518 | 100,277

REPUBLIC OF IRELAND	82,816 79,728 76,720 74,170
GREAT BRITAIN	10,084 10,001 9,754 9,616
NORTHERN IRELAND	4,789 4,696 4,662 4,621
USA	3,960 3,838 3,670 3,557
CANADA	1,259 1,226 1,195 1,162
REST OF WORLD	8,364 7,864 7,517 7,151

CLUBS AND SOCIETIES

48 | 48 | 49 | 49

SPORTS CLUBS

120 | 119 | 118 | 112

STUDENT SOCIETIES

THE LARGEST SOCIETIES ARE:

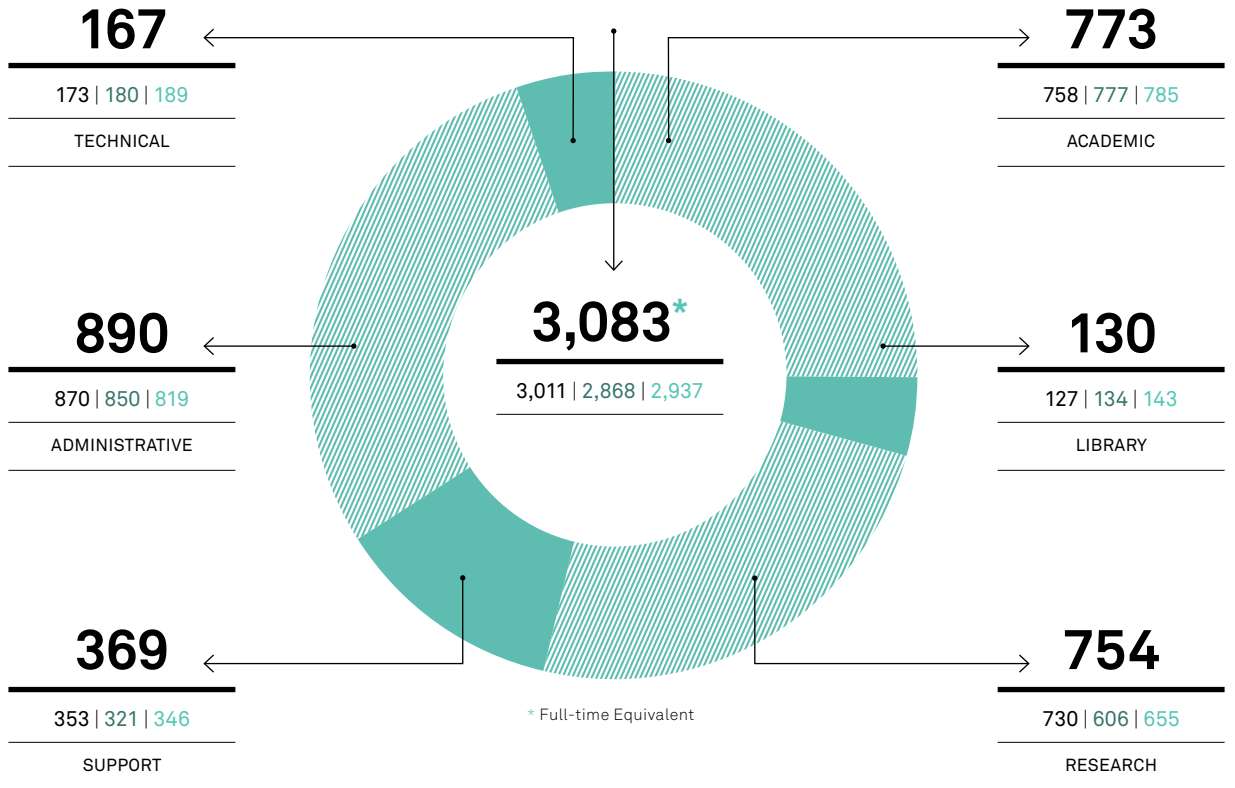
- THE VINCENT DE PAUL SOCIETY
- THE PHILOSOPHICAL SOCIETY (THE PHIL)
- DU PLAYERS
- THE COLLEGE HISTORICAL SOCIETY (THE HIST)

— The college historical society (the hist) is the oldest student society in the world, founded in 1770

Staff Statistics

2016 | 2015 | 2014 | 2013

(4 year comparisons)



ACADEMIC STAFF



63%

61% | 61% | 60%

IRISH

37%

39% | 39% | 40%

INTERNATIONAL

FACULTIES



ARTS, HUMANITIES AND SOCIAL SCIENCES

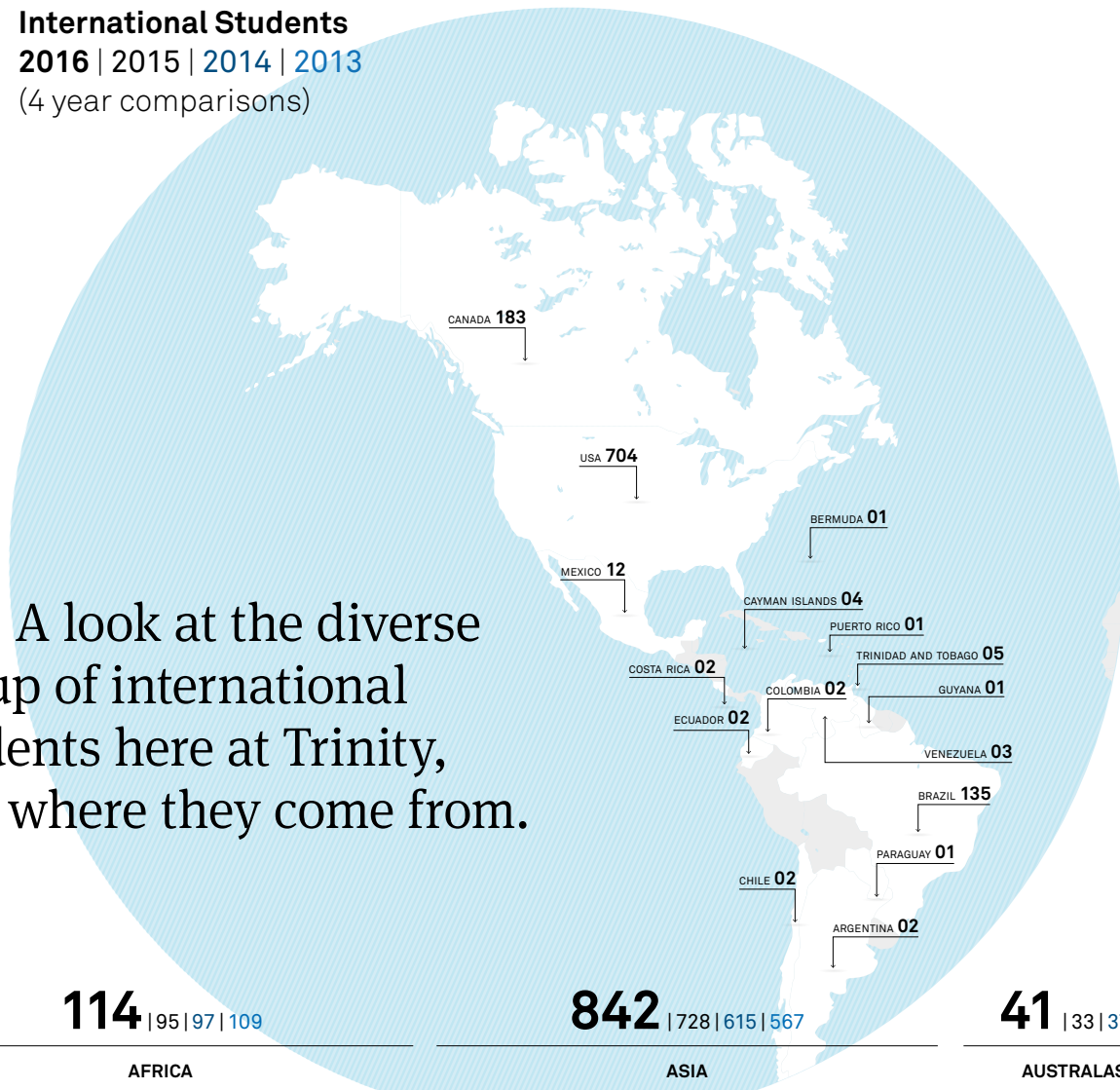
ENGINEERING, MATHEMATICS AND SCIENCE

HEALTH SCIENCES

02 International Students

2016 | 2015 | 2014 | 2013
(4 year comparisons)

→ A look at the diverse group of international students here at Trinity, and where they come from.



114 | 95 | 97 | 109

AFRICA

ALGERIA	1	2	1	1	MOROCCO	5	2		
BOTSWANA	1	1	1	5	MOZAMBIQUE	1	1	1	1
BURUNDI	1	1	1	1	NIGER	1	1		
CAMEROON	1	1	1	1	NIGERIA	22	17	23	33
EGYPT	14	8	4	3	REP OF EQUATORIAL GUINEA	1			
ETHIOPIA	1	2	3	1	RWANDA	1	1		
GHANA	2	2	3	1	SOUTH AFRICA	15	18	15	18
GUINEA	1	1	1	1	SUDAN	4	6	6	6
KENYA	2	3	5	4	TANZANIA	1	1	1	1
LESOTHO	1	1	1	1	TUNISIA	1			
LIBYA	13	14	5	6	UGANDA	6	3	5	3
MADAGASCAR	1	1	1	1	ZAMBIA	6	1	3	3
MALAWI	3	1	5	4	ZIMBABWE	3	3	3	5
MAURITIUS	12	9	9	7	TOTAL	114	95	97	109

842 | 728 | 615 | 567

ASIA

AFGHANISTAN	1	MACAO	1	2					
ARMENIA	1	1	1	1	MALAYSIA	122	108	108	107
AZERBAIJAN	1	1	1	2	NEPAL	5	3	3	3
BAHRAIN	2	4	3	2	OMAN	9	6	5	3
BANGLADESH	6	4	5	7	PAKISTAN	14	18	16	17
BHUTAN	1	1	1	1	PALESTINE	1	1	1	1
BRUNEI DARUSSALAM	3	1	1	1	PHILIPPINES	10	12	10	10
CHINA	159	143	122	99	QATAR	2	2	1	1
HONG KONG	20	10	4	1	REP OF KOREA	15	7	13	14
INDIA	158	112	91	90	SAUDI ARABIA	31	26	28	24
INDONESIA	3	2	2	1	SINGAPORE	184	187	131	120
ISLAMIC REP OF IRAN	18	14	14	12	SRI LANKA	1	3	4	2
IRAQ	8	10	7	7	SYRIAN ARAB REPUBLIC	1	1	1	1
ISRAEL	2	1	2	1	TAIWAN REP OF CHINA	4	3	1	1
JAPAN	27	19	22	16	THAILAND	3	1	1	1
JORDAN	9	9	3	6	UNITED ARAB EMIRATES	8	6	5	6
KUWAIT	12	10	8	8	VIETNAM	3	4	1	3
LEBANON	1	2	1	1	TOTAL	842	728	615	567

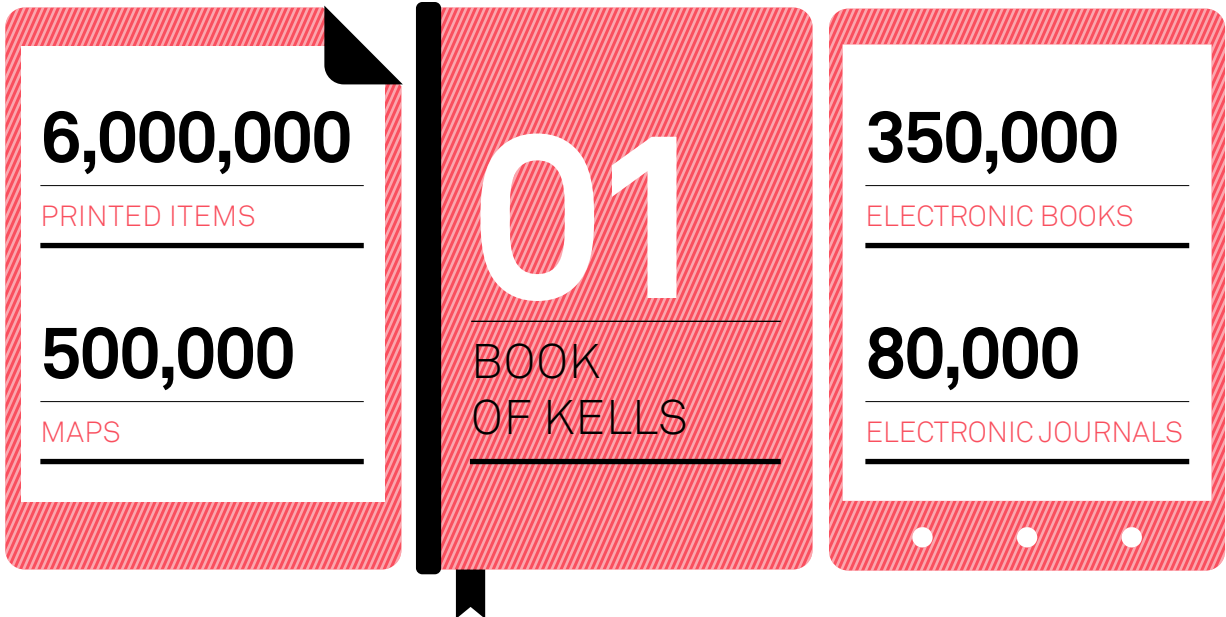
41 | 33 | 37 | 33

AUSTRALASIA

AUSTRALIA	40	30	31	26
NEW ZEALAND	1	3	6	7
TOTAL	41	33	37	33

02 Library

LIBRARY COLLECTION HAS



TRINITY'S RESEARCH THEMES

— AGEING	— IDENTITIES IN TRANSFORMATION	— MANUSCRIPT, BOOK & PRINT CULTURES
— CANCER	— IMMUNOLOGY, INFLAMMATION & INFECTION	— NANOSCIENCE
— CREATIVE ARTS PRACTICE	— INCLUSIVE SOCIETY	— NEUROSCIENCE
— CREATIVE TECHNOLOGIES	— INTERNATIONAL DEVELOPMENT	— NEXT GENERATION MEDICAL DEVICES
— DIGITAL ENGAGEMENT	— INTERNATIONAL INTEGRATION	— SMART AND SUSTAINABLE PLANET
— DIGITAL HUMANITIES	— MAKING IRELAND	— TELECOMMUNICATIONS
— GENES AND SOCIETY		

LEADING FLAGSHIP RESEARCH INSTITUTES

05

- TRINITY BIOMEDICAL SCIENCES INSTITUTE
- CENTRE FOR RESEARCH ON ADAPTIVE NANOSTRUCTURES AND NANODEVICES (CRANN)
- TRINITY COLLEGE INSTITUTE OF NEUROSCIENCE (NATIONAL NEUROSCIENCE NETWORK)
- TRINITY LONG ROOM HUB, ARTS AND HUMANITIES RESEARCH INSTITUTE
- TRINITY TRANSLATIONAL MEDICINE INSTITUTE

Commercialisation of Research

2016 | 2015 | 2014

(3 year comparisons)

IN THE PERIOD 2011–2016
(2010–2015) (2009–2014)

329 | 314 | 308

DISCLOSURES OF NOVEL INVENTIONS

125 | 102 | 81

LICENCES TO INDUSTRY GRANTED

28 | 36 | 37

TRINITY CAMPUS
COMPANIES APPROVED

IN THE YEAR ENDED SEPTEMBER 2016
(2015) (2014)

04 | 03 | 04

TRINITY CAMPUS COMPANIES

60 | 53 | 58

DISCLOSURES OF NOVEL INTELLECTUAL
PROPERTY RECEIVED

34 | 23 | 28

COMMERCIALISATION LICENCES
TO INDUSTRY

15 | 18 | 23

NEW PATENT APPLICATIONS FILED

58 | 59 | 32

COLLABORATIVE RESEARCH
AGREEMENTS WITH INDUSTRY EACH <€25K

69 | 55 | 51

COLLABORATIVE RESEARCH
AGREEMENTS WITH INDUSTRY EACH >€25K

CONSOLIDATED FINANCIAL STATEMENTS

€321.2M

TOTAL INCOME FOR YEAR
ENDED 2015 (EXCLUDING
GRANT AMORTISATION)

€314.5M

TOTAL INCOME FOR YEAR
ENDED 2014 (EXCLUDING
GRANT AMORTISATION)

€305.2M

TOTAL INCOME FOR YEAR
ENDED 2013 (EXCLUDING
GRANT AMORTISATION)

€308.9M

TOTAL INCOME FOR YEAR
ENDED 2012 (EXCLUDING
GRANT AMORTISATION)

FINANCIAL YEAR	€m 2015	€m 2014	€m 2013	€m 2012
STATE GRANTS	€44.5	€47.3	€54.5	€58.7
ACADEMIC FEES	€128.9	€124.2	€116.1	€113.8
RESEARCH GRANTS AND CONTRACTS	€85.2	€78.0	€74.7	€75.9
COMMERCIAL REVENUE UNIT INCOME	€29.1	€25.2	€23.3	€23.3
OTHER INCOME	€23.3	€24.0	€27.3	€26.2
ENDOWMENT AND INVESTMENT INCOME	€10.2	€15.8	€9.3	€11.0
INCOME (EXCLUDING GRANT AMORTISATION)	€321.2	€314.5	€305.2	€308.9

Trinity's Global Relations

Trinity's vision, as set out in our current Strategic Plan 2014–2019, is to be 'a university of global consequence, known for realising student potential and for research and scholarship that benefits Ireland and the world'. Growing globally is central to our mission in education, research and innovation – we pursue policies and actions to increase student mobility, deepen collaborations with peer institutions round the world, and to ensure a welcoming, international campus that celebrates diversity.

Student Mobility

'Geographical diversity in our student community is critical in developing an educational milieu which fosters cross-cultural understanding and prepares all students for a life of global citizenship', Strategic Plan 2014–2019.

In 2015/16, Trinity welcomed over 4,500 students from outside of Ireland, with 1,800 of these from outside of Europe, representing 26% and 11% respectively of the total student body, and a 54% increase since 2011/12 in non-EU students.

During the academic year, 433 Trinity students studied overseas as part of mobility programmes, representing a 28% increase in the number of students engaging in student exchanges since 2011/12. Trinity currently has almost 200 Erasmus partner universities across Europe.

We continue to expand our college-wide student exchange programme and in 2015/16, added eight new agreements to bring the number of non-EU exchanges with high ranking universities globally to 35. There are many opportunities for students to study abroad in leading Asian universities (including mainland China and Hong Kong, Singapore, Japan and Korea) and students are supported by the Provost's Asian Travel Bursary which defrays some of the costs encountered.

During 2016, Trinity became a member of the Consortium for Advanced Studies Abroad (CASA) and hosted the CASA 2016 Board meeting in Dublin on 20th June 2016. CASA, a non-profit consortium of nine leading research universities in the United States including Harvard, Brown and Columbia, was established to provide a framework to facilitate student mobility internationally, through the establishment of study-centres around the world. Trinity is the tenth CASA member and the first from outside the United States.

Membership of CASA will allow Trinity students to study alongside their counterparts from other CASA members in locations around the world, in partnership with leading local universities. The first Trinity CASA students are expected to be among the CASA cohort in Havana in January 2017.



→ We continue to expand our college-wide student exchange programme and in 2015/16, added eight new agreements to bring the number of non-EU exchanges with high ranking universities globally to 35.



03

BELOW – Non-EU student exchange universities.

Partnerships and Global Collaborations

Trinity continues to build strategic partnerships and joint and degree programmes with peer institutions worldwide... After four years of successful collaboration with the Singapore Institute of Technology (SIT), and 421 graduates from programmes in Physiotherapy, Occupational Therapy, Diagnostic Radiography and Radiation Therapy, we are now embarking on our first joint degree programme with SIT in Physiotherapy – 100 students will be enrolled from September 2016. SIT is set to be a leader in innovative university education by integrating learning, industry and community.

Trinity and Thapar University in the Punjab, India have agreed a significant partnership which involves collaboration in undergraduate programmes and research in Engineering and Computer Science. As part of the overall partnership, Thapar University will align its curriculum with that of Trinity and this will enable the articulation programme which will see 40 students from Thapar entering year 3 in Trinity to complete their degrees in Engineering and Computer Science.

A key component of the partnership will be the appointment of two professors who will develop collaborative research across the two institutions.

2016 has also seen Trinity expand its international access and participation initiative through the development of a new *International Foundation Programme* delivered through a strategic partnership with Marino Institute of Education, an associated college of Trinity. The Foundation Programme was developed by Trinity academics as a preparatory foundation year for students coming from abroad to enable progression to undergraduate courses across the three faculties. Twenty students from China, South Korea, Malaysia, Nigeria, Bahrain, Saudi Arabia, and Kuwait are enrolled on the first year of the programme.

In addition to core modules in English and Maths, the programme aims to equip students to think critically, express viewpoints, and to debate and problem-solve effectively within the learning environment. It encourages students to become independent in their learning and prepares them for undergraduate study in Trinity.

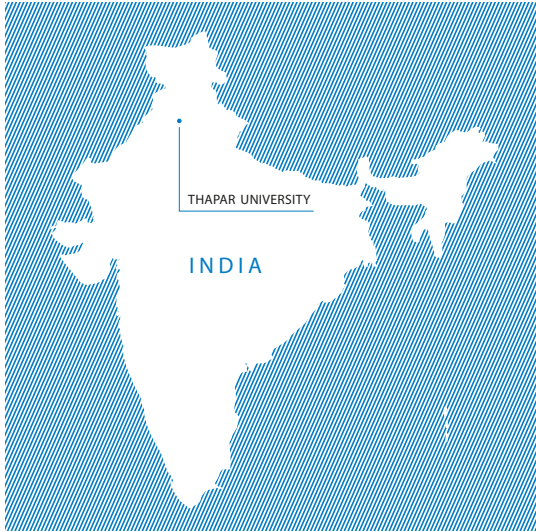
Internationalizing the University

The Global Relations Office provides support services for international students to help them embrace college life at Trinity. This includes managing the *Trinity Global Room*, an innovative space designed to link the University to the world. Acting as a platform to celebrate cultural diversity within Trinity, the Global Room is an area where students and staff can relax, converse and learn about different cultures and customs.

REGION	UNIVERSITY
AUSTRALIA	AUSTRALIAN NATIONAL UNIVERSITY UNIVERSITY OF MELBOURNE UNIVERSITY OF NEW SOUTH WALES UNIVERSITY OF QUEENSLAND UNIVERSITY OF SYDNEY
CANADA	MCGILL UNIVERSITY UNIVERSITY OF TORONTO UNIVERSITY OF WATERLOO
CHINA	BEIHANG UNIVERSITY FUDAN UNIVERSITY PEKING UNIVERSITY TSINGHUA UNIVERSITY UNIVERSITY OF NOTTINGHAM NINGBO, CHINA WUHAN UNIVERSITY XI'AN JIAOTONG-LIVERPOOL UNIVERSITY
HONG KONG	CHINESE UNIVERSITY OF HONG KONG HONG KONG UNIVERSITY HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
JAPAN	UNIVERSITY OF TOKYO
RUSSIA	MOSCOW STATE UNIVERSITY
SINGAPORE	NATIONAL UNIVERSITY OF SINGAPORE SINGAPORE MANAGEMENT UNIVERSITY
SOUTH AMERICA	PUC RIO
US	BARNARD COLLEGE BOSTON COLLEGE GEORGETOWN UNIVERSITY NEW YORK UNIVERSITY UNIVERSITY OF CALIFORNIA UNIVERSITY OF CHICAGO UNIVERSITY OF MASSACHUSETTS AMHERST UNIVERSITY OF NORTH CAROLINA, CHAPEL HILL UNIVERSITY OF NOTRE DAME UNIVERSITY OF PENNSYLVANIA UNIVERSITY OF SOUTHERN CALIFORNIA UNIVERSITY OF WISCONSIN AT MADISON

BELOW – Provost Dr Patrick Prendergast and Vice-President for Global Relations, Prof Juliette Hussey with Trinity Global Engagement Award recipients Prof Daniel Faas and Prof Mauro Ferreira and Certificate of Excellence winners to mark

their significant contribution to Trinity's Global Engagement activities, Prof Rosemary Byrne, School of Law, Prof Fabio Boylan, School of Pharmacy and Pharmaceutical Sciences and Prof Nigel Stevenson, School of Biochemistry and Immunology.



This year the Global Relations Office organised hundreds of events, including celebrations for a range of international festivals such as Thanksgiving, Diwali and Chinese New Year, as well as film screenings, international dance, music and art showcases, and seminars and talks.

In addition to the programmes run during term, Trinity has also embarked on a range of international summer school programmes. For example:

The Brown Summer Programme in Contemporary Global Politics was developed as a collaborative initiative between Brown University, the Global Relations Office and the Department of Political Science, with the aim of welcoming Brown University students for summer study at Trinity. The inaugural programme welcomed 16 students from Brown University and one student from Princeton University.

In July 2016 we welcomed 200 students from 18 countries to the Riverdance Trinity College International Summer School where students participated in a week long programme of dance at the Lir Academy of Dramatic Art.

Global Engagement Awards

The Global Engagement Awards is an annual event in recognition of Trinity's global engagement activities. This year's three recipients were: Professor Mauro Ferreira, School of Physics; Professor Kevin Kelly, School of Engineering; and Professor Daniel Faas, School of Social Sciences and Philosophy.

Professor Ferreira was key in advising Trinity on the Science without Borders programme as well as playing a pivotal role in recruiting Brazilian students to Trinity. In addition to being Trinity's representative on CLUSTER (Consortium

Linking Universities of Science and Technology for Education and Research), Professor Kelly was instrumental in setting up a global network for design innovation in undergraduate Engineering programmes in leading universities. As well as collaborating in research across three continents Professor Faas has been a longstanding champion for student and staff mobility programmes. He led on coordinating the academic content for the social sciences modules on the recently launched International Foundation Programme.

Alumni Networks

The Global Alumni Network continues to provide valuable support to Trinity in a number of key areas abroad, with alumni around the globe proud and eager to support the University. With over 75 regional branches, hundreds of alumni volunteers have been involved in numerous programmes, from supporting student recruitment and visiting students, as well as visiting staff. In the area of student recruitment, 36 alumni formally volunteered to support specific recruitment fairs and events in 2015/16. Their role and the role of many more, informally, is a valuable resource for students, with 24% of incoming students in 2015/16 referencing alumni as a source of information about Trinity.

Another global initiative proving successful is the International Welcome Programme, which pairs students travelling abroad with local alumni. In 2015/16, the programme ran in 29 cities/states in seven non-EU countries (Australia, Canada, China, Japan, Russia, Singapore and USA), matching 47 students with 36 alumni.

Research Case Studies

01 Peter Gallagher

02 Cecily Begley

03 Neville Cox

04 Carol Newman

05 Eoin O'Sullivan

06 Lorna Carson

07 David Coleman

08 Naomi Harte

09 Seamus Martin

10 Sinéad Ryan

11 Nicola Marples

12 Carmel O'Sullivan



BACK (L-R) – Prof David Coleman, Dr Nicola Marples, Prof Sinéad Ryan, Prof Peter Gallagher.

FRONT (L-R) – Dr Naomi Harte, Provost Dr Patrick Prendergast, Dr Carol Newman.

04 Living with a Star: Understanding Solar Activity and its Terrestrial Effects

Peter Gallagher

The Sun, the source of light and heat for Earth, is a far from quiet star. From time to time it launches ejections of hot gas called solar storms, which can produce beautiful auroral displays on Earth and have more sinister effects on navigation and communications systems, satellite electronics, and power grids.

Due to an intense solar storm in November 2015, aircraft were not allowed to take off from airports in Sweden for over an hour, while in March 1989, a solar storm triggered a sequence of events that caused a nine-hour outage of the Hydro-Quebec power grid in Canada. A solar storm later that year caused a halt in all trading on Toronto's stock market.

This is nothing new. In 1859, the largest solar storm on record occurred. The aurora that it produced was visible as far south as Italy in Europe and Jamaica in the Caribbean. Here in Ireland, the Irish Times of the day reported "the whole sky from the horizon to the zenith being irradiated with a rich purple tint [and] telegraph communications with all quarters were disturbed owing to some mysterious atmospheric influence".

Trinity's tradition in solar-terrestrial research – In Trinity, there is a long tradition of research in geomagnetism. Humphrey Lloyd, Professor of Natural

and Experimental Philosophy, and Provost 1867–1881, built a magnetic observatory in the Provost's Garden in the 1830s, and together with fellow Dubliner, Sir Edward Sabine, developed a global network of magnetic observatories. They became the first to confirm the link between solar activity and magnetic disturbances here on Earth. Later, the great Trinity physicist George Francis Fitzgerald (1851–1901) used a magnetometer located near the transatlantic telegraph cable in Valentia, Co. Kerry to show that variations in the Earth's magnetic field could cause current surges in the telegraph cable – early proof of the damaging effects of solar storms on communications links.

The Rosse Solar-Terrestrial Observatory

– To investigate these enigmatic Sun-Terrestrial connections, I have established a large and active research group in the School of Physics to understand the causes and consequences of solar storms, using data from European Space Agency (ESA) and NASA satellites. In addition, I have developed Trinity's Rosse Observatory at Birr Castle, Co. Offaly to continuously monitor bursts of radiation from the Sun and their effects on Earth's ionosphere and magnetic field. The data processing techniques my team is developing are used to characterize the ever-changing

magnetic field of sunspots and track the dynamics of solar storms as they are launched, while their forecasting techniques are used to predict when solar storms will occur and when they might impact the Earth.

2016 is a particularly exciting year for the group as we begin building a large radio telescope called the Low Frequency Array (LOFAR) at Birr. This project, supported by Dermot Desmond, Denis O'Brien, Joe Hogan and Science Foundation Ireland, will connect Ireland to the largest network of radio telescope in the world and enable my team to study solar activity with better detail than ever before.

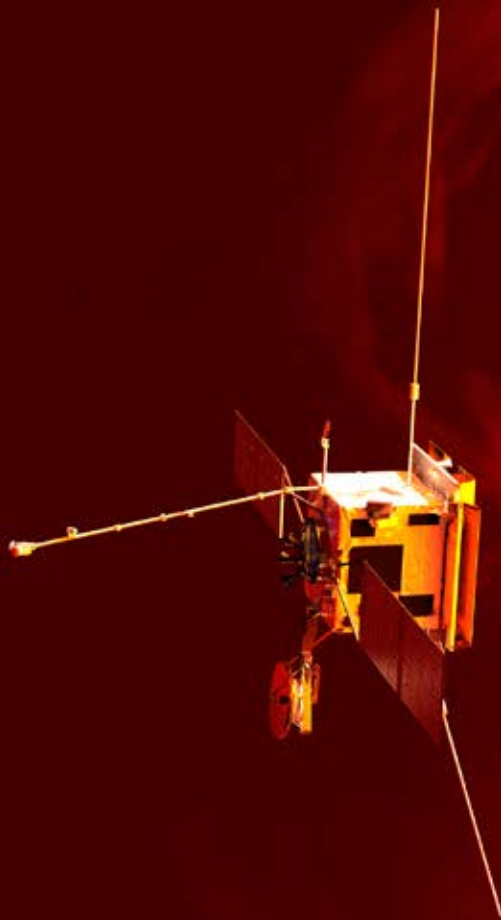
Space exploration – The Solar Physics Group also works closely with ESA and NASA teams exploring solar activity using their fleets of spacecraft. I am a Co-Investigator for the Solar Telescope Imaging X-rays (STIX) instrument which will be launched on ESA's Solar Orbiter spacecraft in 2018. This ambitious mission will fly inside the orbit of Mercury giving solar physicists a closer view of the enigmatic Sun than ever before, keeping Trinity scientists at the frontiers of space exploration and solar-terrestrial physics.

Peter Gallagher received his BSc from UCD and MSc and PhD from Queen's University Belfast. He spent six years in the US as a Postdoc at Owens Valley Radio Observatory and Big Bear Solar Observatory in California and Senior Scientist at NASA Goddard Space Flight Centre. He joined Trinity in 2006 and is a Professor in Astrophysics, Director of the Rosse Observatory, and Associate Dean of Research. Published in over 100 papers in leading journals, he is supported by the IRC, SFI, AXA, ESA, and Horizon 2020. He is a Senior Advisor to ESA's Director of Science.

Contact: Peter.Gallagher@tcd.ie

BELOW – Image courtesy of European Space Agency at www.sci.esa.int

→ The Solar Physics Group also works closely with ESA and NASA teams exploring solar activity using their fleets of spacecraft.



04 Normalising Childbirth

Cecily Begley

Childbirth is a normal, physiological process that has a profound impact on every couple's life. For the majority of women it remains normal, with 56% of all women in Ireland having a spontaneous vaginal birth. Many interventions are used, however, in even so-called "normal" births. For over thirty years, my research has focussed on decreasing unnecessary interventions in childbirth. My early research included a randomised trial comparing giving a drug routinely to contract the uterus immediately after birth (active management), and giving no drug unless it was necessary (physiological care). This showed that both methods had benefits and harms, but that routine drugs were not essential for normal, healthy, low-risk women.

I also studied episiotomies in normal birth in one Dublin hospital. An episiotomy is a cut made in the soft tissue just below the vagina, and my study concluded that it should only be done when absolutely necessary. Following this study, episiotomy rates in this hospital, in 1986, were halved in first-time mothers, from 54% to 25%, and reduced from 25% to 7% in women having their second baby.

The "MidU" study followed, which compared midwife-led with consultant-led care in Ireland's first two midwife-led units, and was commissioned by the HSE, and conducted by the School of Nursing & Midwifery in Trinity. Published in December 2009, this

showed that midwife-led care was as safe as consultant-led, used less intervention, was viewed with greater satisfaction by women, and cost €182 less per woman.

Promoting maternal wellbeing and increasing vaginal births – Our present research programme has two strands: preventing maternal morbidity and decreasing caesarean section. The MAMMI study (Maternal health And Maternal Morbidity in Ireland) is a longitudinal cohort study involving 3,000 first-time mothers, funded by the Health Research Board (four grants), Science Without Borders, and Rotunda and Coombe maternity hospitals (www.mammi.ie).

Initial results in 2015 show startling levels of physical and mental problems experienced by first-time mothers, the majority of whom do not tell healthcare professionals about their difficulties. This is a major source of anxiety to a substantial minority of women, at a time when they should be free to enjoy their baby. Future work will evaluate interventions to decrease key morbidities.

I also lead the OptiBIRTH FP7-funded project, with a consortium of eleven partners from eight European countries (www.optibirth.eu/optibirth). The stimulus for this work was the "widespread concern" noted in the 2008 European Perinatal Health Report over rising caesarean section (CS) rates, varying from 15% in the Netherlands to 38% in Italy.

Much of the rise is due to routine CS following previous CS, despite calls for increased vaginal birth after caesarean (VBAC), which results in less mortality and morbidity and is the preferred option for the majority of women.



Cecily Begley received her MSc and PhD from Trinity College Dublin and joined the university in 1996 to open and develop the School of Nursing and Midwifery. She is now Professor of Nursing and Midwifery and leads the Maternity Care Research Group. She is visiting professor in the University of Gothenburg, section editor of *BMC Pregnancy and Childbirth*, and has published almost 160 papers in peer-reviewed journals. Her research focuses on decreasing unnecessary interventions and promoting normality in childbirth.

Contact: cbegley@tcd.ie

The aim of OptiBIRTH is to increase VBAC rates through enhanced women-centred maternity care. We are conducting a cluster randomised trial in Ireland, Germany and Italy, involving 1,800 consenting women in fifteen maternity hospitals. The intervention we are testing involves evidence-based education of women, information for clinicians, opinion

leaders, audit and peer review of caesarean sections in each site, and joint decision-making by women and clinicians. Results, which will be published next year, following the five-year study, will influence EU health policymaking and have the potential to avoid 160,000 unnecessary caesarean sections per annum in Europe, with savings of €156 million.

→ The aim of OptiBIRTH is to increase VBAC rates through enhanced women-centred maternity care. We are conducting a cluster randomised trial in Ireland, Germany and Italy, involving 1,800 consenting women in fifteen maternity hospitals.

TOP LEFT – Rachel and Mark Singleton, with baby William, born at home, a normal vaginal birth following a previous caesarean section. Rachel had to travel to the UK to obtain the birth she wanted, which was not available here in Ireland.

BOTTOM LEFT – Luke Mangan.

ABOVE – Iva.

04 Exploring Tensions in the Relationship between Islamic and Western Worldviews

Neville Cox

In 2005 Denmark's *Jyllands Posten* newspaper published 12 cartoons depicting the Prophet Muhammad, the central and most sacred human figure in the Islamic faith. Two things about these publications, and the controversy that followed, are of particular note for my research. First, they trivialised the sacred and implied that there was some inherent connection between the Prophet (and presumably, thus, the religion which he formed) and global terrorism. Secondly, they emphasised the 'otherness' of Islam in so far as western society was concerned, through the proposition that one *should* be free, as a matter of right, to publish whatever one wants about religion, God or sacred things. Inherent within the response from many western commentators to both the cartoons and the perceived Islamic intolerance of them, was the view that western free speech values were inherently and universally *right* and that any value system which stood against them (such as Islam) must be universally *wrong*.

Challenging Western misconceptions

– In my research I seek to explore the tensions that are inherent in the relationship between Islamic and western worldviews. In a recently published article in the Australian *Law Journal* I argue that there can be no genuine or inherent connection between *Shari'a* law and terrorism.

More generally, I seek to locate the principles behind certain controversial aspects of *Shari'a* law within, rather than outside, liberal theory, and thus to characterise what are often seen as conflicts of principle between two purportedly universal world views as simply different applications of the same principles, resulting from the fact that religion is an express element of the public morality of most Islamic states, but not of their western, secular counterparts. It is my hope that this will serve to counter some of the misconceptions about Islamic law – including fundamentalist interpretations thereof – that abound in western discourse.

I have focused on the concept of blasphemy laws (something which gained an obvious traction in the wake of the 2015 *Charlie Hebdo* attacks). My conclusion, published in 2015–16 in the *Human Rights Law Review* and *Oxford Journal of Law and Religion*, is that, in principle, Islamic blasphemy laws are indistinguishable from western laws against hate speech or holocaust denial. Both seek to prohibit the saying of the morally unacceptable (something permitted as a matter of international human rights law) – with the only difference being the (unprovable) verdict of each worldview as to what is morally unacceptable.

In addition I am currently researching into laws which either require or prohibit the wearing of certain forms of

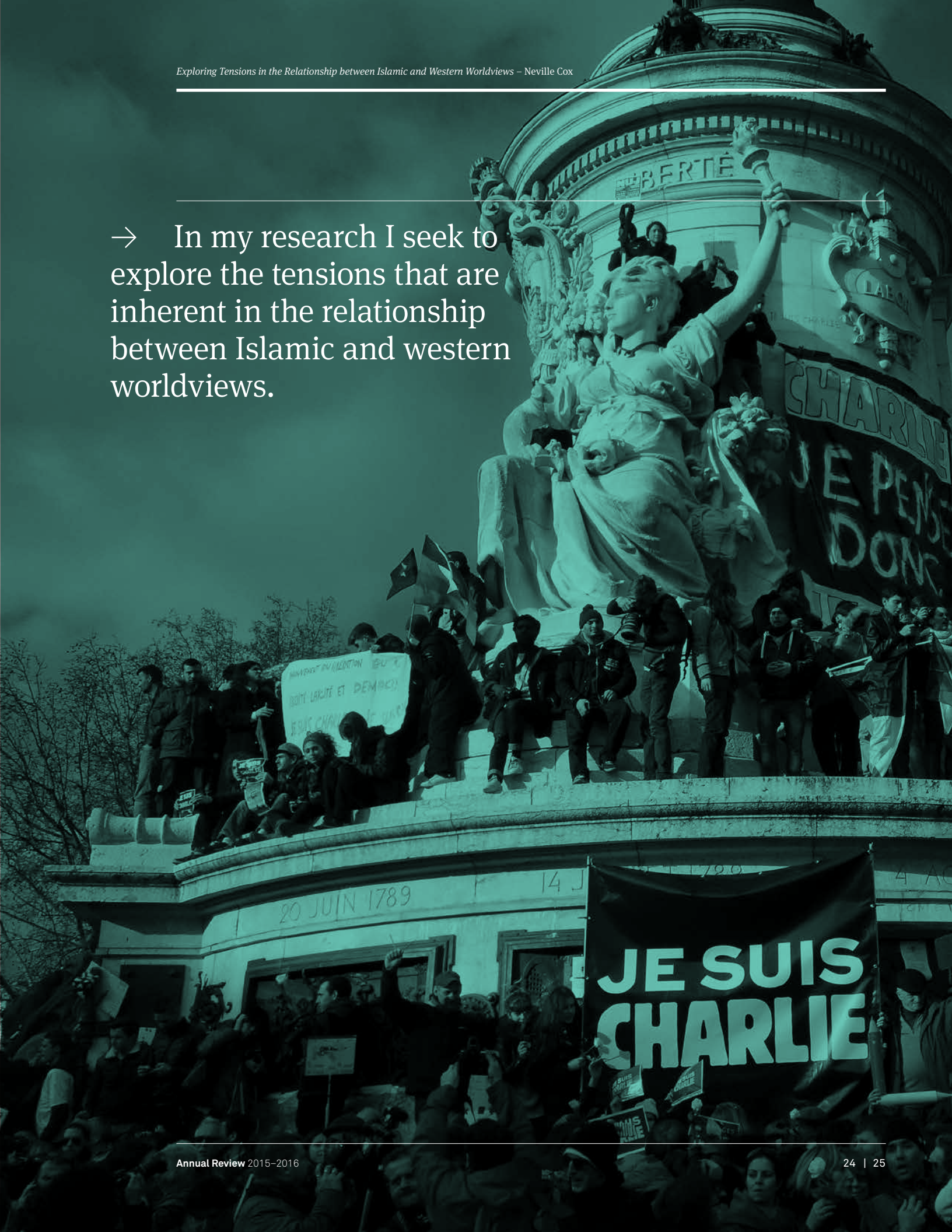
Islamic head or face coverings. Again my argument is that there is nothing unusual in principle about a law or indeed a cultural or societal norm which tells women (or men) what to wear, nor is there any reason to characterise Islamic rules of this kind as inherently misogynistic. Rather they reflect cultural conclusions as to what parts of the body are sexualised which are neither empirically right nor wrong, oppressive or empowering, but simply different to the equivalent standards in the West.

Applications of my research – My research plans for the coming years centre around these broad themes. I am currently writing a monograph on the issue of laws pertaining to what can broadly be termed 'Islamic veiling' linking such laws (and the various societal pressures on some Islamic women to veil) with equivalent laws and pressures which impact on the sartorial choices of women in western society. I am also planning to organise a symposium on the topic in 2017. Beyond this I am working on an essay on the roots of attitudes to blasphemy laws for a European wide publication on *European Religious Illiteracy in a Pluralistic Society* published by the European Foundation for Religious Sciences.

Neville Cox received his LLB and PhD degrees from Trinity College Dublin and his BL degree from the Honourable Society of King's Inns. He has lectured in Trinity since 1996 and, since July 2016 is the Dean of Graduate Studies. He has also lectured widely in the United States and was a visiting scholar in residence at Washington and Lee Law School in Virginia. He is the author of five books and numerous law review articles. He researches in the area of Islamic law with a particular focus on its relationship to International Human Rights law.

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→ In my research I seek to explore the tensions that are inherent in the relationship between Islamic and western worldviews.



04 Understanding the Micro-foundations of Development

Carol Newman

Over the past two decades, significant progress has been made in addressing issues of the developing world, but this progress has been unevenly distributed. With increasing challenges on the horizon, such as rapid population growth, climate change and security issues, the fate of the poorest will continue to be a shared global challenge.

For policymakers, addressing emerging challenges is complex, particularly given that the majority of the poor live in remote and often fragile contexts. Poor governance, a lack of leadership, and corruption add further constraints to the development process.

Understanding these complexities requires significant academic research input. My research aims to uncover why significant disparities in income and welfare continue to exist and what policies can be put in place to address them. I aim to ensure that policy advice arising from research is built on sound identification strategies that are generalizable to other settings and contexts. Through working closely with local partners and governments, I ensure that my work addresses the relevant research questions and has real impact.

Trinity Impact Evaluation Unit (TIME)

– The first strand of my research is concerned with evaluating the impact

of development projects. TIME was established by researchers in the Department of Economics in 2015 with the aim of understanding which investments in developing countries work, which do not, and why. Understanding the effectiveness of these investments requires the use of rigorous research methodologies. I am currently involved in three large-scale randomized controlled trials examining: the impact of nutrition interventions in HIV treatment; the impact of empowering women through the use of role models; and the effectiveness of community engagement interventions in flood risk prevention. The results of these trials will be finalized by the end of 2016 and will be disseminated through publication in academic papers and a set of more accessible policy briefs to ensure that the findings reach a wide audience. These will be made available through the TIME website (www.tcd.ie/economics/time). The large scale and geographical scope of the studies make the results highly relevant to other researchers but also to development practitioners and policy makers throughout the developing world.

Structural transformation – The second strand of my research is concerned with the process of structural transformation (the shift of resources towards more productive sectors of the economy)

in developing countries. This body of work is the product of a 10-year collaboration with researchers at the University of Copenhagen and UNU-WIDER.

A key focus of our research is on understanding the industrialization process in low income settings, using detailed micro data on firms. Our research in Vietnam analyses the evolution of the Vietnamese industrial sector focusing on globalization and international integration. We have published a number of academic papers on the basis of this research in journals such as the *European Economic Review*, *World Bank Economic Review*, *Journal of Economic Geography* and the *Review of Finance*. Lessons drawn from this work have been used to understand the industrialization process in Africa, the findings from which we have published in two books in 2016, *Made in Africa: Learning to Compete in Industry*, published by Brookings Institution Press and *Manufacturing Transformation: Comparative Studies of Industrial Development in Africa and Emerging Asia*, published by Oxford University Press. In a related project, we work closely with various government institutions in South Africa, to understand the impact of government policies aimed at increasing the productivity of firms.

Carol Newman received her BA and PhD from Trinity and in 2002 joined the Department of Economics, where she is now Associate Professor. She is Chair of the Trinity International Development Initiative and co-founder of the Trinity Impact Evaluation Unit. Her research is in the field of development economics, in particular the micro-foundations of development – she has published 24 internationally peer-reviewed journal articles, 7 books, and 14 book chapters and is involved in a number of major development projects in South East Asia and Africa.

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Understanding the constraints to structural transformation requires knowledge of how households behave and make decisions. Our work in Vietnam involves the collection of an extensive dataset of 3,000 rural households, tracked over a 10-year period. This is a rich and unique source of data that has facilitated the analysis of a range of important academic and policy-issues, such as household savings and investment behaviour, property rights, child labour, political connections and micro-credit, which we have published in a number of academic papers and policy briefs. In addition, an edited volume bringing together all of our findings from this body of work entitled *Growth, structural, transformation and rural change in Viet Nam: A rising dragon on the move*, to which I contribute a number of chapters, will be published by Oxford University press early in 2017. Given the remarkable success story of the Vietnamese economy over the last decade, our findings will be of interest to researchers and policy makers around the globe.

→ My research aims to uncover why significant disparities in income and welfare continue to exist and what policies can be put in place to address them.



04 Tackling Homelessness – a Housing-led Approach

Eoin O’Sullivan

Homelessness has increased in virtually all European Union member states over the past decade. Politicians and policy makers have increasingly sought to devise solutions to homelessness based on research evidence rather than on tradition and instinct, and this research is demonstrating that a large part of the problem is the manner in which services are delivered, rather than the problem being homeless people themselves.

The primary traditional response to homelessness was the provision of communal or congregate accommodation in ‘shelters’. Shelters have their origins in the mid-19th century and their emergence came in parallel with a range of other institutions to manage the poor, including workhouses, prisons and a vast array of asylums and penitentiaries. The failure of these institutions to reform or rehabilitate, to desist or to deter was clearly evident by the end of the 19th century, but it was to take several decades before the majority of these massive mausoleums of misery gradually fell into disuse and disgrace. However, two institutions survived and indeed have thrived into the 21st century – prisons and shelters for the homeless.

Homeless people – a heterogeneous population – Research increasingly demonstrates the limited efficacy of providing shelters as a response to homelessness. We have robust evidence that

those who experience homelessness are not just those depicted by the media – the stereotypical rough sleeper – but are a heterogeneous population, with rough sleepers in a minority. It would seem to be an erroneous policy to cluster this heterogeneous population in congregate settings and expect this policy and practice response to aid their exiting from homelessness.

The housing-led approach – Methodologically sophisticated research clearly demonstrates the vastly superior housing retention rates when housing is made available *first* to homeless people, rather than after a series of interventions designed to make them *ready* for housing. Popularly known as the housing-led approach, this evidence based policy is transforming how policy makers at a local and national level are devising responses to homelessness. This approach was adopted by the Irish government in 2013 with the publication of a *Homelessness Policy Statement* which drew on a review of existing policies and practices – entitled *Ending Homelessness – A Housing-Led Approach* – that I was commissioned to produce by the Department of the Environment, Community and Local Government.

At a European level, I published, with colleagues from other institutions, the first comprehensive overview

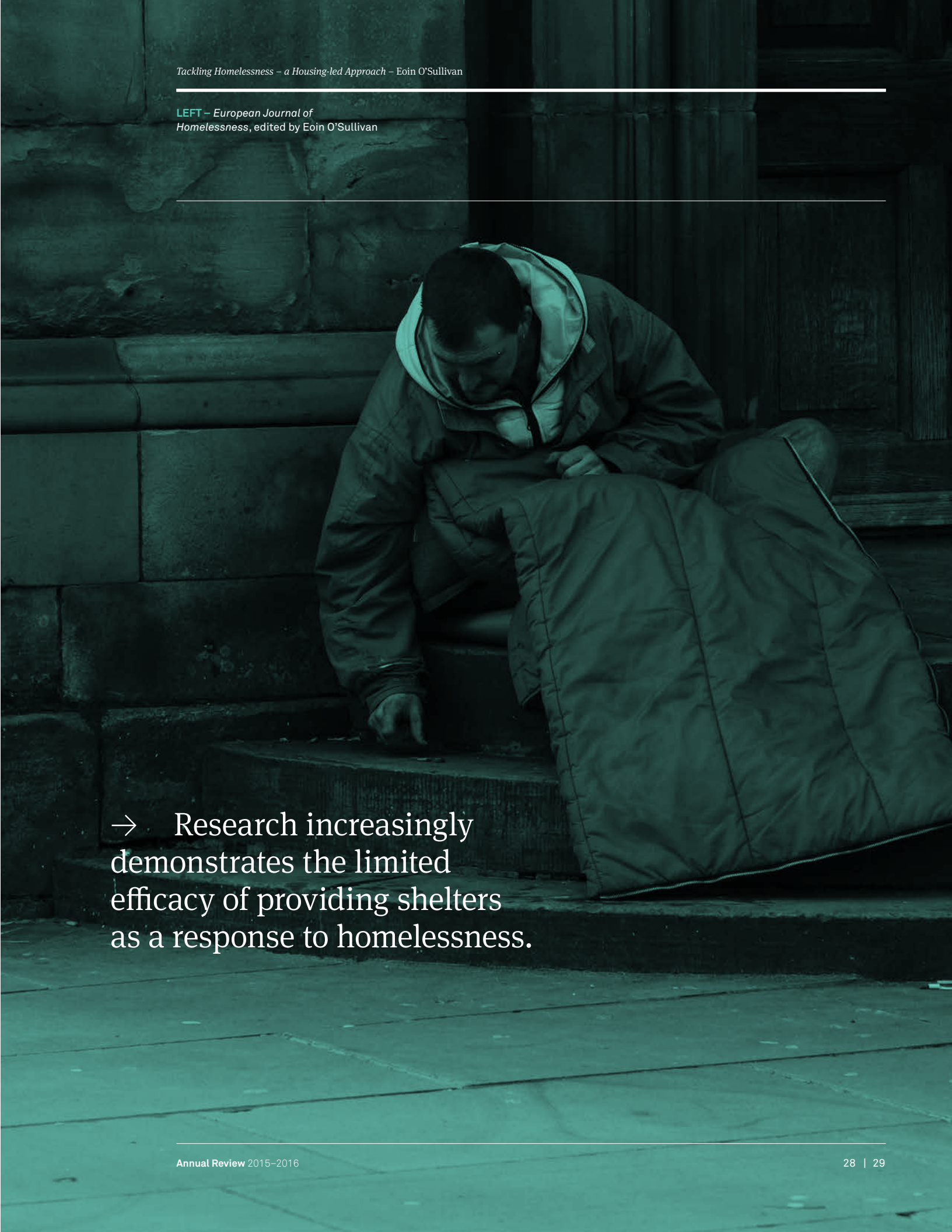
of responses to homelessness in member states in 2010, commissioned by the Belgian Presidency of the Council of the European Union. This has led the shift towards housing-led responses in an increasing number of member states. As editor of the *European Journal of Homelessness*, published twice a year since 2008 and celebrating its 10th anniversary in 2016, I aim to provide a forum where a rigorous and critical analysis of policy and practice on both the nature of and responses to homelessness in Europe and further afield can take place. The Journal deliberately aims to inform not only academics, but also policy makers and practitioners, and it has made a significant contribution to providing evidence based responses to homelessness by publishing methodologically sophisticated papers that are contributing to re-orientating policy responses to reflect the research evidence.



Eoin O’Sullivan received his BA from NUIG, his MA from UL and his PhD from Trinity College Dublin and joined the School of Social Work and Social Policy as a lecturer in 1999. He is now Professor in Social Policy and Head of the School of Social Work and Social Policy. His research focuses on both comparative dimensions of homelessness, and the history of the institutionalisation of marginal populations in the 19th and 20th century.

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LEFT – *European Journal of Homelessness*, edited by Eoin O’Sullivan



→ Research increasingly demonstrates the limited efficacy of providing shelters as a response to homelessness.

04 Understanding Diversity Through Urban Multilingualism

Lorna Carson

We live in an increasingly urbanised world, with more than half of the global population living in cities. Much of the research on contemporary city life tends to overlook multilingualism and there is a lack of serious and sustained research on the many languages spoken within neighbourhoods and communities. My research on multilingualism focuses on language and diversity, especially in city life. The extent and composition of multilingualism in urban contexts is directly impacted by serious global challenges: migration, the economic crisis, the rise of the far right and growing intolerance of diversity.

A 'two-tier' multilingualism – The contemporary multilingual city (including Dublin, where some 200 languages are spoken) provides a living laboratory for the study of language use. Whilst rural areas are also affected by immigration and mobility, the city is a particularly concentrated example of both the co-existence of different language communities (societal multilingualism) as well as multilingual citizens (individual multilingualism).

We clearly see a growing and dynamic multilingualism in the city where different languages are celebrated and seen as an enriching resource. But there is also evidence of a 'two-tier' multilingualism: an elite version which includes the larger European languages, sought after by employers, and a less prestigious version which tends to include the languages of immigrants.

In the elite version, multi-lingualism is viewed from a narrow competence perspective that tends to see language capital uniquely in terms of employability. In the less prestigious version, where the proficiency of migrants in multiple languages may be ignored because of a lack of English language competence, multilingualism is seen an obstacle to integration, or as an unwelcome burden on public spending because of the need for translation and interpretation.

Through systematically analysing attitudes, behaviours and practices, applied linguistic research gives us a deeper understanding of the language needs of individuals and groups and suggests how instruments and policies can be created and adapted, especially in relation to language learning, teaching

and assessment. I investigate how fostering language learning can contribute to individual wellbeing and social cohesion, specifically how languages are learned, supported or indeed lost throughout the lifespan.

Using a variety of methods (interviews, surveys, ethnographic, photographic and archival), my research has resulted in academic publications including, most recently, *The Multilingual City: Vitality, Conflict and Change* (Multilingual Matters, 2016), as well as in the publication of online toolkits to help support community groups involved in language teaching in volunteer schools, in compiling records of good practice in language support across Europe, and developing language curricula and materials.



Lorna Carson joined the School of Linguistic, Speech and Communication Sciences in 2006, where she is assistant professor in Applied Linguistics and Director of the Trinity Centre for Asian Studies. She holds a BA (Mod.), MPhil and PhD from Trinity College Dublin, and an MA from the College of Europe, Bruges. In 2015 she was elected a Fellow of Trinity College Dublin. She has been awarded three European Commission grants for projects researching multilingualism and language learning. She is currently President of the Irish Association for Applied Linguistics.

Contact: carsonle@tcd.ie

LEFT – Graffiti in Oslo.

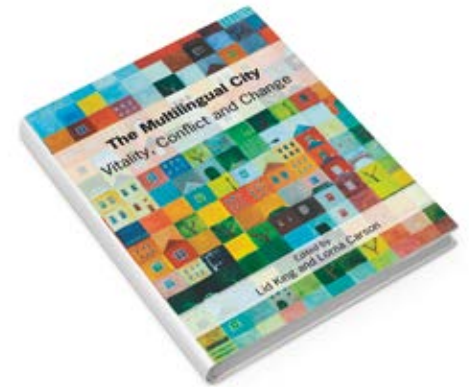
RIGHT TOP – *The Multilingual City: Vitality, Conflict and Change*, co-edited by Lorna Carson.

RIGHT BOTTOM – Korean shopfront in London.

Multilingualism and European identity formation – Having led the 60-strong research team across 18 cities in the European Commission-funded LUCIDE project ('Languages in Urban Communities: Integration and Diversity for Europe', 2011–2014, www.urbanlanguages.eu), which conducted an extensive comparative study of multilingualism in different spheres of city life (economic, education, etc.), I am now tracking the linguistic aspects of European identity formation specifically among young city-dwellers from all sorts of backgrounds, examining whether linguistic diversity is supported, tolerated, hidden, or indeed actively discouraged (www.euromec.eu). This project, funded by the European Commission's Jean Monnet programme (2014–2017),

focuses on diversity in three European cities (Krakow, Sofia and Dublin), each with very different experiences of immigration. Immigration is one of the most pressing political and social issues of contemporary life, and many consensual views about multilingualism – for instance the benefits of allowing for multiple linguistic and cultural practices and for overlapping identities – are now being called into question. Our research suggests that governments are leaning towards policies which assume that diversity is a threat to social cohesion, rather than a way of allowing citizens to flourish in their private and public lives. In addition to a forthcoming publication on multilingualism and migration in a global context, Euromec will host a summer school next

summer in Trinity for postgraduate students from a variety of disciplines whose work focuses on diversity and inclusion.



→ The contemporary multilingual city (including Dublin, where some 200 languages are spoken) provides a living laboratory for the study of language use.



04 Combating MRSA, Biofilms and Reservoirs of Healthcare-associated Infections

David C. Coleman

Patients in healthcare facilities are often more susceptible to infection than are healthy individuals. Despite an extraordinary range of prevention and control measures, many acquire healthcare-associated infections. My research group in Trinity's School of Dental Science Microbiology Unit works at an international level to develop effective practical solutions to minimise these infection risks.

Microbial biofilm build-up in water networks and dental systems – Water delivered to taps, washbasins and medical devices acts as a source of microbial contamination due to the build-up of microbial biofilms, which are produced by microorganisms to aid their survival. Slimy in texture, biofilms protect resident microbes from disinfectants and antibiotics and are difficult to remove using conventional approaches. In addition to harbouring harmful microorganisms, they may interfere with equipment.

Examples of commonly used water networks which are prone to biofilms, and represent a considerable infection risk to patients and clinical staff, include hospital taps, U-bends from clinical washbasins, and dental chair unit waterlines which provide water to irrigate tooth surfaces and to cool dental drills.

We have developed automated systems for disinfecting such water networks by harnessing the cleaning and disinfection properties of metastable electrochemically-activated solutions

generated from dilute salt solutions. This negates the need for toxic chemical disinfectants, reduces costs, and results in biofilm-free systems, providing water virtually free from microorganisms and very substantially reducing infection risk.

Dental suction systems remove fluids (e.g. blood and saliva) and debris from the mouth during dental treatment; they can become heavily contaminated with biofilm, which damage the equipment and present multiple infection risks. In a long-term study carried out between 2010–2015, we established that universally used decontamination methods were ineffective due to design problems. In co-operation with industrial partners, we simplified the design and automated the disinfection process, solving the problem.

Several of our systems for dental and waterline treatment and dental suction decontamination technology were successfully commercialised between 2006–2015 in collaboration with our long-term industrial partners Planmecca Oy

(Helsinki, Finland). These include the Waterline Cleaning System, the Water Management System, the Centralised Water Quality System and the Suction Tube Cleaning System.

New and re-equipping dental hospitals and clinics worldwide have now adopted our disinfection technology and this has benefitted millions of patients every day. In addition to greatly reducing infection risks, our technology provides reduced environmental impact.

MRSA – Our research has applications beyond combating biofilms. Methicillin-resistant *Staphylococcus aureus* (often called 'superbugs') are a group of pathogenic bacteria responsible for severe healthcare – and community-associated infections worldwide. MRSA have been endemic in Irish hospitals for 40 years and place a significant burden on patients and healthcare resources.

Fig 1

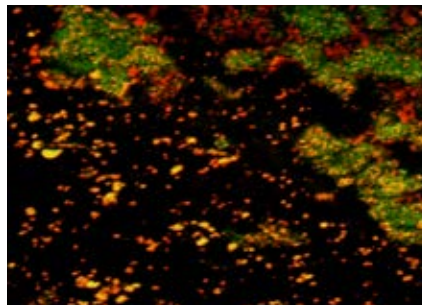
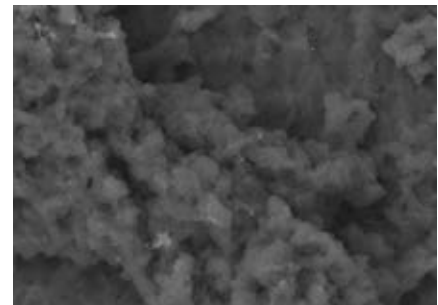


Fig 2



David Coleman received his BA (Mod), PhD and ScD from Trinity. Joining the School of Dental Science in 1989, he is now Professor of Oral and Applied Microbiology and head of the division of Oral Biosciences. He is a Fellow of Trinity and the Royal College of Pathologists, London, member of the RIA and winner of the RIA silver medal for microbiology. Published in 170+ articles in peer-reviewed journals, his research interests include minimising infection risks from water networks and medical devices, and the population biology of methicillin resistant *Staphylococcus aureus* (MRSA) and pathogenic *Candida* species. Contact: dcoleman@tcd.ie

Fig 1. Electron micrograph showing heterogenous bacterial biofilm on the internal surface of a dental waterline.

Fig 2. Electron micrograph showing two-day old biofilm in a dental waterline.

→ My research group in Trinity's School of Dental Science Microbiology Unit works at an international level to develop effective practical solutions to minimise these infection risks.

My group – in collaboration with the National MRSA Reference Laboratory, together with colleagues at St James's and Beaumont hospitals in Dublin, the School of Veterinary Medicine in UCD and academic and industrial collaborators from Germany, the UK and the USA – have applied high-throughput DNA microarray and whole genome sequencing strategies to investigate the population dynamics of MRSA in real-time. The Irish Health Research Board funded much of our early work in this area. This approach revealed a large variety of different clones circulating within Irish hospitals and the community, and the frequent introduction of new MRSA clones into Ireland from abroad. It also revealed transfer of MRSA from animals to humans. Further studies identified the acquisition of mobile genetic elements by Irish MRSA from other bacteria that encode resistance to last-line antibiotics.

The results of our research are being used to identify routes of MRSA

transmission between hospitals and other healthcare facilities and the community in Ireland and internationally. In particular, the identification of mobile genetics encoding virulence determinants or antibiotic resistance determinants that circulate among global MRSA strains has highlighted that enhanced surveillance and detailed analysis of MRSA strains circulating internationally is imperative for the early identification of emerging strains locally to prevent them becoming widespread. Our studies revealed that international travel is a significant factor in the introduction of new MRSA strains to Ireland and that routine screening of healthcare staff for MRSA colonisation should be considered in endemic settings such as Ireland. The importation and spread of livestock associated MRSA clones in farm animals and their carers in Ireland also highlights that consideration should be given to screening imported livestock to protect this economically important industry.

Fig 3. (above) Dental unit equipped with an integrated and automated suction system decontamination unit (Suction Tube Cleaning System: STCS) developed in collaboration with Planmeca Oy (Helsinki, Finland). Boyle *et al.*, 2015. *Journal of Dentistry*, 43(10):1268–1279.

04 The Engineering Behind Understanding Speech

Naomi Harte

Humans love to talk and for the lucky majority speech is a natural and easy form of communication. So why is it so hard for computers to understand what we say? The challenge of speech recognition has seen tremendous progress in the past decade, with applications like Apple's Siri now widely used. But there is much more to speech than the words we say. A decade ago, engineers were happy to correctly detect a sequence of spoken words. Now I, and my research team in the ADAPT Centre, are going beyond those words to automatically achieve a fuller understanding of speech. This has applications for audio-visual speech recognition, online surfing, and in animal vocalisation and species delimitation.

Watch my lips – A major obstacle to speech recognition by machine is noise: other people talking, traffic going by, or the radio in the background. When talking to a person in a noisy situation, you subconsciously start to lip-read to augment the information your brain receives. My ongoing research in ADAPT seeks to establish what visual features are the most useful to augment the speech information we extract, and how to cleverly fuse these two sources. My group has recently published the TCD-TIMIT database, an audio-visual database of high-resolution continuous speech, which has the potential to become the de facto standard for evaluating audio visual speech recognition systems. This research was funded

by Science Foundation Ireland and the database has been made freely available for researchers worldwide to download.

Thin-slicing – Emotion is expressed in speech through the words we say, how we say them, and also our visual expression. My research investigates how to automatically recognise charismatic and inspirational speakers. This has useful application in selecting from the vast amount of online digital content. In particular we have looked at the concept of thin-slicing, whereby humans tend to make the same judgment of a speaker from a short 30-second clip as from an entire talk. Our work shows that we can automatically detect charismatic talks with limited data, but the data needs to be well chosen rather than randomly sampled. By automatically locating events of interest such as peak intonation changes, audience feedback and laughter, we can accurately predict how users will rate

talks. This has potential applications for personalised online searches of TED Talks or YouTube.

Species delimitation – My expertise in speech processing has application beyond consumer technology. Through an ongoing collaboration with colleagues in Zoology in Trinity, I am exploiting my knowledge of speech signals to analyse bird song. The analogies between human speech and bird vocalisations are remarkable. Specifically, my group is developing measures of similarity of bird vocalisations to allow zoologists to systematically compare bird populations. This has significant potential implications for species delimitation (i.e. identifying species-level biological diversity). This work has led to my chairing a special session on bird and animal vocalisations at Interspeech 2016, the premier international conference on the science and technology of spoken language processing.

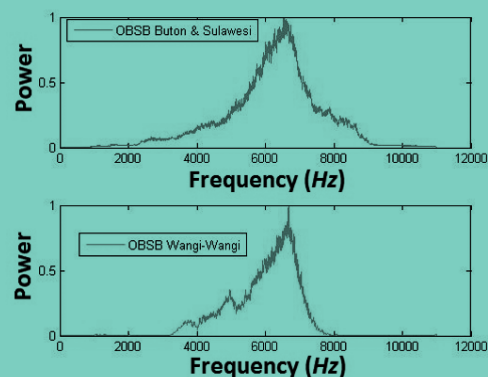


Fig 1

Naomi Harte received her BA BAI from Trinity College Dublin and her PhD from Queen's University Belfast. She then spent a number of years in high-tech start-ups, and this experience continues to bring a real-world agenda to her research today. Naomi returned to Trinity as an SFI Engineering Lecturer in Digital Media Systems in 2008. Her research area is human speech communication with a focus on audio visual speech processing, speaker verification for biometrics, speech quality and emotion in speech. She has numerous technology patents and licences through her collaboration with tech giant Google in the USA, and is widely published in her field.

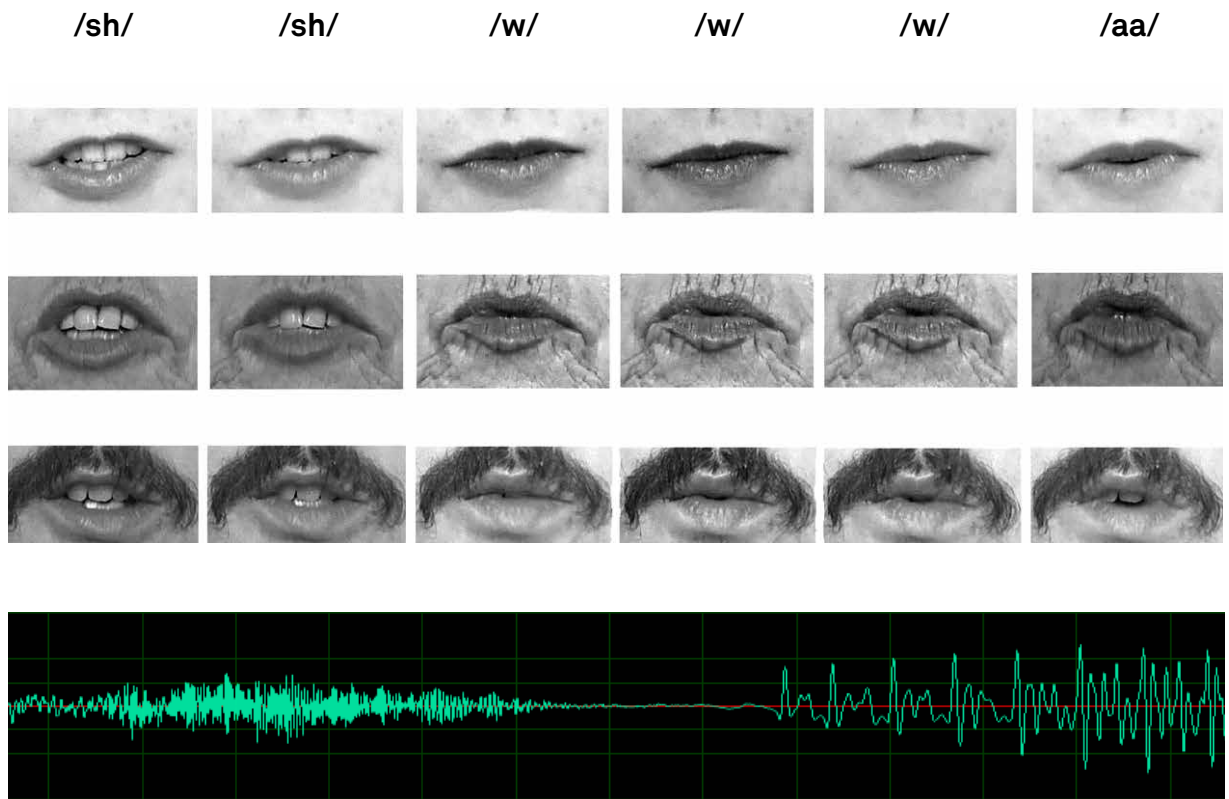
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Fig 1. Olive Backed Sunbird from Wangi-Wangi islands in Indonesia, picture courtesy of Nicola Marples. The two plots show how this bird's characteristic song differs in frequency content from neighbouring populations of the same species on Buton and Sulawesi.

Fig 2. Audio signal of speaker saying “shwa”, with associated mouth movements from three different speakers. Note that the middle speaker is a professionally trained lipspeaker.

→ My ongoing research in ADAPT seeks to establish what visual features are the most useful to augment the speech information we extract, and how to cleverly fuse these two sources.

Fig 2



04 Inflammatory Tales of Cell Death

Seamus Martin

Literally billions of cells die in the human body on a daily basis due to wear and tear, infection, malfunction or just old age, but these dead cells are typically swiftly replaced through the birth of new cells through cell division. There is a parallel here with our own lives, as we will all inevitably undergo a journey from birth to death, and will be replaced through the births of our children. Another parallel between human and cellular societies is how the aftermath of death is dealt with. Within tissues, dead cells are normally recognized and removed from the tissues by specialized 'cellular undertakers', called macrophages. These cellular undertakers recognize changes that take place as cells die and quickly remove them from the tissues before their contents can leak out. If this cellular burial ritual doesn't happen, then the process of inflammation is triggered. It is this nexus between cell death and inflammation that is the main focus of my work within the Department of Genetics at Trinity.

Alarming alarmins – Inflammation is the process that kick-starts the immune response and is typically accompanied by swelling, redness, pain and heat, all side-effects of our many different cell types rushing into a tissue to fight infection. Inflammation is generally a good thing as it typically helps to eliminate bacteria and viruses that try to enter the body on a daily basis. But it is not only

infection that triggers inflammation. We are all familiar with the rapid swelling and soreness if we twist an ankle or sprain a wrist. This type of inflammation is due to cell damage within the injured tissues releasing molecules (called alarmins) that trigger the inflammatory process. Although the fact that dead cells release alarmins that can trigger inflammation has been known for a very long time, the identity of these molecules has been mysterious and a hotly debated topic between immunologists.

So, why do we care about alarmins? Inflammation is a double-edged sword; too little and we become susceptible to infection, but too much and we cause tissue injury and make the situation worse. Chronic inflammation is a major contributory factor in numerous human ailments, from cancer to rheumatoid arthritis and many other diseases in between. Consequently, there is huge interest in the molecules produced within our bodies that drive inflammation and remarkable success has been achieved over the past decade in treating inflammatory diseases by targeting these molecules. But there is much more to do. My laboratory, funded by a major award from Science Foundation Ireland, is focused towards understanding how dead cells trigger inflammation. We are working towards identifying the key alarmins and how exactly these molecules become activated.

Arming the alarmins – and switching them off – We have made a major breakthrough in this area over the past year by identifying a group of protein-cutting molecules, called proteases, which effectively arm the alarmins by flicking a switch on the latter that greatly increases their inflammatory properties. This discovery makes this group of proteases attract targets for anti-inflammatory therapies and we have followed up this work by screening for compounds that can switch off the activities of these inflammatory proteases. We have now found several such compounds and are currently testing their ability to treat various types of inflammation. One possible application of such molecules is in psoriasis, which affects 2% of the Irish population, where it may be possible to switch off the inflammatory process in the skin by applying protease inhibitors that prevent alarmins released by dying cells from becoming fully armed, thereby blocking the vicious cycle of inflammation.

“There is a parallel here with our own lives, as we will all inevitably undergo a journey from birth to death, and will be replaced through the births of our children.”

Seamus Martin holds the Smurfit Chair of Medical Genetics at Trinity. An NUI PhD graduate, he held research fellowships at University College London and University of California, San Diego. Author of the textbook 'Essential Immunology', he has received grants from the Wellcome Trust and SFI. Winner of the GlaxoSmithKline award from the UK Biochemical Society 2006, the RDS/Irish Times Boyle Medal 2014, and the ICDS Prize 2016, he has been elected to EMBO and the RIA. One of the most highly cited scientists in his field worldwide, his work focuses on how cell death promotes inflammation.

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Fig 1. Laser confocal images of human cells undergoing programmed cell death (apoptosis) upon switching on the Parkin protein (red), which is commonly mutated in Parkinson's Disease.

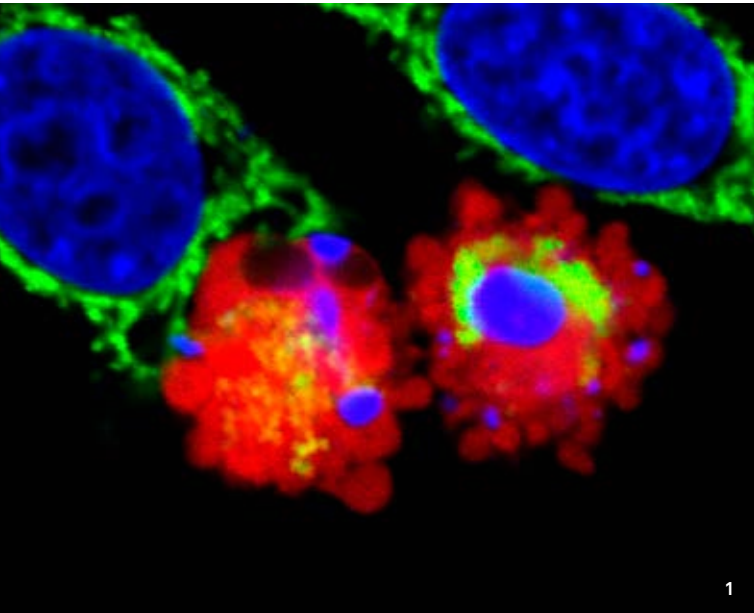


Fig 2. Human cervical carcinoma cells undergoing programmed cell death upon treatment with a cancer chemotherapeutic drug. Ongoing studies in the Martin laboratory are aimed at exploring how chemotherapeutic drugs kill cells and how this can be optimized.

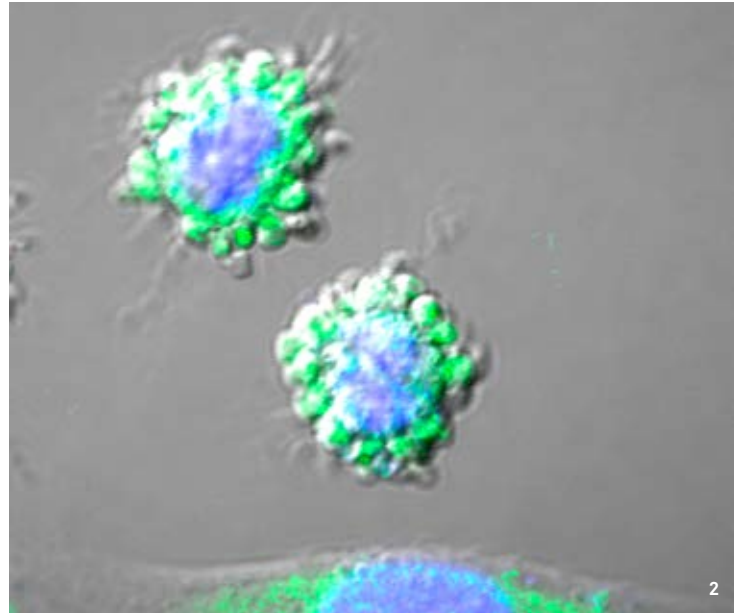
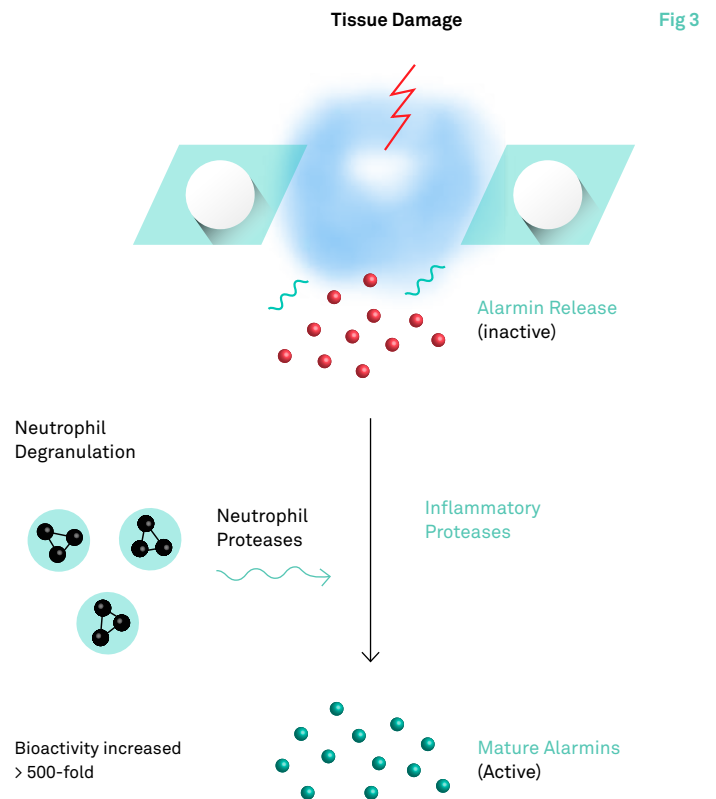


Fig 3. The Martin laboratory at Trinity have recently found that proteases released from white blood cells (neutrophils) play an important role in activating immune signaling molecules (Alarmins) that are released from damaged cells, thereby promoting inflammation.

We have filed a patent application on these discoveries and are currently in discussion with a number of Pharma companies with a view to developing this strategy further. We are collaborating with colleague Professor Alan Irvine in St James's hospital to develop this further in patients, and have also collaborated extensively with Dr Ed Lavelle in the Trinity Biomedical Sciences Institute in our ongoing work. In our wider research programme we have collaborated with scientists in Germany, Belgium, San Francisco, London and elsewhere.



04 Understanding Particle Physics with High-Performance Computing

Sinéad Ryan

High-energy particle physics is the study of matter's most fundamental constituents and the forces between them. Theory and experiment together are helping us to understand the evolution of the Universe from moments after the Big Bang. The Standard Model of particle physics is a theory that describes three of the four fundamental forces: electromagnetism, the weak, and strong nuclear forces in one coherent picture. Developed during the second half of the 20th century, its theoretical predictions have been verified to extraordinary precision by the collaborative effort of scientists at experiments such as the Tevatron at Fermilab in the US and more recently the Large Hadron Collider (LHC) at CERN in Europe where the Higgs boson was found in 2012.

This discovery completes the Standard Model and yet we know that further discovery awaits. The Standard Model does not describe gravity and many of the more complete theories also predict a plethora of new "supersymmetric" particles. Meanwhile, new and fleeting exotic states of matter have been discovered that remain a puzzle and require a deeper theoretical understanding of the strong interaction.

Quantum Chromodynamics and the confinement mechanism – My research is in quantum chromodynamics (QCD), the quantum theory of the strong nuclear interactions that bind the elementary constituents of matter: quarks (named

by physicist Murray Gell-Mann and taken from a passage in Finnegans Wake) and gluons inside protons and neutrons and that also hold the protons and neutrons inside the atomic nucleus.

QCD behaves very differently to the quantum theory of light and electromagnetism whose effects decrease with distance – e.g. when you pull attracting magnets apart the strength of the interaction decreases as the distance between them increases. But in QCD, as the distance between quarks increases the strength of interaction between them, carried by the gluons, does not decrease and, at the typical separations between quarks in a proton, the force stays strong enough to keep them permanently bound inside the proton. A complete understanding of this confinement mechanism is still an outstanding problem in particle physics. Under these conditions, the traditional calculation tool – called perturbation theory – no longer works and a new approach is needed for QCD.

Lattice QCD is a non-perturbative formulation of the theory on a four-dimensional space-time grid (a lattice), that enables calculations of observable particles by numerical simulation, allowing us to make predictions and probe the nature of newly-discovered particles. QCD is a "grand challenge" meaning that large-scale high-performance supercomputing resources are needed to make realistic numerical predictions. The Lattice QCD research group in the School

of Mathematics has access to some of the world's fastest supercomputers through collaboration with researchers in the US and Europe.

Numerical predictions of new exotic particles – While quarks are not observed free in nature their properties are inferred from theory and experiment. They are the elementary building blocks of matter – first proposed in the 1960s by theoretical physicists Gell-Mann and Zweig to bring order to and explain the zoo of new particles that had been discovered at experiments.

We now know that there are six different so-called flavours of quarks: *up*, *down*, *strange*, *charm*, *bottom* and *top* that combine to form composite states, e.g. a proton is formed from two up quarks and a down quark. My research is focused on the properties of the heavy *charm* and *bottom* quarks. In particular, it is the charm spectrum – states made from charm quarks and/or antiquarks – that has yielded recent unexpected and unexplained new particles at experiments in Japan, the US, Europe and China.

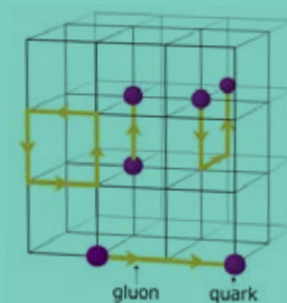


Fig 1

Sinéad Ryan received her BSc (Hons) and MSc from UCC and a PhD in theoretical particle physics from the University of Edinburgh. She joined Trinity in 1999 from the Fermi National Accelerator Laboratory in the US, became a Fellow in 2003 and was Head of School of Mathematics. She has published highly-cited papers in lattice quantum chromodynamics and leads successful international research collaborations. She has served on international institutional review committees and conference advisory boards and is a member of the Theory Advisory Group for the PANDA experiment in Germany.

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Fig 1. Representation of a 3-dimensional spatial lattice with quarks on the sites and gluons on the links of the lattice. The fourth dimension in the discretisation scheme is time.

Fig 2. The calculated spectrum of charmonium states including predictions for exotic as yet undiscovered states.

At Trinity and together with collaborators in the US and UK, we have developed new theoretical methods using the lattice QCD framework to make state-of-the-art spectrum calculations, aiming to understand these mysterious new forms of matter. The calculated spectrum of charmonium states is shown in Figure 2, and includes predictions for exotic as yet undiscovered states. By understanding this physics we probe the features of QCD,

including confinement and along the way we are developing new algorithmic and theoretical understanding of non-perturbative quantum field theories that will be applicable elsewhere. This work was awarded computing time at some of the US's most advanced supercomputing facilities and the results are guiding and informing new experimental searches around the world.

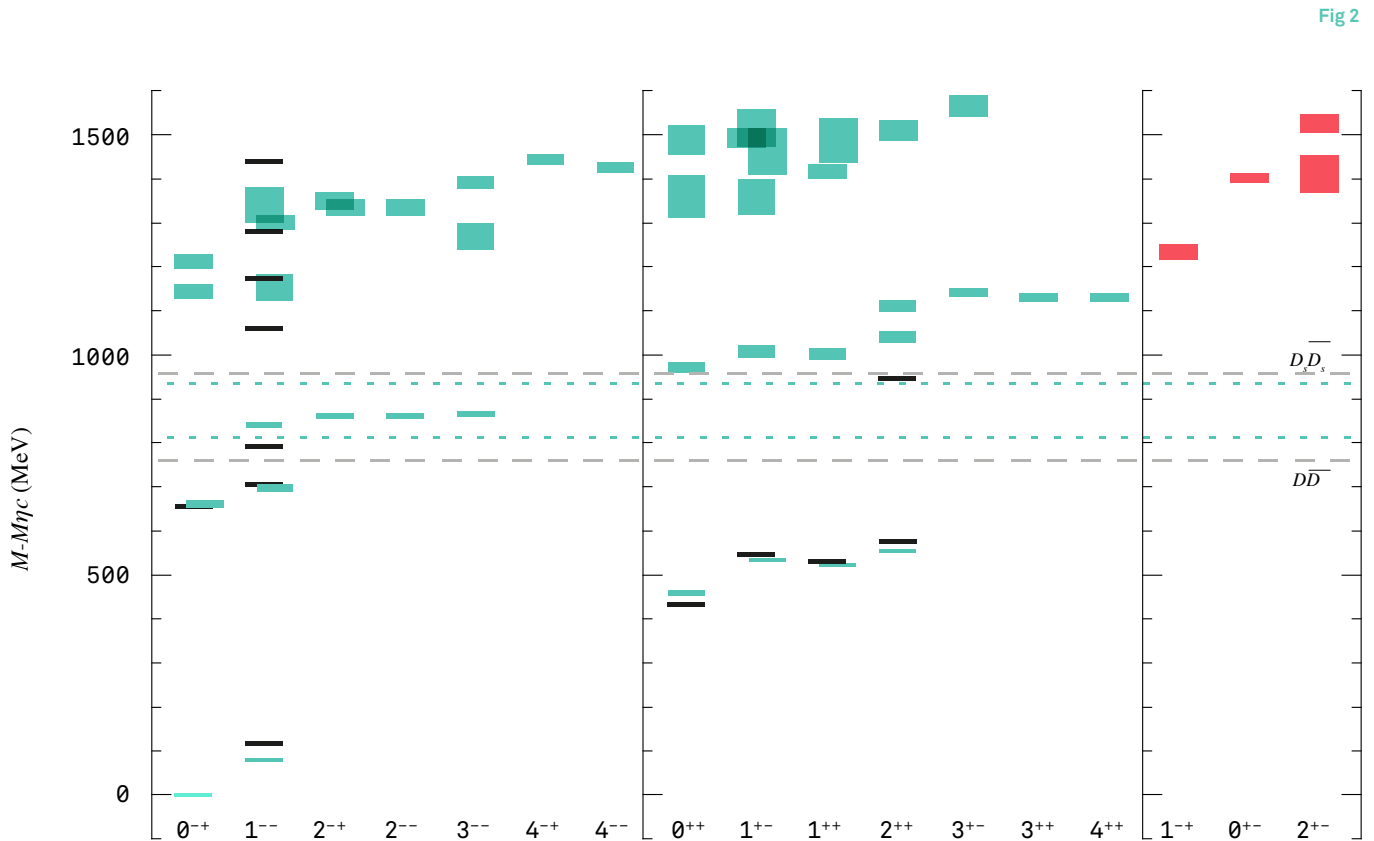


Fig 2

04 Fussy Eaters Help Explain Showy Insects

Nicola Marples

Like some of our children, birds and fish may turn out to be fussy eaters, sticking to the tried and tested diet they know, and very resistant to eating anything new. I discovered this behaviour in birds, called Dietary Conservatism (DC) during my PhD in Cardiff University and have been exploring its implications ever since. One intriguing aspect is that it's not universal, just as not all our kids are fussy about food. Birds and fish (we've not yet tested any mammals) divide into about a third of the population which are fussy, that is they show DC, while the other individuals in the same population are "adventurous consumers" (AC). These AC individuals will show a brief fear of new things, but get over it quickly and start eating the new food in a matter of minutes. In contrast DC individuals avoid the new food for months, or in one of our studies, for over two years – a lifetime for a small bird!

How does this relate to brightly coloured insects? – A long-standing paradox in evolutionary biology has been the evolution of brightly coloured insects, which draw attention to themselves and therefore should be quickly eaten by predators and die out. They don't die out because they are usually poisonous, so their bright colours are a signal to the predators that they are not a good meal. This signal plus defensive toxin is called aposematism. However the signal only works when there are enough signalling insects around that the predators have a chance to learn the meaning of the signal. How could such a system evolve,

since the very first aposematic animal to evolve would have been on its own? The predators would not know the signal, would eat the conspicuous new prey (and get poisoned), and drive aposematism extinct before it ever got going.

There are a number of answers to this evolutionary paradox, and DC is likely to be one of them. In collaboration with colleagues in Cardiff University, we have shown experimentally that DC individuals in both birds and fish avoid the new brightly coloured prey type for long enough for it to breed and spread through the population, even if the new prey is not poisonous. So if our new aposematic individual evolved in a DC predator's territory, it would have evolutionary time to evolve a toxin and to become numerous enough that aposematism could begin to work as an effective defence.

From singletons to crowds – That is all very well for a single predator, but many animals forage in groups: fish shoals or bird flocks. We would expect that most groups of predators would have at least one AC individual amongst their number, as usually two thirds of the population is AC. So the AC individual should kill off the newly evolving aposematic prey. Initial results from our latest research suggest this doesn't happen. It seems that the AC individuals see the DC ones avoiding the new food type and copy them, deciding not to risk eating it. We have an experiment running now to see how many DC fish must be present in a shoal to convince

the AC fish to avoid novel food. If ACs will listen to the minority view then even mixed foraging groups may be fussy enough to allow aposematism to evolve.

Why is this useful? – This fundamental research allows us to understand evolution and the natural world better, which is of wide interest and enhances our enjoyment of life. However it also has applications which might not be immediately obvious. Understanding how to reduce DC so that a change in farm animals' diets does not reduce their productivity is useful to the farming industry, while enhancing DC in flocks of pest birds can be exploited to protect sown grain. Our pilot studies have shown that this works on a small scale, so we are now looking for funding from Teagasc or the Department of Agriculture, Food and the Marine to test this at the farm level.

Conservationists need to know about these findings too. Reintroduction of groups of animals to their natural habitats will need to include the right balance of AC and DC foragers in order to restore the natural interactions with their prey. In addition, DC and AC individuals may need different post-release support in order to deal with the new foods they encounter in the wild.

It is even possible that understanding bird and fish foraging strategies can help us understand and even combat fussy eating in our own species, which may be good for the food industry and for our diets too!

Nicola Marples received her BA (Hons) in Zoology from the University of Oxford and PhD from Cardiff University. She carried out postdoctoral research in Leiden University and Sussex University before joining Trinity in 1996 and is now associate professor and Fellow. Winner of a Provost's Teaching Award and the National Teaching Hero award, she has an H-index of 18, and has 64 publications cited 1385 times (Google Scholar). Her research centres on understanding evolutionary change through behavioural ecology using Fundamental, Conservation and Applied approaches.

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→ A long-standing paradox in evolutionary biology has been the evolution of brightly coloured insects, which draw attention to themselves and therefore should be quickly eaten by predators and die out.



04 Active and Engaged Learning – Researching Arts Based Approaches to Education

Carmel O’Sullivan

A fundamental obligation of any society is to prepare its young people to lead productive and fulfilling lives as adults. Education is typically the clarion call to action to address the many challenges which impede this responsibility. Education is acknowledged as a key lever of inequalities, and has long been recognised as the foundation of progressive and knowledge based economies and societies. It is increasingly called upon to address poverty, disadvantage and issues of inclusion in society – gender, disability, race and ethnicity. My work in the Arts Education Research Group (AERG) within the School of Education examines arts based, active learning approaches to address social challenges.

Social Drama and Autism Spectrum Disorder (ASD) – I lead a large funded research group within AERG in developing a novel social and communication skills intervention for children and young adults with ASD. Supported by the NGO, Aspire Ireland, this longitudinal study is pioneering a unique form of social skills education in addressing the core deficits associated with autism. Working with many of the same participants for more than 10 years, the arts based pedagogies underpinning *Social Drama* – a unique set of strategies to learning where participants explore and experience social situations using drama, music, movement

and visual art – are leading to a breakthrough in further understanding the autism spectrum. We have identified 12 distinct subtypes on the spectrum. This advance will facilitate tailor-made social and educational interventions for specific subtypes, resulting in better outcomes for participants. Training has been provided to educational and health professionals in Ireland and internationally, most recently in Hong Kong. This is the only longitudinal study of its kind in the world and the first cohort of results are in press.

Career LEAP (Local Employment Action Partnership) – Working with East Wall Youth, Swan Youth, Business in the Community (BITC), and over 15 prominent businesses, the *Career LEAP* programme is an innovative study between community, business and research partners, funded by the City of Dublin Education and Training Board (CDET B). My research team in the School of Education is investigating the area of ‘Work Readiness’ among young unemployed adults (18–24) in the north inner city of Dublin, many of whom have significant and multiple barriers to employment, such as coming from low-income families, substance abuse, mental ill health, convictions, early parenthood, a lack of basic skills, and low levels of motivation and confidence. *Career LEAP* directs cutting edge educational and occupational psychology on how career

identity is formed, and how people can be effective in the workplace, into creative training techniques, designed to facilitate the transfer of skills learned during the training to everyday life and the workplace.

The programme prioritises active and engaged teaching and learning methods, using role-play, vignettes, walking debates, problem-based learning and cooperative learning which are proving highly successful with participants (most of whom were failed by mainstream educational approaches and left school early) and by the business partners participating in the training with the research team. The advanced 10 module programme we have developed will be made freely available online to community and business partners worldwide once the research is completed in late 2016.



Carmel O’Sullivan received her BEd from Mary Immaculate College, Limerick and her MA and PhD from Birmingham City University. She joined Trinity in 1998, having worked at Newman College’s Faculty of Education, University of Birmingham. She served as the Coordinator of Trinity’s four Associated Colleges of Education from 2000–05, as Warden of Trinity Hall from 1999–2005, and is now Head of the School of Education. Published widely, her research interests are in drama and arts education, autism studies, early childhood education and creative teaching and learning.

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LEFT – *Practical Guide to Planning Drama in Education*, authored by Carmel O’Sullivan and published in Chinese.

RIGHT BOTTOM – Business partners working with participants.

RIGHT TOP – Minister Damien English attending a workshop.



Creative Teaching and Learning in Early Childhood Education in China – Advances in the field of neuroscience and early childhood development confirm the importance of the first few years of a child’s life in terms of their all-round development. Following a period of significant educational reform in China, which recognises the early childhood sector as central to social and economic success, and building on educational drama workshops I had provided to teachers and educators in China, I was invited by China Renmin University Press (the People’s Press), the largest educational publishing press in China, to write three books to introduce educational

professionals to drama as a cross curricular teaching and learning tool in early years education. These books, published in 2016, will introduce a new generation of kindergarten and primary school teachers, parents and educators to an active and creative way of teaching and learning all subjects on the curriculum in China, with play, drama, music, dance, visual art and craft as the active learning pedagogies. The books will form the basis of a collaborative programme in Continuing Professional Development for teachers and educators, offered by Trinity’s School of Education, and rolled out from October 2016 onwards, initially in Beijing and Shanghai.



→ Education is increasingly called upon to address poverty, disadvantage and issues of inclusion in society – gender, disability, race and ethnicity. My work in the Arts Education Research Group examines arts based, active learning approaches to address social challenges.

Innovation and Enterprise

Trinity and UCD have collaborated to help launch a new €60 million fund to invest in early stage companies emerging from third-level research. The fund, which will provide capital and expertise for scaling campus companies, was announced in June by Atlantic Bridge, one of Europe's top performing growth technology funds. The fund is aimed at early stage companies built from world class research in all Irish third-level institutions, and focusing on software, hardware, engineering, physical sciences, life sciences and agri-food.

This fund brings together significant institutional investment from the European Investment Fund and Enterprise Ireland, as well as AIB and Bank of Ireland. Trinity and UCD have also invested in the fund, which will enhance their already significant success in creating spin-outs and will benefit the whole Irish third level sector.

Over the past 10 years Trinity has produced more entrepreneurs than any other university in Europe. For the second year running, the *Universities Report*, published in September 2016 by private equity and venture capital-focused research firm, Pitchbook, revealed that Trinity is first in Europe for producing undergraduate alumni who go on to create companies that secure first-round venture capital funding. In the

past decade Trinity has produced 192 such entrepreneurs and 180 companies, raising capital of approximately US \$2,166 million – making Trinity the only European university to be ranked in the *Report's* Top 50.

Recent success stories contributing to PitchBook's figures include computer science graduates Eoghan McCabe, CEO of Intercom, David O'Flanagan, CEO of Boxever, Steve Collins, CTO of Swrve, and economics graduate Alister Musgrave, managing director of MoneyHero.com.hk – their companies collectively raised over \$140 million within the last year.

Also contributing are serial entrepreneurs Dylan Collins and Sean Blanchfield, who formed their first company, Phorest, while students on Trinity campus. They have since gone on to form Demonware, Jolt, SuperAwesome, and PageFair.

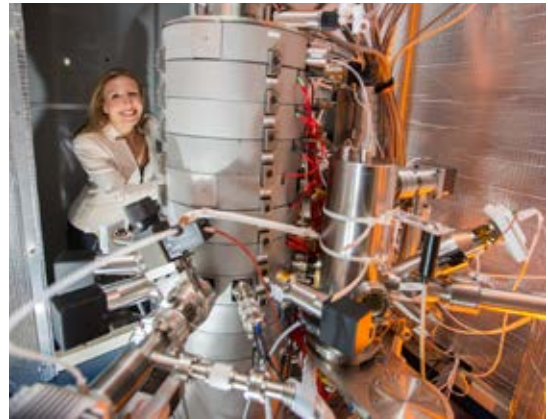
The pipeline for next year's PitchBook report is already strong as Trinity graduate and Professor of Biochemistry, Luke O'Neill, announced in September a major investment in a new Trinity campus company he co-founded. Inflazome Ltd, founded to develop molecules and associated intellectual property discovered at Trinity and at The University of Queensland, and licensed from UniQuest, closed a Series A financing round of €15 million. It will develop treatments for chronic inflammatory diseases.

RIGHT – Jamie Holohan, Colin Burke and Sean Connor of Trinity LaunchBox team Surfbuoy.

→ Trinity is now the first university in Ireland to launch its own digital student card.



05



Genable Technologies, an Irish bio-pharma company developed at Trinity in 2003, which specialises in developing gene medicines to target genetic diseases, was sold to US gene therapy leader, *Spark Therapeutics* in March. *Genable Technologies* has collaborated with Spark since 2014 in the development of a therapeutic programme that targets one of the most prevalent forms of inherited retinal disease (IRD).

Staff Innovation

Trinity was the only institution to win two Knowledge Transfer Ireland Impact Awards 2016 for top performance in industry engagement and commercialisation of research. Professor of Chemical Physics, Jonathan Coleman, who licensed research with Thomas Swan and Samsung won the *License to Market* category while the *Consultancy Impact* award was secured by Professor Emeritus, Mike Jones, and Assistant Professor in Plant Sciences, Matthew Saunders, for supporting the company Monford AG, and for the product they developed post-consultancy with Trinity, called *Grassometer*.

Trinity scooped the Irish Software Award for *Outstanding Academic Achievement of the Year* in November 2015 with its Virtual Reality Audio Technology, THRIVE, led by Professor of Engineering Science, Frank Boland which was acquired by Google last year. At the same ceremony, campus company Silvercloud Health picked up the award for Emerging Company of the Year.

Trinity campus company CrewFactors won the US Simulation Industry MODSIM WORLD entrepreneur competition for their platform technology that assesses team communication skills of personnel working in safety-critical environments such as aviation, maritime and healthcare.

A digital health technology project enabling older people with multiple chronic diseases to self-manage their conditions and be cared for in their own homes was launched in June. Led by the Trinity Centre for Practice and Healthcare Innovation, 'ProACT' brings together an EU consortium of research institutions, SMEs, health service providers, EU networks and

multinational ICT companies IBM and Philips. When complete, the €4.87 million Horizon 2020 funded project will be the first cloud based, digital solution of its kind in Ireland and Europe.

ADAPT, the Centre for Digital Content Technology, was launched in January to focus on developing next generation digital content technologies more effectively for businesses and individuals. Supported by an SFI investment of €24 million and €26 million from 19 industry partners, ADAPT is led out of Trinity and combines the research expertise of Trinity, DCU, UCD and DIT. Two hundred highly skilled postgraduate students will be trained at ADAPT over the next six years – this will foster the development of spin-out companies and the creation of 300 high skill jobs.

Three SFI research centres led out of Trinity – ADAPT, AMBER, and CONNECT – secured €6 million in Horizon 2020 funding for a new postdoctoral programme, EDGE, which will employ 71 world-class ICT researchers. It's the single biggest award for Trinity under Horizon 2020. EDGE will support research in strategically important areas of ICT: advanced materials, telecommunications networks and digital content technology, and will strengthen Ireland's ability to create and attract high quality jobs.

AMBER, the materials science centre, launched Ireland's most powerful microscope, the NION UltraSTEM 200, an electron microscope that analyses single atoms and objects a million times smaller than a human hair, using scanning transmission electron microscopy. The €5.7 million SFI-funded microscope is one of the top 10 microscopes in the world. It will help scientists push boundaries in materials science, ICT, energy storage, pharmaceuticals, medical devices and diagnostics, leading to innovations that benefit society.

Trinity has won 50% of all Irish European Research Council (ERC) awards in Horizon 2020 and per capita Ireland is now ranked 2nd in Europe behind Israel for these awards. This is personified by the success of Professor Valeria Nicolosi in AMBER and the School of Chemistry's pioneering research focusing on creating a new type of extremely long lasting

FAR LEFT – Trinity Provost Dr Patrick Prendergast with Minister for Jobs, Enterprise and Innovation Mary Mitchell O'Connor TD and UCD President Prof Andrew Deeks at the University Bridge fund announcement.

LEFT – Prof Valeria Nicolosi, PI at AMBER and School of Chemistry with the NION UltraSTEM 200 microscope.

battery – that can come in any shape or size and be camouflaged within any type of material. She is Ireland's only five-time ERC awardee, and has secured over €12 million in funding for her research in the past five years at Trinity.

The Trinity Biomedical Sciences Institute (TBSI) marked its fifth anniversary this year. Its researchers have re-shaped the scientific and medical landscape by making influential discoveries including: a re-orientation of how we understand the immune system; a plethora of new medical devices; a new way of regenerating tissues and organs; and innovative ways of harnessing the neural engineering of the brain. TBSI's first five years have seen: €83 million in research funding awarded to principal investigators; seven spin-out companies formed; more than 120 people moving into privately funded jobs; and 34 patents applied for, and 12 granted.

Business magazine, *Silicon Republic*, ran an article in June celebrating "10 major Irish breakthroughs of the year so far". Of these ten, eight were Trinity breakthroughs. Trinity's research continues to have impact – raising capital and most importantly, is improving people's lives.

Student Innovation

Trinity is committed to providing an environment that enables innovation and entrepreneurship at all levels across the university. Fourteen new teams of budding entrepreneurs participated in Trinity's student start-up accelerator, *Launchbox* – benefitting from office space, funding, mentorship, access to alumni, partner and investor networks, and the ideal collaborative environment over a three month summer period.

Some of the business ventures in this year's LaunchBox programme include:

- *BetterExaminations*, enabling students and teachers to search and save past exam papers in a matter of seconds;
- *SmallFarms*, marketing crickets as a highly nutritious protein source to reduce the environmentally unworkable burden of livestock production;
- *Criserv*, a social enterprise linking refugees and aid recipients with NGOs assisting Syrian refugees as they transit through Europe;
- *Nu.*, an innovative ethical fashion community aiming to reinvent the way we shop so that our retail practices become more sustainable;
- *Fallsafe*, providing elderly people with a means to swiftly and reliably call for help after suffering falls;
- *Haysaver*, a smart-agriculture early-warning system to prevent spontaneous haybale combustion; and
- *Surfbuoy*, an innovative water safety device that is only buoyant when activated.

The fourth year of the highly successful programme, led and funded by Trinity, sees a new programme manager on board and sponsorship from the Bank of Ireland. Over 150 students have gone through the programme in the last four years, 40 jobs have been created by LaunchBox startups, and over €3.5 million of investment has been raised.

Past Launchbox successes include social enterprise *Foodcloud*, which helps businesses redistribute surplus food to those in need, and *Touchtech*, a payment processing venture. *Artomatix*, founded in 2014, allows artists to automate low-level creative tasks while concentrating on the higher-level art components of computer games. Founded by Trinity PhD student, Eric Risser, the company secured €1.5 million via a Horizon 2020 award in August.

The *Blackstone LaunchPad* campus entrepreneurship programme for students at Trinity was officially launched with a bespoke venue at the Berkeley Library in February. It follows the announcement last summer by An Taoiseach, Enda Kenny, of the Blackstone Charitable Foundation's €2 million grant for the entrepreneurship programme in collaboration with Trinity, NUIG and UCC.

Blackstone LaunchPad at Trinity fosters student entrepreneurs, connecting them with business and providing them with the skills and network necessary to succeed as entrepreneurs. LaunchPad has been very successful on campus: over 80 student startups have registered since it opened and over 15 student startups have progressed to early stage funding.

Trinity student entrepreneur Finn Murphy who, in partnership with Trinity IT Services, developed a Trinity student card for smartphones, the first of its kind in Ireland, has benefited from the guidance of the Blackstone LaunchPad team and the Launchbox programme. He has finalised a licensing agreement with the University to develop the venture and bring the unique service to other institutions and organisations across the country. The product was supported and developed by the University through IT Services and a team of students led by a Trinity computer scientist. From idea to product, Trinity is now the first university in Ireland to launch its own digital student card and, thanks to partnership with Irish Rail, issues the only digital ID to be accepted as proof of identity by a national body.

The *Innovation Academy*, jointly run by Trinity, UCD and Queen's University Belfast, continued to offer innovation and entrepreneurial training to postgraduates, encouraging them to consider the societal and economic impact of their research, and to convert their knowledge into products, services and policies.

Public Engagement

Centenary Commemorations

The 1916 Easter Rising was a pivotal moment in modern Irish history, transforming the political landscape and paving the way for Irish independence, while leaving a contentious legacy. Trinity was a key location during the Rising – the campus was turned into a hospital for the wounded, a temporary burial ground, and eventually a barracks with the stationing of 4,000 troops. The Centenary gave the University the opportunity to critically examine the legacy of the Rising and explore what happened within Trinity's walls a hundred years ago.

In the lead up to the centenary, Professor Roy Foster, Carroll Chair of Irish History, University of Oxford, delivered the Trinity Long Room Hub's annual Edmund Burke Lecture in October 2015 on the theme: '*An inheritance from our forefathers? Historians and the memory of the Irish revolution*'.

Several initiatives marked the centenary of Proclamation Day on 15th March, including a symposium '*The 1916 Proclamation in its National and International Context*'. Our students, accompanied by Trinity's Trad Society, participated in the nationwide reading of the Proclamation by all Irish educational institutions, while Trinity students studying outside Ireland were captured in a video reading the Proclamation.

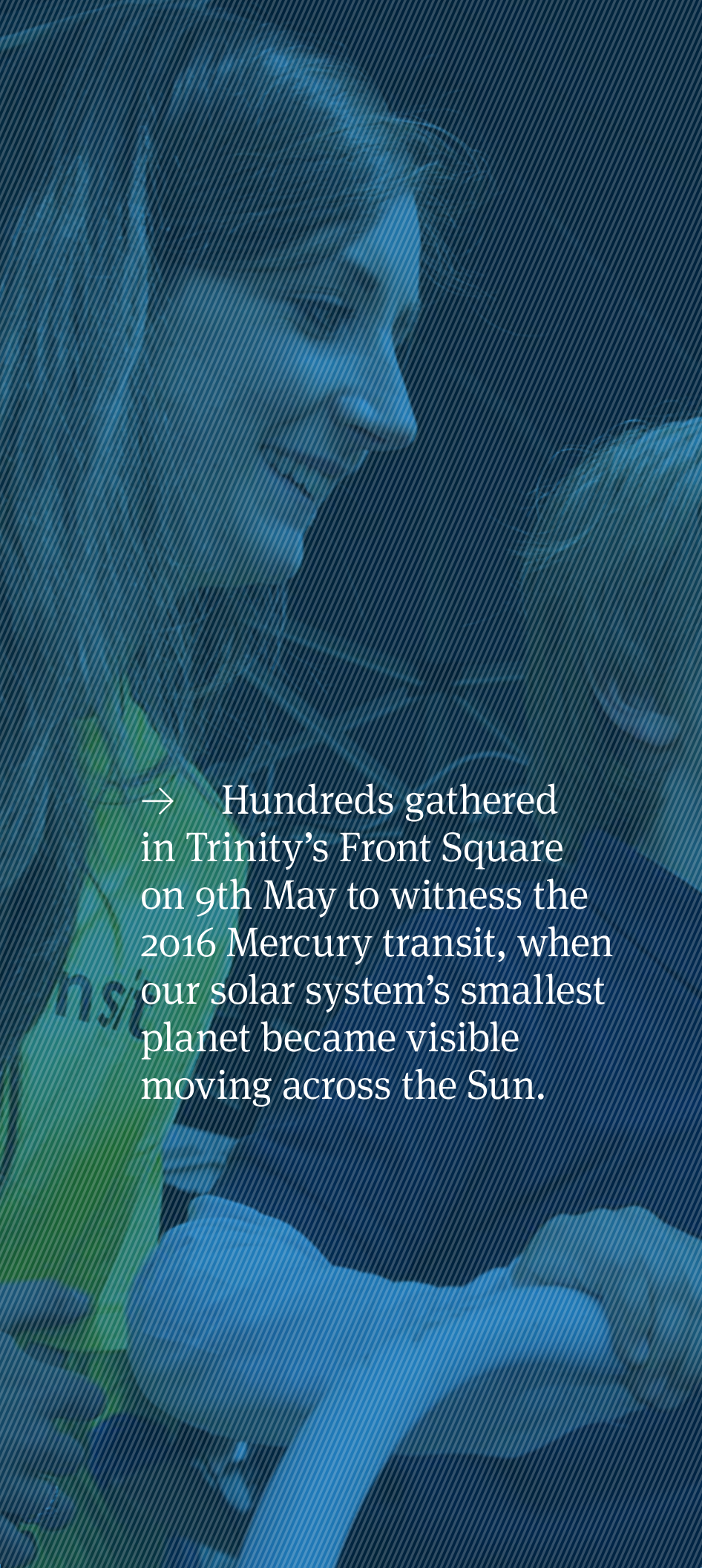
A collection of 17 translations of the Proclamation was launched at a reception hosted by the Provost and attended by the Lord Mayor, Críona Ní Dhálaigh and ambassadors to Ireland. Each ambassador received a copy of the Proclamation

in their own language: Arabic, Bulgarian, Chinese, Croatian, Dutch, French, German, Greek, Hebrew, Italian, Japanese, Korean, Latin, Polish, Russian, Spanish and Turkish.

Over 10,000 people visited the campus to participate in talks, debates, exhibitions, performances and vintage tennis matches during RTÉ's *Reflecting the Rising*, a free family event which took place throughout Dublin city centre on Monday 28th March.

Trinity was the first Irish university to host a major 1916 event outside Ireland, when it joined with the Institute of Irish Studies, at the University of Liverpool, to host a debate in London on 31st March featuring academics from Ireland, the UK and the USA.

Changed Utterly: recording and reflecting on the Rising 1916–2016, an exhibition in the Old Library examined the way the Rising was recorded at the time; how it was commemorated 50 years later; and how it is being discussed and reassessed in 2016. Key artefacts on display included: the Library's copy of the Proclamation, torn from the walls of the GPO, along with WWI recruitment poster pasted to the back; photographs of British troops in Trinity's Front Square; the scrapbook of Elsie Mahaffy, daughter of Trinity Provost John Pentland Mahaffy, and occupant of the Provost's House during the Rising; and the casing of a bullet which pierced the roof of the Library during Easter week.



→ Hundreds gathered in Trinity's Front Square on 9th May to witness the 2016 Mercury transit, when our solar system's smallest planet became visible moving across the Sun.



06



In addition, rare and previously unpublished material held in the Library is now accessible globally, thanks to an online collaboration between Trinity and Google. *Dublin Rising 1916–2016*, an interactive Google Street View tour, narrated by actor Colin Farrell, lets visitors virtually explore the streets, events and people who shaped history 100 years ago.

The public was invited to explore prior Irish rebellions and the historical context to the Rising through a free 14-week online lecture series, *Ireland in Rebellion, 1782–1916*, delivered by Professor Patrick Geoghegan and colleagues in the School of Histories and Humanities.

In other commemoration initiatives, Trinity Library marked the centenary of the Battle of the Somme with a new website, *'Fit as fiddles and hard as nails' – Irish soldiers' voices from the Great War*, a rich source of digitised diaries and letters from Irish officers who fought.

Professor Chris Morash, Trinity's Seamus Heaney Professor of Irish Writing, delivered a public lecture to mark the 150th anniversary of the birth of poet, W.B. Yeats in December 2015. The event also marked the launch of the "Regenerating Yeats" project, a student-led initiative calling on writers worldwide to submit new translations of Yeats's work to the *Trinity Journal of Literary Translation*.

The 750th anniversary of Dante's birth was celebrated by a 6-hour marathon reading by 36 readers, including the Papal Nuncio and Italian Ambassador, in nine different languages of the *Paradiso* from Dante's *Divine Comedy* in Trinity's Chapel.

Key Irish and British officials who negotiated the 1985 Anglo-Irish Agreement gathered to discuss the legacy of the historic treaty, which gives the government of Ireland an official consultative role in the affairs of Northern Ireland, at a public event in Trinity in November 2015 to mark the 30th anniversary.

Public Lectures and Forums

Trinity hosts a range of public lectures organised by its research institutes, centres, and schools. The Trinity Long Room Hub's new 'Behind the Headlines' discussion series offers background analyses to current issues. Topics in 2015/16 included: 'Undermining Democracy', 'Terrorism Today', 'Destination Europe: Reflections on the Refugee Crisis', and 'Brexit', with guest speaker, the British Ambassador to Ireland, HE Dominick Chilcott.

Trinity experts also contributed to the School of Social Sciences and Philosophy's public lecture, 'The Brexit Debate – EU Integration or Disintegration?' held in the run-up to the UK referendum. And for the second year running, the School hosted its Henry Grattan Lecture outside Ireland inviting the former Governor of the Central Bank, Professor Patrick Honohan to speak on 'Reflections on the Irish Economy – 1916–2016' at the Embassy of Ireland in London in May.

In other current affairs events, a 'Meet the Candidates' forum, held in Trinity in April, saw fifteen of the sixteen Seanad Eireann candidates in the Dublin University constituency addressing an audience of alumni, staff and students.

LEFT – Vintage tennis match at RTE's Reflecting the Rising event.

BELOW – British troops in Front Square, Easter 1916.

Marking the 10th anniversary of TILDA (The Irish Longitudinal Study on Ageing), Professor James Smith, Distinguished Chair in Labor Markets and Demographic Studies at US-based policy-research institute RAND Corporation, gave a talk in May on the education of Irish migrants to the US.

The ADAPT Centre for Digital Content Technology hosted two public lectures with ethical themes: in October 2015 leading ethicist, Dr Johnny Hartz Søraker of the University of Twente discussed how technology impacts happiness and well-being, while in January the controversial EU ruling on our 'Right to be Forgotten' online was debated by leading national and international speakers.

Well-being was also the subject of Professor Martin Seligman's lecture in February. The leading clinical and experimental psychologist, and University of Pennsylvania professor spoke on 'The Power of Positivity' to a packed lecture, hosted by the School of Psychology, the Psychological Society of Ireland and the HSE.

In a year of events entitled '*The Library of the Future; the Future of the Library*' the Library looked at how libraries are evolving in response to transformative shifts in information, education and society. Events included: a 'Library Futures' symposium with leading guests from the British Library, Stanford University Library, Bodley Library Cambridge, and Harvard University; a public discussion forum, *The Future of Monographs in a World of Open Access* to mark International Open Access Week; a seminar chaired by Karlin Lillington of the *Irish Times* on *Memory in a Digital Age: Collecting, Accessing and Forgetting*; and a talk by historian Robert Darnton on *Libraries, Books, and the Digital Future*.

Exhibitions and Events

Trinity opened its doors again to the public on Culture Night in September and Open House Dublin in October. As part of Dublin's New Year's Eve Festival, Trinity's front façade was lit up, and again for St Patrick's Day when it went green.

Science Gallery Dublin provides Trinity with world class space for innovative public exhibitions. It held four exhibitions in 2015/16: *Secret – nothing to hide here*; *Trauma – built to break*; *Field Test – radical adventures in future farming*; and *Seeing – what are you looking at?*

Death, violence and the monstrous in children's literature were explored in an exhibition at Dublin City Library and Archive to mark the end of a two year project by the National Collection of Children's Books. The Irish Research Council-funded project, a joint initiative between Trinity's School of English and the Church of Ireland College of Education, has developed a new online catalogue detailing over 250,000 children's books in over 90 languages from five libraries in Dublin.



Hundreds gathered in Trinity's Front Square on 9th May to witness the 2016 Mercury transit, when our solar system's smallest planet became visible moving across the Sun. The crowd availed of high-tech telescopes, and saw the rare event streamed to a plasma TV from NASA's Solar Dynamics Observatory.

The Faculty of Arts, Humanities and Social Sciences hosted 2016's Trinity Week with a public programme of lectures, symposia, and poetry readings around the theme 'Memory'.

2016 was the inaugural year of the Trinity Walton Club – a not-for-profit STEM Education programme subsidised by the University and supporters, including the Bank of Ireland. The Club invites secondary school students to attend STEM learning environments in Trinity labs on Saturdays. Seventy-one 'Walton Clubbers' showcased their STEM projects and prototype solutions to societal problems at an exhibition and graduation ceremony in May.

Beyond the Campus

National College Awareness Week which supports second level pupils to become 'College Ready' and is the brainchild of Kathleen O'Toole-Brennan of the Trinity Access Programme, was held again in November and saw hundreds of activities in schools and communities around the country.

Trinity's Students' Union held a two day activist festival in March in collaboration with the Philosophical Society (The Phil), Science Gallery Dublin and Graduate Students' Union. With the theme 'Turning Theory into Action', the aim was to bridge the gap between students and national activism.

An 8-week 'EngAGE with Science' intergenerational community learning outreach programme – run by AMBER (the SFI funded materials science centre in Trinity) and Trinity EngAGE (the Centre for Research in Ageing) in collaboration with St Andrew's Resource Centre – brought together primary school students, teachers, researchers and older people to debate developments in science.

The Student Experience

Students arrive at Trinity with enormous potential and the University takes pride in fostering a community where their potential is realised.

Our mission is for students to leave here transformed, not only by their academic achievements but by their personal development. We pledge to educate graduates who are able and willing to engage positively with society in all its facets. We expect our students to be ambitious for themselves and to seek out the opportunities which we provide for them to develop intellectually, socially, physically, and morally – so that they become active citizens within local, national and international communities. This vision is at the core of the Trinity Student Experience.

Trinity recognizes that the Trinity Student Experience is delivered not only in the academic environment but also in the student's co- and extra-curricular activities. Students are actively encouraged to embrace all the richness of our diverse community and the wide range of extra- and co-curricular activities on offer. Large numbers of students participate in one or more of the 48 sports clubs and 120 student societies, or give their time and talent to one of the numerous volunteering organisations. Students involved in at least one activity outside the classroom are happier, better-adjusted, enjoy college life more, perform better academically, and are better prepared for life after graduation.

The Dean of Students, Professor Kevin O'Kelly champions the student experience, integrating the out-of-class activities of students with the academic mission of the University to ensure that their years in Trinity provide students with unlimited opportunities for involvement, leadership, and personal exploration.



→ Students are actively encouraged to embrace all the richness of our diverse community and the wide range of extra- and co-curricular activities on offer.



07



Student Societies

Freshers Week showcased the diversity of activities open to Trinity students from the political to the cultural to plain fun and entertainment. AIESEC organized a 'Global Village' featuring Trinity's international societies.

As in previous years, societies distinguished themselves by the high calibre of their invited guests. The Philosophical Society (The Phil) hosted numerous international speakers including US Vice-President Joe Biden, Apple CEO Tim Cook, founder of Pixar and President of Walt Disney Animations Ed Catmull, and the first female director of CERN, Fabiola Gianotti. The Global Development Society and Trocaire hosted Raji Sourani, director of the Palestinian Centre for Human Rights Society; the European Law Students Association hosted Susan McMonagle of the UN Refugee Agency on a panel discussion on the Syrian refugee crisis; The Law Society invited Fatou Bensouda, chief prosecutor of the International Criminal Court; and teams from Trinity and Cambridge University debated the motion 'This House believes that a Brexit would be good for the EU' at a Student Economic Review debate co-hosted with the College History Society (The Hist).

Social awareness featured in many student activities. TCDSU hosted a two-day activist festival in collaboration with The Phil, The Science Gallery and the Graduate Students' Union. The theme was 'Turning Theory into Action' and the objective was to bring together students, activists,

academics, NGOs and the community sector with the aim of bridging the gap between students and national activism.

Many of the student activities were recognized nationally at the 2016 Student Achievement Awards Ireland: the SU Consent Campaign won Welfare Campaign of the Year; Edmund Heaphy, editor of the *University Times*, won Journalist of the Year and the *University Times* itself won publication of the Year; Lia McCann won Class Rep of the Year and Loen Kohl won Best International Student of the year.

Volunteering and Fund-raising

The Dean's Roll of Honour recognizes learning gained through various types of co-curricular volunteering. This year the Dean's Roll of Honour received over 200 applications and recognized 30 students for the Dean's Leadership Award and 65 for the Dean's List. The invited speaker was Colm O'Gorman, executive director of Amnesty International Ireland who spoke eloquently about the impact the act of volunteering had on his own development as well as the community.

Once again Raise and Give (RAG) week was a great success. Organised by the Students' Union and Trinity Volunteering, it supported 13 charities, including ten student-run charities as well as the Trinity Access Programme and the Student and Postgraduate Hardship funds. All these charities and programmes support people in Trinity, outside the college, and internationally.

LEFT – Tim Cook takes a ‘selfie’ with Trinity students.

BELOW LEFT – Teams from Trinity and Cambridge University debate the motion *This House Believes that a Brexit would be good for the EU*.

BELOW RIGHT – Colm O’Gorman, Amnesty International with Dean’s Leadership Award recipients, Hilary Lesson and Carla King-Molina.



→ This year the Dean’s Roll of Honour received over 200 applications and recognized 30 students for the Dean’s Leadership Award and 65 for the Dean’s List.

This year’s Med Day, an annual fundraising event run by Trinity’s medical students, raised an impressive €52,000, exceeding last year’s total of €46,000. This year’s funds were in aid of:

- St James’s Hospital’s ‘Target Lung Cancer’ initiative;
- The purchase of an ultrasound machine for the Rheumatology Department in Tallaght Hospital;
- The renovation of a family room in the Acute Medical Unit at Tallaght Hospital; and
- The purchase of a ‘Cough Assistance Machine’ for patients at the National Rehabilitation Hospital.

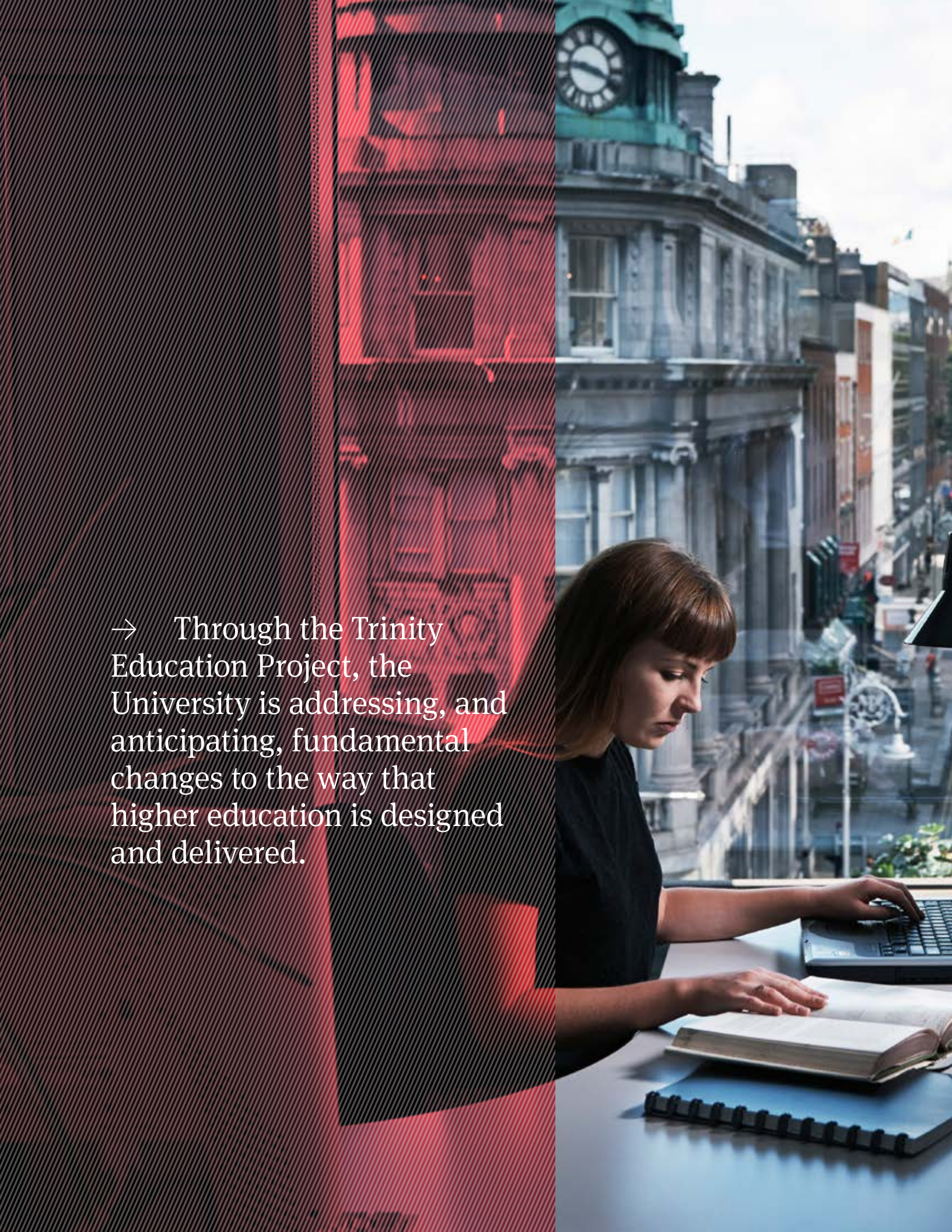
Some of the funds raised were contributed to the Trinity Access Programme. The event was sponsored by Lowlow Dairy, and launched by the Minister for Health, Leo Varadkar.

The Trinity Education Project

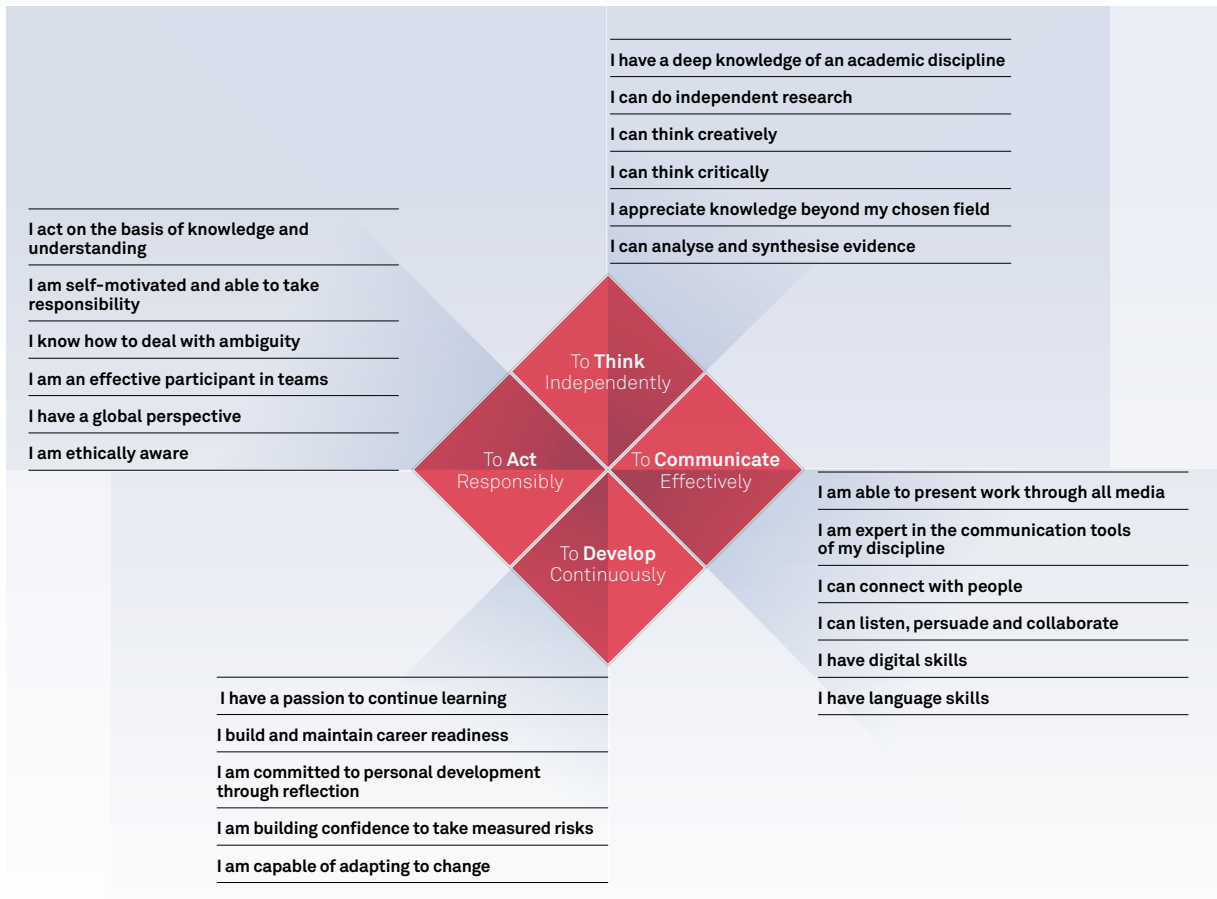
An ambitious university-wide project is underway to renew and refresh the undergraduate curriculum. The Trinity Education Project is one of the central initiatives of the University's Strategic Plan 2014–19.

Globally, this is a period of significant transformational change for higher education provision. New and merging disciplines, the technology revolution, globalisation, and changing employer needs are all contributing to a transformed higher education landscape. As examples: alongside traditional disciplines, new interdisciplinary approaches like bioengineering and neuroscience have emerged; technological advances have enabled online education and eLearning; globalisation has greatly facilitated international research collaborations and student exchange programmes; and the traditional model of a job and career for life is evolving into something more flexible and variable, which in turn is greatly impacting on employer needs and student expectations.

Trinity's current curriculum educates students to the highest of standards, but no curriculum is so good that it cannot improve, and in the light of new discoveries in disciplinary knowledge and pedagogy, and in response to the ever changing context in which our graduates compete, we recognise that our curriculum must evolve. It's against this backdrop and in this spirit that we have embarked on a project to rearticulate what a Trinity Education should be in the 21st century, and to re-emphasize our role as a leader in education.



→ Through the Trinity Education Project, the University is addressing, and anticipating, fundamental changes to the way that higher education is designed and delivered.



There is widespread support from staff and students for change at an institutional level and 2015/16 saw productive consultations with the College community. Led by the Vice-Provost and Chief Academic Officer, Professor Linda Hogan, the Trinity Education Project has benefitted from extensive evaluation of existing programmes and research into the best programmes internationally, and is now structured around seven strands (including technology-enhanced learning, internships and student mobility), which report to a steering committee chaired by the Provost.

In June 2016 an interim report from the Trinity Education Project was presented to the University Council, summarising key decisions. This report provides a good indication of the direction in which we are travelling and should be seen as a platform on which the next phase of the project, namely planning for implementation, will build.

The report agrees on a university-wide set of graduate attributes which will shape the kind of education we offer. These attributes are:

- to think independently;
- to communicate effectively;
- to develop continuously; and
- to act responsibly.

These attributes encapsulate the knowledge, skills, and qualities that students should develop during their time at university so as to be equipped to manage complex challenges in an ever-changing environment, to reinvent themselves through lifelong learning, and to contribute effectively to their professions and to broader society, locally and internationally. Students will achieve these attributes through academic and co- and extra-curricular activities, and throughout their time at Trinity, they will be provided with opportunities to develop and demonstrate their achievement of the attributes.



The interim report further outlines a set of curriculum principles that will underpin what and how we teach; a new programme design to deliver greater depth, breadth and flexibility in undergraduate programming; a new approach to the assessment and examination of students; and the retention of the ‘capstone’ or independent research project in the final years.

Staff and students will benefit from more diverse styles of assessment, greater flexibility in combining subjects and in changing pathways during the course of study, and greater support for students to strengthen their international experience and improve career readiness.

The proposals above were agreed by the University Council, including changes in the academic year structure to support the delivery of the Project. The academic year structure proposals will now go forward for discussion and decision.

The successful delivery of the Trinity Education Project will require a further two years of detailed work, which will be overseen by a number of working groups, with representation from across the College community.

Through the Trinity Education Project, the University is addressing, and anticipating, fundamental changes to the way that higher education is designed and delivered. We look forward to offering students entering college in 2018/19 a distinctive, innovative education, which continues in Trinity’s great tradition of excellence.

www.tcd.ie/academic-services/tep

Raising Our Game, a Review of Sport in 2015/16

This year saw the launch of a new Strategy for Sport, entitled 'Raising Our Game', and it was also the first year of the Bank of Ireland's sponsorship of Trinity Sport. This contributed to an exceptional year, with significant increases in participation in programmes and courses, and huge successes by Trinity athletes and clubs in national and international competitions.

Strategy for Sport 'Raising Our Game'

The new strategy aims to re-establish the University as a leading force in all aspects of third level sport, setting out a pathway to be one of the best university sporting experiences in Ireland. Its overarching vision is to place sport at the heart of the Trinity experience, which will be achieved through performance and participation.

The strategy, developed following a wide consultation process involving students, staff, alumni and community users, will further enhance the participation of students, and the wider college community, in all types of activity at the level of their choosing.

Programmes and Participation

Five-a-side soccer, dodgeball, tag rugby and badminton were among the tournaments in the new expanded intramural programme. The annual run series continued to grow with a record turnout for the Trinity Operation Transformation Run, 60 participants in the Annual Reindeer Run and a maximum capacity of 260 participants in the Campus 5k, led by Olympic medallist Sonia O'Sullivan. The development programmes delivered by Trinity Sport during the year included the Student Sport Volunteer Programme, Coach Education Programme and the Junior Sports Leadership Course.

RIGHT – Trinity Rugby v St Mary's, College Park.

→ The Strategy for Sport's overarching vision is to place sport at the heart of the Trinity experience, which will be achieved through performance and participation.



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Fitness classes and courses continue to be very popular with almost 23,000 people participating in 2015, an increase of 6% from the previous year. This will be further expanded with the introduction of new fitness classes, new yoga and Pilates courses, and staff-only classes, amongst other initiatives.

Over 2,100 children between 4 and 15 years, attended the children's camps which are run year round, during school holidays. In addition, the normal run of children and family programmes were extended, with courses in swimming, climbing and tennis.

Student Achievement

Trinity sports clubs had amazing successes representing the University at numerous national and international competitions. The men's 1st Rugby team capped off a memorable season by winning promotion to Division 1A, the top tier of Irish club rugby. This was after competing against universities from across the world at the start of the season in the inaugural World University Championships in which they were runners-up, and defeating local rivals UCD in the annual Colours match. The camogie club won the honours by winning the Fr Meachair Cup, with the Gaelic football freshers following suit by winning the Division 2 title.

The future of rowing looks bright with strong performances by our novice men and women in particular. The men's Novice 8 were unbeaten all season, winning the Colours race, Trinity Regatta and at the Irish Rowing Championships to name

just a few. The women's Novice 8 had a similarly strong year, claiming victory in several regattas and were crowned Novice 8 champions of Ireland at the Irish Rowing Championships in July. In addition, at the Cork Regatta in June four of our senior women were chosen to represent Ireland at the Home International Regatta in Wales in July. Both the Senior 8 and Senior 4 were coached to victory by DULBC's Andrew Coleman. All in all a great climax to the rowing year.

The squash team won the Leinster league Division 1; the men's hockey 1st's won Division 1B with the ladies hockey 1st's qualifying for the promotion playoffs to the newly formed IHA national league. All of these successes occurred outside of the normal third level competitions for students only.

The Snow Sports club successfully took on the organisation of the inaugural Leinster Universities & Colleges league in which Trinity, UCD, DCU, DIT and Maynooth competed. Other notable successes at intervarsity competitions were recorded by Trinity sports clubs including Tennis, Ultimate Frisbee, Snow Sports, Fencing, Sub Aqua, Squash, Trampoline, Rifle, Boxing and Volleyball.

Throughout the year several of our students competed internationally, representing the University and their country in a range of sports. These included Anna-May Whelan (hockey), Jenny Andreasson (sailing), Scott Flannigan (sailing), Ayman Ben Mohamad (soccer), Rachel Taylor (golf), Nicholas Armstrong (golf), James Bollard (rugby) and Lisa McKenna and Ciara Mahon (handball).

LEFT – The Sesquicentenary Regatta at Islandbridge in April.

BELOW – Hockey pitch in Santry Sports Grounds.

BOTTOM – Sports Person of the Year winner, Prakash Vijayanath is congratulated by Sonia O'Sullivan and Head of Sport, Michelle Tanner (right).

The third annual Sports Awards in April was an occasion to showcase the clubs' achievements as well as to appreciate the students' voluntary work undertaken on behalf of their clubs. The evening was hosted by RTÉ sports reporter Evanne Ní Chuilinn who conducted a live interview with special guest Sonia O'Sullivan. The following awards were presented on the night:

- Club Administrator of the Year: Roisin Greening (Trampoline Club)
- Club of the Year: Sub Aqua Club
- Coach of the Year: Nicholas Dunlop (Boat Club)
- Team of the Year: DUBC Senior 8 (Boat Club)
- Sports Person of the Year: Prakash Vijayanath (Badminton Club)
- Contribution to College Sport: Tony Smeeth (Rugby Club)

In addition 21 'Pinks' were presented on the night. Pinks are awarded to college athletes who compete for a university club at both inter-collegiate competitions and international levels.

Sports Scholarships

Sixty scholarships were awarded across 13 sports at the 2015/16 awards ceremony. Supported by the Bank of Ireland, the recipients included:

- Commonwealth Games athletes Victoria Mullin (air pistol) and Prakash Vijayanath (badminton);
- 4th year pharmacy student and recently capped Irish senior hockey player Anna May Whelan;
- 3rd year BESS student Ayman Ben Mohamad who has recently been called up to the Tunisian International soccer team;
- Senior inter-county Gaelic footballers Tiarnán Daly (Fermanagh) and Michael O'Grady (Kildare);
- U21 All Ireland hurling winner and 1st year, Eoghan McNamara;
- Three of the crew who won Trinity's first Senior IV National title in twelve years, Sally O'Brien, Aoife Leahy and Gillian Crowe; and
- Two students from the Centre for Inclusion and Intellectual Disability, Maeve Phillips, European and World Down Syndrome swimming medallist and Fiachra Costello, minor Gaelic football champion.

There were also 30 rugby scholarships awarded on the night, which paid dividends when the 1st team secured promotion to Division 1A and won the annual Colours match against a strong UCD side.



Sport Facilities

Trinity Sports Centre was awarded 'Leisure Centre of the Year' at the annual White Flag Awards and achieved Gold for the White Flag National Quality Standard which grades facilities and operational standards.

Phase 1B at Santry Sports Grounds was completed, comprising three 5-a-side 3G synthetic playing pitches, a natural sand-based flood-lit GAA pitch, upgrades to the entrance of the grounds and a complete revamp of parking facilities.

College Park was upgraded with the installation of flood lights over the rugby pitch enabling Trinity to host the annual rugby Colours in March for the first time in the history of the event.

Trinity Sport expanded its reach to students during 2015/16 with the installation of new gym equipment in Trinity Hall, allowing student residents to exercise on site.

www.tcd.ie/Sport

New Professor Interviews

01 Caitríona Lally

02 Brendan Kelly

03 Michael Morris

04 Luiz DaSilva

05 Ursula Fearon

06 Mary Cosgrove



10

Professor Caitríona Lally
Professor in Bioengineering

→ At school in Galway, Caitríona Lally was torn between her love for biology, maths and physics: “I thought medicine would take too long to qualify in so I decided to study mechanical engineering (in the University of Limerick), which I enjoyed but I really missed biology – I felt there was something missing in what I was applying my knowledge to.”

For her third year work placement, she went to work in Stryker, currently one of the largest orthopaedic implant companies worldwide: “There, I realised that I could use my mechanical engineering and apply it to medicine and biology in order to advance and improve healthcare, and that was it – I was sold.”

Had Biomedical Engineering been available to undergraduates in the 1990s, as it is now, she would have opted for that. As it is, she was fortunate in being at the vanguard of bioengineering in Ireland, embarking on her PhD at a stage when the “biomedical device industry and universities were starting to collaborate” and launching a career which has now seen her appointed to Trinity as Professor in Bioengineering in the Department of Mechanical and Manufacturing Engineering, eleven years after finishing her PhD here.

She comes to Trinity from her previous position in DCU, with a European Research Council (ERC) grant, one of the most prestigious grants in academia: “I’m looking into using magnetic resonance imaging techniques to examine arteries – it’s a non-invasive way to look at the artery and the underlying collagen structure in order to get an early diagnosis of tissue degeneration.”

The magnetic resonance imaging technique she uses, called diffusion tensor imaging, was initially developed for tracking neurons in the brain. Her research group, along with Dr Christian Kerskens in the Trinity College Institute of

Neuroscience (TCIN), was the first to apply it to arteries and only one other group (in Holland) have done this worldwide.

Like all ERC projects, hers is ambitious and risky – “the ERC funds frontier and pioneering research and there’s always an element of risk in that” – but if successful, the gain is significant: “we’ll have an early-stage diagnostic tool that is non-invasive for detecting atherosclerosis and heart disease, and potentially, down the line, for aneurysms. And with this early analysis, we’ll be able to say what intervention is needed, and when. In addition, using this information in computational models, we can design patient specific devices to treat the diseased artery”.

The grant, which started in September 2015, has four years to run, and is continuing on research which Caitríona started in DCU. She is excited about results so far but says the “real challenge is getting the information from arteries in the body, rather than in the lab.” To achieve this she is working with the Centre for Advanced Imaging in St James’s Hospital, one of Trinity’s teaching hospitals.

She firmly believes that Trinity is the best possible place for her research: “Trinity opened a Centre for Bioengineering just over a decade ago and is a leader in the field. And Trinity is highly interdisciplinary which is key for my research – we work with TCIN and St James’s Hospital on the imaging but we are also developing a tissue engineered blood vessel in the Trinity Biomedical Sciences Institute.”



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As a PhD student in the early 2000s, she was part of a dynamic group under Patrick Prendergast, then Professor of Bioengineering, now Provost of Trinity. “My PhD, on arterial mechanics and stenting, was linked with Medtronic in Galway; it was an exciting time and Patrick [Prendergast] was inspirational to work with.” Today she is back working with colleagues from that period.

“What I really value in Trinity is the collegiality. People want to help you – for instance Professor Daniel Kelly, an ERC grant recipient himself, really helped me get my ERC grant. That kind of support is amazing – to be in an environment where everyone wants the best for you and your research. In my first three weeks here, I mentioned to someone that I wanted to explore the possibility of using a particular fluorescent probe which binds to collagen that I had identified from literature, and a colleague said, ‘Oh, Paula Murphy in Zoology has that probe and I’m sure she’ll be happy to work with you to use it for arterial tissue’, which she did. That was a great introduction to how it is here.”

Ireland is recognised as a world-class centre of excellence for medical devices. Consequently, as an academic discipline, Bioengineering has a strong record of industrial collaboration and so she has always thought commercially about her research. She expects that her ERC research will be developed into software that allows doctors to compare their patients’ arterial fibre patterns to those of known fibre patterns at risk. “In time we’ll talk to companies like Phillips or Siemens to see if they want to co-develop this imaging technique or incorporate it into their existing software suites.”

One of her PhD students is doing work on heart valves, funded by Boston Scientific in Galway, and she herself is currently working on a commercial project, supported by Enterprise Ireland, to develop a novel angioplastic balloon [an endovascular procedure to widen narrowed or obstructed arteries]: “I identified a clinical need for a balloon that wouldn’t just go to one diameter and one shape – if it goes to multiple diameters and multiple shapes and doesn’t have to be retracted, you could potentially carry out a number of procedures at the same time. So the balloon I’m developing can take up an hourglass shape and a cylindrical shape. It is aimed at use in valvuloplasty, the *in situ* expansion of a diseased heart valve”.

She has a manufacturing partner in Wexford, and the product will either be developed as a spin-out or as a co-development with an existing market leader.

The European Research Council requires that more than 50 percent of time be given to the ERC grant; Cairtriona has committed 70 percent which doesn’t leave much time for teaching, but she supervises undergraduate and taught postgraduate projects and also delivers a third year module on medical device design, which involves “a lot of hands-on work – everything from 3D printing to testing prototypes. It’s the kind of module students really enjoy because they get to see their ideas take shape, literally.”

She is the mother of four young children, aged between three and eight, so when not at work, she’s with them: “We like to be outdoors a lot – north Dublin has great parks.” Inevitably, motherhood has changed her working life: “Before I had children I could stay on and keep writing and keep thinking, but now I need to be home at a certain time. But when the kids are in bed you can start thinking about that next big idea again!”

With her children getting older, she can now think about taking a sabbatical, which is one of her priorities for the next four or five years: “I’d like to do a placement, ideally in the States in a good lab, possibly in UCLA or somewhere else where I have strong links. It would be great for me in terms of my research, and exciting for the family to spend a few months abroad.”

Her other priorities are, of course, to deliver on the ERC grant – “I want to be able to demonstrate that we have a diagnostic tool that is non-invasive. That would hopefully lead onto further funding to detect, for instance, the onset of aneurysms.”

And in terms of the University, she would like, eventually, to take on a leadership role: “It’s difficult currently with the time demanded by the ERC grant, but I’d like to take on a role like Director of the Biomedical Engineering Programme, or indeed put myself forward as Director of the Trinity Centre for Bioengineering. I love doing my research but I can see the huge value and importance of being involved in the strategic direction of research, helping to take the University to the next level.”

Professor Brendan Kelly

Professor of Psychiatry (2005)

→ “Right now, I’m looking at human rights and social justice in connection with mental health. Traditionally in psychiatry, focus on social justice has been on not depriving people of their right to liberty. But Ireland’s mental health legislation is now in line with international practice and our rates of deprivation of liberty are well below the EU norm, so the discussion needs to move on to look at social and economic rights, and particularly social exclusion and economic deprivation. People with mental health issues are more likely to be homeless or unemployed, less likely to marry, and more likely to end up in prison.”

Brendan Kelly, newly appointed Professor of Psychiatry, is talking about his research, which links, he explains, with his current clinical work in Tallaght hospital and previously in the Mater Hospital: “Tallaght, and more so the Mater, are in deprived areas, and the more deprived an area is, the more mental health issues it has, and the more likely patients are to be hospitalised. Economic deprivation can also affect people’s ability to articulate what they want from mental health services.”

This research incorporates psychiatry, public and population health, economics, social policy and law – multiple disciplines crossing faculties and schools. This doesn’t faze Brendan, who explains that his path “to this point has been very varied and more interdisciplinary than would be common.”

This turns out to be understatement: as well as a doctorate in psychiatry, he has three Masters – in epidemiology, health care management and Buddhist studies – and three more doctorates in governance, history, and law. Four PhDs and three Masters in diverse fields is exceptional and has contributed to a publishing record of 200 peer-reviewed articles and 400 non-peer reviewed. How did he manage this while having a clinical practice and teaching?

“All my research interests are very linked,” he explains, “My masters in Buddhist studies focused on meditation and I was also interested in the Tibetan tradition of self-immolation for political purposes and how it correlates with suicide in western psychiatry. Then for my doctorate in governance, I looked at how you manage and monitor something as large as the health service, and how you can make governance systems work better for patients. My doctorate in law looked at mental health law and human rights in the UK and Ireland, and the PhD in history was on the history of psychiatry in Ireland. So all these things are very relevant, to each other and to my practice and research as a psychiatrist.”

And at their core, all these disciplines are about human behaviour. At school, Brendan knew he wanted to be a psychiatrist or an economist – “My precision puzzled the guidance counsellor – he wanted to know why I wasn’t choosing more broadly between medicine and science. I can’t say really except that what I’m interested in is human behaviour, and I count economics in that. The idea that economics could ever be regarded as an exact science amazes me. It’s hilarious anyone would think our financial behaviour is governed by logic or reason.”

10

So he studied medicine in University College Galway, always intending to be a psychiatrist. After graduating in 1996, he worked as an intern in Galway for a year, and then embarked on four years' training in psychiatry in Dublin – moving between a number of hospitals including St James's, St Patrick's, Tallaght, St John of God's, and the Stewart's Hospital for intellectual disabilities. After working in Dundrum Central Mental Hospital and in Navan, he qualified to become a consultant psychiatrist and joined the faculty in UCD in 2006 with a clinical practice in the Mater Hospital.

His appointment to Trinity and Tallaght comes with more research time: "Trinity has an internationally recognised department of psychiatry, the largest in the country, with a strong emphasis on genetic research and brain imaging research. I'm part of the biological research programme."

He's delighted with Trinity's interdisciplinarity, which resonates strongly with his own research. "In the law school, [Professor] Mark Bell is doing significant work on mental health law and employment. And on the Tallaght campus, Trinity is currently developing the Institute of Population Health, which has done research into physical health over the past few years and is now expanding into mental health."

He's strongly involved with Trinity's Medical Humanities Programme. "This explores links between medicine, art, and humanities. Through this programme medical students might engage with a work of art or literature, either through creation or appreciation. A Trinity study established that medical students are very interested in playing instruments, speaking languages, and engaging with literature. Encouraging them to pursue these interests helps broaden their understanding and their appreciation of human nature. It reminds them of the bigger world – with medicine you can become highly focussed on small details."

He practises what he teaches: his main interest, outside the university and hospital, is cinema-going – "anything in the IFI or Lighthouse, I go to speculatively".

Teaching, he says, has changed hugely over the ten or fifteen years: "The biggest change is the arrival of the smartphone. Complex questions that they might once have been expected to remember, junior doctors can now just look up. We've witnessed a shift from a system based on memory of facts to one based on knowing where to find information and how to critically evaluate it."

Students, he finds, "are sophisticated users of information and technology" – which means that the challenge, as a teacher, is "to emphasize the importance of the non-information base of medical practice – for instance interacting with patients and their families and giving due regard to their preferences. Not all medical decisions are 100 percent information driven, though we may feel they should be."

To get students thinking beyond information, he uses role play and brings them outside the lecture room to day care hospitals and domiciliary wards. "Some years ago, I had a patient who lived up a tree. I visited him there with my students. They need to know that they will need more than their smartphones, which are very important but also very seductive."

He also wants to get them thinking about how and why they make diagnoses and take decisions: "If, for example, a doctor has seen similar symptoms in other patients within the last few days, that will affect the diagnosis. We all use presumption and pattern recognition, which works most of the time, but not always – it helps to be aware of the extent to which our thinking and experiences affect our diagnoses."

He is "tremendously interested in education", and not only of medical students: "I think the work we're doing studying the cognitive patterns of decision-making in medical students will feed into other education programmes".

His other priorities for the next few years are "to renew and expand our mental health services programmes here in Tallaght and to work in partnership with the Institute of Population Health to complement Trinity's existing strengths in biological psychiatry."

And he looks forward to further developing Trinity's interdisciplinarity "through the medical humanities programme, and through making strong links to the Schools of Law, Histories and Humanities, Social Work and Social Policy and others".

Including quite possibly the School of Drama, Film and Music – he ends on an appropriately interdisciplinary note with insight into the depiction of psychiatry on film: "Psychiatry in cinema is often used as way of dispensing with unwanted characters – you send them off to the asylum. And often psychiatrists are portrayed unsympathetic, though that might be changing. The film of Sebastian Barry's *The Secret Scripture* features a conflicted but well-meaning psychiatrist, and in a recent Irish film this summer, *My Name is Emily*, Barry McGovern plays a psychiatrist who quotes Plato which I liked."



10 Professor Michael Morris

Professor of Surface and Interface Chemistry and Director of AMBER

→ “AMBER is unique as a model. Yes, there are other centres round the world which are industry-focused – we’re all doing research that leads to developing real products and processes – but the difference in AMBER, is that we’re trying to drive it from basic science. We want to develop a fundamental research base which allows us to answer really difficult questions, and to predict what’s coming up, and advise on what areas to focus on.”

Michael Morris, newly appointed Professor of Surface and Interface Chemistry in Trinity and new Director of AMBER, the Science Foundation Ireland funded material sciences centre, launched in 2013 and based at Trinity, is talking about what makes AMBER unique and how he would like to see the centre’s relationship with industry partners develop.

Ireland is ranked third in the world for materials science and AMBER has played a significant role in this positioning. The Centre – a collaboration between Trinity, University College Cork (UCC) and the Royal College of Surgeons in Ireland – works with industry partners to research into nano and bio materials, such as graphene and collagen scaffolds, to develop wide-ranging products from next generation computer chips to new medical devices and pharmaceuticals.

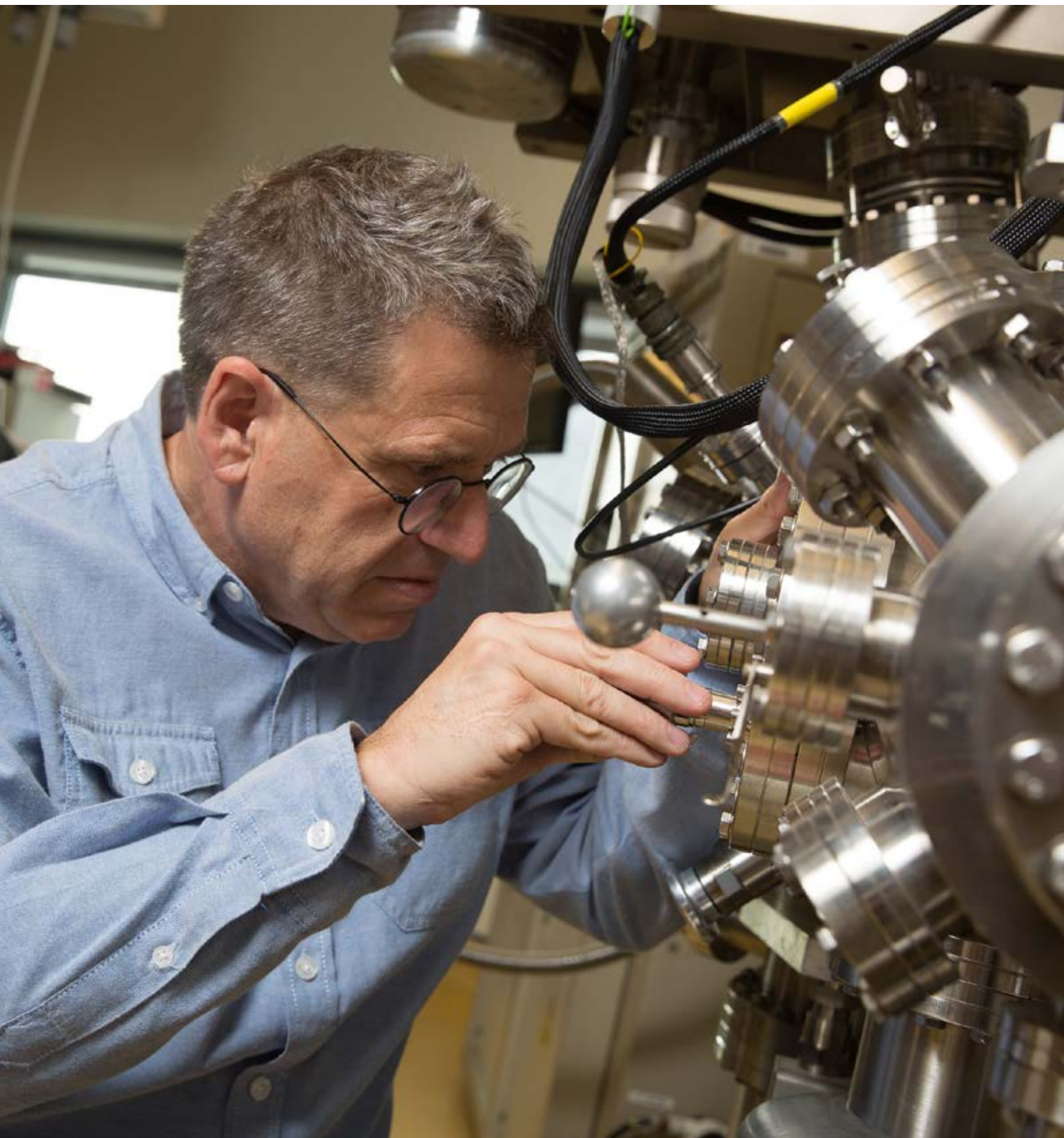
Michael, who was appointed Director in October 2015, points out that AMBER has delivered strongly on projects for industry and has thus built up confidence to the point where “Industry partners are recognising our expertise and our importance as a future talent pipeline. Intel, for instance, has recruited over 40 people from AMBER.”

Previous to his recent appointments, Michael was Chair of Inorganic Chemistry in UCC and worked as a Principal Investigator in AMBER, so is no stranger to the centre. The projects on which he has been working are on-going: “Over the

last nine months, most of my group have been transitioning from UCC to Trinity lab space.”

His group works on block co-polymer self-assembly: “We focus on the chemistry that drives materials to spontaneously form ordered arrangements. In our case using polymer mixtures that separate in the same way that oil and water do. By tying the polymers together the separation happens on the nanoscale and is called nanophase separation. This type of self-assembly is useful in an awful lot of industries – from generating surfaces for computers and smartphones that won’t get wet, to developing more accurate diagnostics that allow for much earlier detection of diseases and self-detection.”

This means that his group works with a range of industries. Collaborating with industry has been key to his research from the start. “In 1995,” he recalls, “I was the first Irish recipient of research funding from Intel – I worked on a method for electrically separating the connections on silicon devices.” Previously, when finishing his PhD in the early 1980s in the University of Liverpool, at a time when British industry was beginning to collaborate with academia, he developed links with the chemical company, ICI, and ended up working for them. Understanding the interests of academia and industry comes naturally to him, which is critical in his role as Director of AMBER.



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His route into studying chemistry was a novel one: “As a child I was much more interested in art. I was painting – sort of abstract pictures I guess – from the age of eight or nine. Then in secondary school my chemistry teacher had a PhD in the chemical composition of paints through the ages. I got really interested in that, and from there I decided to study chemistry. I grew up 100 metres from the University of Liverpool so that’s where I went – I crossed the road to the campus. It was a great place to study, with brilliant professors, I really enjoyed it.” (He still paints for two or three hours a week, but recreationally only).

He stayed on at Liverpool to do his PhD, on the way that atoms diffuse across surfaces and coalesce, and was subsequently a post-doctoral fellow in Imperial College London and a lecturer in Strathclyde University before taking up an endowed lectureship with ICI in Cardiff University in 1987 and then moving to ICI headquarters in Durham as a research scientist with particular interest in developing high temperature catalysts.

“I was with ICI for six years. I enjoyed it but then they were downsizing and the job was constantly changing beneath me. I’d met the head of Chemistry at UCC a few times at conferences and he phoned to ask did I want a job. My family is Irish and I knew Cork pretty well because ICI had a plant there. It was the change I was looking for.”

He arrived in Cork in 1993 at a time when Ireland “still wasn’t terribly research active” but “the landscape began to change” when Enterprise Ireland (then Forfas), the HEA and eventually SFI “began scaling research”.

At UCC, he developed his expertise with block co-polymer self-assembly into a spin-out company, Glantreo, which launched in 2004. “We make materials to sell into the chromatography space.” In 2010 Glantreo signed a very significant contract to supply silica based materials to a US company, and the company currently employs between six and ten people, with Michael now acting as a scientific advisor.

He is not currently looking to found another company – “It’s a lot of work and it impacts the amount of research you can do. I’d prefer to license, or to act as a scientific mentor to an entrepreneur.”

His work in AMBER is so demanding that he has yet to contribute to teaching in the School of Chemistry, but “that will change”. He thinks now is an interesting time to be developing curricula: “I don’t think we quite understand how kids learn any more. They have access to so much more information. I don’t think us posting lectures online qualifies as e-learning. The job of the lecturer is to give fundamental

core knowledge so students can screen what they find online. We have to train them to look at things critically.”

He doesn’t particularly like students focusing too much on revision and in UCC he tried to pioneer open book exams. “If you revise too much, you tend to silo everything rather than get a rounded view of the question”. He believes in reinforced learning – “I like to constantly give the same information in different ways in order to embed it, and to show the connectivity between subject matters.”

However AMBER rather than the curriculum will be claiming his attention for the next three and a half years, at least. So far he has found the transition from Cork to Dublin easy – “Dublin is more similar to Liverpool where I grew up – same style houses, Georgian architecture, the people are the same, even the accent is similar” – but he can’t speak for his wife – “she’s a Cork girl”. His eldest son will probably finish his Leaving Cert in Cork, the other two children are in primary school.

He is really enjoying Trinity: “the quality of the infrastructure is exceptional, and there are really talented admin people driving AMBER and that’s been incredible.” And he loves that he can meet colleagues in the Trinity Biomedical Sciences Institute and elsewhere to discuss research and ideas. “AMBER is quite horizontal – from hardcore computing all the way through to biological engineering – so it’s a huge advantage to be able to meet people so easily.”

He has three ambitions for AMBER: “First, I’d like us to be really internationally recognised and seen as a driver of research across Europe, as well as within Ireland. We’re definitely getting there – external companies, based in Britain and China, are approaching us.”

“Secondly, I want to communicate strongly to the public how important research is for the well-being of the country, to show that what we do increases jobs, and brings all kinds of benefits. There are many ways of raising awareness, including establishing excellent media contacts, and meeting with government and the civil service – and then of course working with teachers and secondary schools, that’s crucial also.” He is very impressed by the Science Gallery’s work with schools and children.

Finally, he hopes to influence industry to really understand the value of research, particularly basic research. “Most industries are manufacturing focused. Pharmaceutical companies, of course, have a tradition of long research projects. I would hope that the success we’re having in AMBER would persuade companies from all industries of the importance of developing a fundamental research base.”

Professor Luiz DaSilva

Professor of Telecommunications (2014)

→ “I’m extremely proud of my research team at Trinity. We have people from Poland, Slovenia, Portugal, Greece, Russia, Austria, Bolivia, Romania, China, Brazil, and Ireland of course. Different people bring different things to the table – in terms of training, with some researchers taking a more theoretical approach and others a more practical one, but also in terms of cultural background. Our group has great diversity and I come to work every morning really wanting to be here.”

Luiz DaSilva, in the School of Engineering, and Principal Investigator in CONNECT, the Science Foundation Ireland (SFI) funded research centre based in Trinity, is explaining why he decided to leave Virginia Tech in the US, where he was a tenured professor, to take up a full-time position in Trinity in December 2014.

Previously he had shared his time between Trinity and Virginia Tech, but after several years of this he was finding the travel and disruption difficult and felt he needed to choose: “By that time I had grown to really like living in Ireland, and I’d established friendships. Ireland is a positive place for research. There’s a great research ecosystem here, including a strong industry presence, and crucially government investment in research was maintained through the recession. That wasn’t necessarily the case in other European countries, but it’s crucial because you can’t turn research on and off – once you turn it off it may take decades to establish a team and a line of investigation again.”

CONNECT (formerly CTVR) brings together researchers from ten Irish universities and institutes of technology to conduct research in future networks and telecommunications. Luiz’s group focuses on resource management of wireless networks – “which includes wi-fi, mobile networks, and the Internet of Things. How do you take a network, and squeeze as much performance out of it to get the best service you can? How do you manage energy consumption and make decisions

on how to deploy the network? There are loads of possibilities and we’re always looking to find new ways.”

Currently the group is engaged in seven pan-European Horizon 2020 projects, including the €3 million project, FUTEBOL, a collaboration between Brazilian and European researchers, which Professor DaSilva leads. SFI is the other major funder of Luiz’s research, and the CONNECT Centre also counts on numerous industry partners. “My group is currently working with Nokia and Huawei. Each industry project is different – Huawei, for instance, approached us asking us to apply game theory and machine learning to improve their performance and to be more dynamic in the way that they use resources.”

Typically projects last between three and five years. Currently he has seventeen people in his research group, mostly engineering and computer science PhDs and post-docs. He greatly appreciates Trinity’s multidisciplinary environment because there are strong economics, legal and public policy components to how networks are used. “In our group we work on achieving the technically optimal solution for networks, but that’s not necessarily the solution that is ultimately going to be successful in the market. That will also depend on what the regulator allows – often it’s the business world that shapes how these networks evolve. So we rely on colleagues from other disciplines to bring in the legal, business, and public policy components.”

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Growing up in Brazil, Luiz was always interested in science and engineering. After high school, he received a scholarship to attend the University of Kansas to study engineering. “I did my PhD there – using game theory to model network quality of service differentiation.” He joined Virginia Tech as an assistant professor immediately after his PhD, eventually becoming a tenured full professor there.

He first came to Trinity part-time in 2009, under SFI’s Stokes Professorship programme. He now has a personal Chair in Telecommunications and is an IEEE Fellow, for contributions to cognitive networking and resource management of wireless networks. He is currently Director of Research for the School of Engineering. “It’s a three year position, and gives me an opportunity to influence how the School will evolve and progress. With engineering, things change fast. We have to ask ourselves what kind of engineer will we need in ten years’ time? The way things are going, we will want engineers with an interdisciplinary approach who get excited about addressing societal challenges. E3 [Trinity’s planned new Engineering, Energy and Environment Institute] is an exciting opportunity – bringing engineers, computer scientists, and environmental scientists to work at the interface of disciplines to solve issues like energy generation and distribution, or smart agriculture. Several areas in Engineering, including Telecommunications, will have a critical role in how we tackle big societal challenges.”

Adjusting the curricula and introducing educational innovation will also be key to meeting new challenges. He has found that “teaching has changed a lot since I started out. It evolves with the discipline. I find that personally I get better at applying my research to teaching and I have more experience to bring to the class.”

Outside work, he is a keen runner – “I do long runs, sometimes up to Howth, every weekend, and I train for a marathon every year, and I might do some half-marathons too. My favourite half-marathon is round Dingle, which is really beautiful.” In the past few years the CONNECT group has started doing the Phoenix Park run for the Movember charity. “We run as a group – of course there are different levels, but we all get excited about training.”

And every year he takes the group on a retreat to somewhere in the Irish countryside: “We spend two days discussing research and also take some time to climb a hill or do something social outdoors”. It’s important to him “that we remain a really nice group, enjoying each other’s company. People come and go but somehow we’ve been able to keep a strong, welcoming core. The better we all get on, the better we work together.”

His mission is for CONNECT to be recognised as one of the top groups in the world for telecommunications – “in the top 5, why not? We’re already on the map in terms of telecommunications networks research. We’ve achieved excellence that we can build on.”



10 Professor Ursula Fearon

Professor of Molecular Rheumatology (2014)

→ “Trinity provides a fantastic environment for cross-disciplinary research. There’s a lot of complementary expertise, which I believe is crucial for excellence. I’m already collaborating with clinicians in Rheumatology, the oncology group at St James’s Hospital, and the Immunology Department at TBSI – a discipline where Trinity is ranked among the best in the world.”

Professor Ursula Fearon, appointed to the new Chair in Molecular Rheumatology, School of Medicine is talking about her first six months in the job. She started in December 2015 and spent four months “setting up the new unit – which was challenging but very exciting”. Key researchers from her team in St Vincent’s/UCD, where she previously worked, “have made the move” with her, in addition to a number of new staff she has appointed. “This is a vibrant time for Rheumatology, and Immunology, as advances in therapeutic strategies have developed significantly in the past decade”.

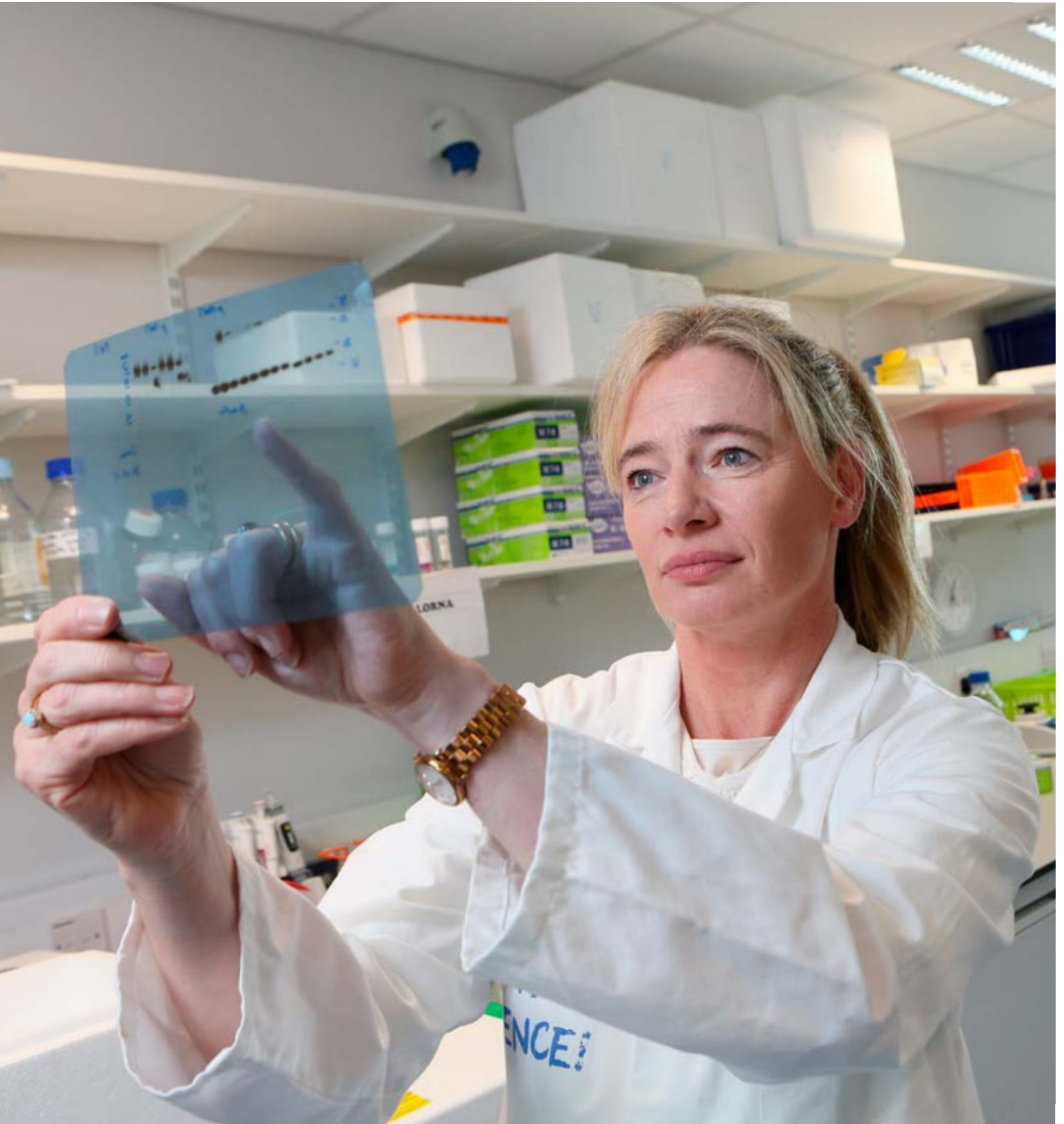
Hers is one of only two new protected chairs of rheumatology in Ireland, and both are of recent appointment: “Seven years ago Arthritis Ireland obtained funding from Atlantic Philanthropies, who wanted to invest in the field of rheumatology, so they created two chairs of rheumatology to advance arthritis research and education to a new level. The two chairs are based in Trinity and UCD, and the goal is to develop a Dublin centre of excellence, which will involve the Schools of Medicine in both universities, the Trinity Biomedical Sciences Institute, the Conway Institute in UCD, and the teaching hospitals – Tallaght, St James’s, St Vincent’s, the Mater and Our Lady’s Children’s Hospital, Crumlin – all working together.”

Translational research is developing rapidly, she explains: “Researchers have to be driven to work in cross-disciplinary fashion, to create collaboration between clinicians and scientists, and importantly to involve patients more closely. Everything we do is applied to our patients.”

She is part of a strong nationwide focus, coordinated across clinics and hospitals, to develop biological registries of all patients in Ireland with a rheumatic illness: “We want all patients to be registered in the clinics where they attend – that way we can develop a national database, which will facilitate the stratification of patients so that the right patient receives the right treatment and we can monitor response to therapies. This is essential if we are to create the appropriate research environment and find preventative and curative strategies for arthritis.”

Treatment of rheumatoid diseases was revolutionised fifteen years ago with the advent of biological therapies; Professor Fearon explains: “Before 2000, the two diseases which I specialise in – rheumatoid arthritis and psoriatic arthritis – could result in patients suffering functional disability within five years and being confined to a wheelchair within ten. Biologic drugs, mainly monoclonal antibodies, have transformed patient outcomes. But not all patients respond to treatments, and of those who do, finding the right treatment can be a process of trial and error. A patient might be put on two different treatments before responding to the third, but by that time may have developed functional disability.”

Ursula’s research is focused on molecular mechanisms of arthritis; her team is examining the components of the joint inflammation at a cellular and molecular level to dissect the signalling and gene pathways that are disturbed in patients who have arthritis. This research, it is hoped, will yield a greater understanding of the causes and processes of arthritis and its resultant damage to joints.



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The main focus is to identify the right treatment from the outset, developing new biomarkers to predict response and therapeutic targets for the non-responders. Her group in Trinity isolates cells from synovial tissue directly from the arthritic joint, and uses high through-put ‘-omic’ technology to identify the phenotypic characteristics of the cells, to allow them to understand the underlying mechanisms of disease and response.

“In other words our approach is to develop precision medicine through stratification which should enable us to know which treatment a patient will respond to first time round. This involves investigating complex interactions between proteins and genes in biologic samples from highly selected patient cohorts and following their outcomes – that’s why a national biologics registry and biobank is so important.” In her research, Ursula has also developed novel models of arthritis which have attracted significant interest from industry partners to examine the role of new ‘pipeline’ drug candidates, before they are brought into clinical trials.

As well as research, she actively contributes to several teaching courses within the School of Medicine: “I deliver lectures on inflammation, autoimmunity, hypoxia, metabolism and angiogenesis – these mechanisms cross all autoimmune diseases, as well as oncology. In the lectures, I always bring the science back to the human condition, that’s my primary focus, how can science provide solutions for patient problems.” In addition to teaching undergraduates, she has continually mentored PhD and MSc 4th level students over the past fifteen years, and counts among her proudest moments “when my students graduate or achieve success in their own research careers”.

As an undergraduate in UCD, Ursula studied science rather than medicine. “I always had a fascination to study science – from the tender age of nine, I was obsessed with the TV series, Quincy, about a forensic pathologist; I found it fascinating that you could retrieve that kind of information from a crime scene. Then in secondary school my biology teacher, Ms Mitchell, at Muckross College [in Dublin] was a significant motivator. She made biology classes so exciting,

in the way she brought everything to life! Whatever area we were studying – the circulatory or the digestive system, she always brought it back to the human body and disease. She was a real inspiration to me to study science.”

For her fourth year project in biochemistry in UCD, Ursula went for the “only one that had a human disease aspect”. She loved it so much she then chose to do a PhD in Endocrinology, between UCD and St Vincent’s University Hospital with Professor T.J. McKenna, a renowned endocrinologist and clinical scientist. That experience further reinforced her desire to work in translational research with human subjects. As a post-doc, she worked at the University of Leeds – “it was at a time when a new clinical trials unit was being established and it has since become the premier unit in Europe and one of the leading centres of excellence globally. So it was a very exciting time to be in Leeds.”

She returned to UCD and St Vincent’s Hospital, to take up the position of senior research fellow. “I spent fifteen years in UCD and St Vincent’s, building up the translational research team and forging links with the clinical rheumatology team. In 2014, we were awarded a ‘European Centre for Excellence’ award by EULAR [The European League against Rheumatism] for our research and education achievements. It was a fantastic honour – we were the first rheumatology group in Ireland to receive this award, which is based on research outputs and educational excellence. One of my key goals now is to achieve this award for Rheumatology in Trinity within five years.”

Her other key goals, now that her new unit and group are established at TBSI, are: to facilitate the development of a coordinated nation-wide biologic registry in parallel with a biobank, and to continue to develop collaborative research networks across Europe, and globally. “We’ve already established strong links with groups in Zurich, the Netherlands, Sweden, the UK and Singapore.”

Outside work, Ursula relaxes with her family. She was a keen and competitive sportswoman and musician, and still likes to play golf and ski and is an avid Leinster supporter, but most of the time now you will find her at the side of a hockey or rugby pitch cheering on her children.

Professor Mary Cosgrove

Professor in German

→ “Trinity is very different to anywhere else I’ve worked. The campus is large enough for a city-centre campus but it’s got a very intimate feel to it. And the Provost isn’t this kind of an abstract figure whom you never see again; he’s a presence around the place.”

Mary Cosgrove, Trinity’s new Professor in German, is talking about her initial impressions as she heads into her first year of teaching, having taken up the appointment in April. A UCD graduate, she returns to Ireland after twelve years in the UK, primarily in the University of Edinburgh but latterly in Warwick. Edinburgh, she says, “was a city-centre university, but not a campus one – the departments were dispersed round the city” while Warwick was a campus “but three miles from the nearest city”. The particular combination in Trinity of “contained campus and city-centre location” creates dynamism and a friendly atmosphere and is conducive, she feels, to collaboration and interdisciplinarity.

“The Long Room Hub is a fantastic research space, and I’m loving the Common Room, which I hadn’t experienced since I was in UCD – neither Edinburgh or Warwick had one. It’s so important to have somewhere to meet colleagues informally. It’s genuinely helpful – great ideas for research can come out of conversations with people in different fields.”

Her own research is on “states of mind” – human conditions like melancholy, boredom, and trauma: “What I’m interested in tends to be quite broad, but I look at it through the prism of Germanic studies. So I recently finished a book on melancholy [*Born Under Auschwitz, Melancholy Traditions in Postwar German Literature* (Boydell & Brewer, 2014)] and I’m very interested in boredom – it seems every great writer has written brilliantly about boredom and it’s so much fun to explore! And my interests are now also turning to the concept of crisis. There is so much crisis literature and film coming out of Germany currently, and the question is why? Germany has enjoyed a sustained economic boom, and yet

there’s a ton of crisis stuff being produced, not only novels and films but in sociology – books on exhaustion and burn out. You might expect that in austerity Ireland but why is this happening in Germany?”

It’s research that crosses disciplines, taking in, for instance, economics, social sciences, and psychology. She is open to “teaming up with someone from a STEM subject, who works in neuroscience or psychiatry.” She is used to this kind of collaboration: “I was visiting scholar to the Max Planck Institute in Berlin 2014 where I worked in the Centre for the History of Emotions, which is an interdisciplinary research centre across the arts and humanities and including historians and psychologists.”

Her interest in German began in school – “I had an aunt who settled in Munich, so there was always this connection, and I was always interested in languages. Then at school – in Our Lady’s Grove in Goatstown in Dublin – I had a brilliant German teacher, who really inspired me. And at UCD, where I did French and German, I found the German department so interested and approachable. After I graduated I did get offered a one-year lectrice post in a French university, but by then I’d decided I had to make the choice and it was German, so I went straight through to a one-year MA in German in UCD.”

However, she didn’t immediately launch into academia. “I didn’t go to College intending to be an academic; I thought I’d be working in Europe, as a diplomat in Brussels maybe. I think that’s a big reason why students in Ireland opt to study languages – we’re this outward-looking migratory country and we all have friends and relatives working abroad and it’s something we see ourselves doing.”

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After the MA, she took a break, worked in advertising, and went to Australia for a year, jobbing around and backpacking. She still loves the outdoor life – “I did a half-marathon this year and I love walking and do a lot of yoga – you spend so much time at your desk in this job, it’s good to exercise when you can.” The year off in Australia helped decide her future direction: “I knew I wanted to come back to UCD and do a PhD.” Her dissertation on the Jewish-Austrian writer, Albert Drach, was finished in 2002, after which she worked two years as a temporary lecturer in UCD’s German department.

“In 2004 I applied for post-doc money from the Irish Research Council, which I got, but then the position in Edinburgh was advertised.” By this stage her PhD had been published as *Grotesque Ambivalence: Melancholy and Mourning, the Prose Work of Albert Drach* (2004). “There was very little on Drach, even in German, so I got a really good German publisher who also published in English, and that was decisive to my being appointed to Edinburgh.”

Edinburgh “was very exacting and tough, but in all a great experience. It wasn’t easy to get promoted, but what I came to understand was that if you stepped up and took on a tough job, and if you did it well, then you got great recognition – so that’s what I did.”

She took on the management of the REF 2014 [Research Excellence Framework] submission for Modern Languages. “I was managing a unit of nine language departments, including Film Studies and Celtic and Scottish Studies, and was coordinating the submissions and organising the impact case studies. We had to send out everyone’s work to anonymous peer reviewers to see would it be ranked highly enough to get funding, and I had to write the research strategy of the entire unit, which had never been done.” It was an exhausting three-year commitment but “at the end of it we came 11th in the UK for impact and third in terms of research environment so it was more than worth it.”

Taking on this role secured her promotion and subsequent appointment to Warwick and gave her an insight into what contributes to academic success: “You need to have a mix of stuff going on, a balance of things. It’s not just about your publications and research activity, though obviously that’s crucial; you also have to pay attention to the leadership and managerial side of things. You just do. There are important jobs that many academics feel unqualified to do, however if you step up, you’ll gain better insight into how things work.”

She is looking forward in Trinity to eventually taking on a management and leadership position within the faculty and the University, but first she wants to concentrate on her role in the department and establishing her teaching, and for the next three years’ time will be taken up with her role as Germanic editor of the prestigious *Modern Language Review*. “I got this appointment when I was in Warwick and brought it back to Ireland so for the first time ever the Germanic editor of the Review is in Ireland, which is great.”

Within the department, she will be helping to set up an Erasmus strategic partnership with different partners across the German-speaking world. “The strategic partnerships are about developing quality strategies in teaching and learning, and reinforcing cross-sectoral cooperation. It would be great to get these in place, particularly because that would help with bringing in more PhDs and Post-Docs and could be a great resource when it comes to putting together research teams for Horizon2020 and other cross-national funding bodies.”

That’s important because while Mary has built up strong research collaborators in German and Britain – “my natural partners are in places like Kent, Nottingham, Oxford, and Edinburgh” – but is afraid that “Brexit may complicate matters”. Ultimately she’s hopeful that the UK will continue to be included in EU research programmes but either way, she is looking forward to developing more research partners across Europe. “My attitude is: Go forth and find your people. Build your group”.



Philanthropy and Alumni Engagement

In 2015/16 Trinity received the largest charitable donation in Irish history to tackle dementia. This landmark donation of €138.4 million by The Atlantic Philanthropies is helping Trinity achieve its ambition to become a world leader in ageing research. Co-led by Trinity College Dublin and the University of California, San Francisco (UCSF), the Global Brain Health Institute (GBHI) will train 600 global leaders over 15 years in the US, Ireland and across the world to carry out dementia research, deliver health care, and change policies and practices. GBHI has shared operations in Trinity and the UCSF and is headed by Trinity's Professor of Psychology, Ian Robertson, and Professor Bruce Miller, MD, a behavioural neurologist at UCSF. Trinity and UCSF are in an excellent position to deliver GBHI based on both institutions' renowned reputation in neuroscience.

Trinity Business School

Trinity Business School has grown by over 50% over the last three years and intends to more than double its current size. With the leadership and support of a community of over 30 leading local and international business people, by the end of 2018, Trinity will have built a major international Business School focusing on entrepreneurship and innovation. The School is recruiting international faculty, developing new degree and executive education programmes and constructing an iconic

new Business School building in the heart of the campus along with a co-located Innovation & Entrepreneurship Hub. Within a five year time frame, the goal is for Trinity Business School to be counted among the leading business schools in Europe and to become an anchor for the growing community of leading international companies based in Dublin.

Philanthropic Highlights

The Hamilton Mathematics Institute (HMI) at Trinity College Dublin has been awarded a grant of \$600,000 by the New York-based Simons Foundation to develop a Simons Distinguished Visiting Professor, a Simons Visiting Scholar and a Simons Postdoctoral Fellowship Programme to advance the frontiers of research in mathematics and the basic sciences.

With funding support from Arthritis Ireland, Trinity has appointed Ursula Fearon to the newly established post of Professor of Molecular Rheumatology in the School of Medicine. Professor Fearon will expand academic leadership in rheumatology in Ireland and will further develop Dublin as a leading international centre of excellence in the field.

In 2015, former Trinity Professor in the School of Computer Science & Statistics, John Byrne, passed away and left Trinity a legacy of €230,000 towards various projects including the Student Hardship Fund, Trinity College Library and the Schools of Computer Science & Statistics and Engineering.



→ The Atlantic Philanthropies' landmark award is the largest single programme grant Atlantic Philanthropies has ever made, is the biggest philanthropic donation in Irish history, and the largest ever received by Trinity College Dublin.

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Lady Margaret Hall, an Oxford University College, announced the launch of a four year pilot scheme offering a Foundation Year to students from under-represented backgrounds, in association with Trinity which has operated Trinity Access Programme (TAP) for 22 years. Trinity started the scheme because, like Oxford, the university wanted to attract many more candidates from such backgrounds. Today more than 90% of young people who complete the TAP Foundation Course go on to take a degree at Trinity. Once they start on the degree programme, TAP undergraduates perform as well as any other student. In addition to funding from Government, European and state agencies, TAP receives generous philanthropic support from Trinity alumni and friends, a range of Corporate and Foundation partners and through the annual Alumni Appeal.

Alumni Engagement

Alumni continue to engage with Trinity in a variety of ways at home and abroad. In 2015/16, over 88,000 alumni were contactable by mail, phone or email (an increase from 84,500 in 2014/15). In the year over 71,000 of them received a copy of the annual publication, *Trinity Today*; over 45,000 received a monthly e-zine newsletter, with a new template launched; and over 6,500 connected with student callers to update them on the many ways to stay connected with Trinity and each other, as well as ways to support the University. In addition, fourteen dedicated School Newsletters were sent to over 32,000 alumni worldwide.

This year, over 3,000 alumni have given back to Trinity through a donation as well as volunteering. One example of this is the hundreds of alumni and students connecting via the GradLink Mentoring Programme, now in operation in eight of Trinity's Schools, whereby alumni provide advice to students on next steps after college.

The global alumni network continues to expand, with over 150 events held around the world, supported by 75 regional branches. Some new initiatives this year included an inaugural London Ball as well as two dedicated e-zines to alumni in the UK and USA.

On campus services have expanded with more alumni class reunions supported this year and more alumni taking up the many benefits available to them, such as free Wi-Fi and free access to Trinity College Library and Book of Kells. Our newest alumni also benefited from a final year class photo and LinkedIn profile photo service to them as a parting gift from Trinity.

Our social media channels have also seen growth of 53% on Twitter and 9% on Facebook in the last year. Furthermore the Trinity Development & Alumni website www.tcd.ie/alumni was re-launched to bring the alumni and development content into a more cohesive format providing interesting content and responsive design.

LEFT – Trinity’s Professor of Psychology, Ian Robertson, Mary Sutton, Country Director, The Atlantic Philanthropies, Taoiseach, Enda Kenny, Helen Rochford Brennan, Chair of the

Irish Dementia Working Group and Dr Patrick Prendergast, Provost, Trinity College Dublin at the Global Brain Health Institute (GBHI) announcement.

→ Benefactors through the Centuries are defined as people and entities who gave unrestrictedly a gift to Trinity College Dublin. Gifts valued in excess of €1 million in today’s value and could be in the form of cash, securities, land or a substantial asset.

Benefactors Through the Centuries Chronological List

1. Queen Elizabeth I	24. Sami Nasr	46. David and Mary Went
2. Dublin Corporation	25. Smurfit Kappa	47. Royal City of Dublin Hospital Trust
3. James I	26. Mercer’s Hospital Foundation	48. Kay & Fred Krehbiel
4. Sir Turlough O’Neill	27. Sir Anthony O’Reilly	49. Mark Pigott KBE
5. Sir Hugh Magennis	28. Coca-Cola Corporation	50. PACCAR Inc
6. James Ussher	29. The A.G. Leventis Foundation	51. Anonymous
7. Henry Jones	30. Donald Panoz	52. Irish Life
8. Erasmus Smith Trust	31. Sir Michael Smurfit KBE	53. The Irish Times
9. Charles II	32. John Moores	54. Google
10. Claudius Gilbert	33. Brendan McDonald	55. Dr Stanley Quek
11. Richard Baldwin	34. Wellcome Trust	56. Capt. Cathal Ryan Trust
12. Sir Patrick Dun	35. The Atlantic Philanthropies	57. Ellen Mayston Bates
13. Lord John George Beresford	36. Martin & Carmel Naughton	58. National Children’s Research Centre
14. Edward Cecil Guinness	37. Lewis L. Glucksman & Loretta Brennan Glucksman	59. The People of Ireland
15. Frederick Purser	38. Allied Irish Banks	60. Government of Ireland & its agencies
16. John Purser Griffith	39. Bernard McNamara	61. Alumni Donors
17. Grania, Marchiones of Normanby	40. The Andrew W. Mellon Foundation	62. Trinity Trust
18. Brian, Lord Moyne	41. Bank of Ireland	63. Dr Donald G. Weir
19. Jack Morrison	42. Peter Sutherland SC	64. Terry & Marjorie Neill
20. Rupert Edward Guinness	43. Durkan Family & Friends	65. Eric & Barbara Kinsella
21. Ford Foundation	44. Dermot Desmond	66. Terry & Valerie Gallagher
22. Chester Beatty Trust	45. Dr Beate Schuler	67. Denis & Catherine O’Brien
23. Calouste Gulbenkian Foundation		

Visitors

Trinity continued to welcome many visitors to its campus throughout the year. Over 20,000 Americans visited Dublin in early September for the Aer Lingus Football Classic and Game Week 2016. Trinity was the venue for the official Game Week Welcome Village and played host to a variety of social, cultural and business-orientated activities.

Hundreds of people participating in colourful pep rallies for Boston College and Georgia Tech gathered in Front Square. The crowd, consisting of the college football teams, marching bands, cheerleaders, their supporters and families, was welcomed to Trinity by the Vice-President for Global Relations, Professor Juliette Hussey.

An Irish-American symposium on international collaborations in education, research and innovation opened by the Minister for Education and Skills, Richard Bruton also took place on campus. The presidents of Boston College and Georgia Institute of Technology, Father William P Leahy and Dr G P "Bud" Peterson teamed up with the Provost, Dr Patrick Prendergast for high level discussions. They were joined by US and Irish academics, business leaders and students.

Visitors to the Old Library and Book of Kells exhibition reached nearly 900,000 visitors, the best year ever. Featuring again in this year's Fáilte Ireland's list of Ireland top 10 visitor attractions, visitors came from all over the world with increasing numbers from France, Germany, Ireland China and the USA in particular. On Culture Night, 16th September, over 5,720 visitors enjoyed a Chapel Choir performance while visiting the Old Library.

RIGHT – US Vice-President Joe Biden receiving his honorary doctorate.

→ US Vice-President Joe Biden received an honorary doctorate from Trinity College Dublin in June – his first such degree from a university outside the United States.



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As part of the Trinity Visitor Experience, a team of nine Welcome Ambassador Students worked during the peak tourist season, June to October, promoting the University's venues and facilities open to the public including the Zoological Museum, Book of Kells, Trinity Tours, and the Science Gallery, as well as campus cafes, restaurants and accommodation. These student ambassadors also gave guided tours of the Old Library and the Book of Kells exhibition for Trinity guests, alumni and other visitors when required.

A part-time Education Officer was appointed to co-ordinate education activities in the Old Library for school groups, families and adults.

Over 7,000 people visited the Zoological Museum during three months over the summer to view the iconic 200-year-old collection, which includes approximately 25,000 specimens from Ireland and much further afield. Among these are Ireland's last Great Auk, a large bird that has been extinct since 1844 and which is only preserved in a handful of museums across the globe, a Tasmanian Wolf, which may or may not now be extinct, and 'Prince Tom', the Royal elephant who travelled the world with Queen Victoria's son, Prince Albert.

The new interactive experience for primary school children launched in June 2016 was a success and will be available again from May 2017.

Trinity hosts another leading visitor attraction on campus – Science Gallery Dublin. In 2015/16 there was a record breaking 429,000 visitors to its four exhibitions: *Secret*

– *nothing to hide here*; *Trauma – built to break*; *Field Test – radical adventures in future farming*; and *Seeing – what are you looking at?* Science Gallery Dublin presents science and technology through innovative, inspiring exhibitions – it is both entertaining and pedagogical.

Welcoming dignitaries

US Vice-President Joe Biden received an honorary doctorate from Trinity College Dublin in June – his first such degree from a university outside the United States. The Doctor in Laws recognises the Vice-President's contribution to world politics. Several members of the Biden family were also welcomed to Trinity as part of their visit to Ireland. The Vice-President was awarded with a gold medal by students of the Philosophical Society and later gave a speech to students and staff.

The Italian Minister for Foreign Affairs, Minister Paolo Gentiloni participated in an Institute of International and European Affairs seminar '*Europe After the UK Referendum*' in the Trinity Long Room Hub and met with members of staff from the Italian Department afterwards.

The President of Ireland Michael D. Higgins received a Diploma of Honour from the Chilean Foreign Minister, Mr Heraldo Muñoz at Trinity in January.

Some Nobel Laureates visited Trinity this year. At the Trinity Economic Forum (TEF) in February, the 2002 Nobel Laureate in Economics, Vernon Smith, spoke to a packed theatre of students, academics, and policymakers, from Ireland and

LEFT – American football mascots, Georgia Tech's yellow jacket 'Buzz' and Boston College's 'Baldwin the Eagle'.

TOP RIGHT – African Diplomatic Corps and plenary speakers from TIDI's Africa Day panel discussion at a lunch hosted by the Provost.

BOTTOM RIGHT – Rory O'Neill, Tomas Reichental, Fr Peter McVerry, Senator David Norris and Graca Machel, Honorary Degree recipients with Provost Dr Patrick Prendergast and University Chancellor Mary Robinson.

abroad. Professor Smith's address, co-hosted by the Student Economic Review had the distinction of making this year the first time a Nobel Prize winner partook in the TEF.

The Student Economic Review and College Historical Society hosted the 2015 Nobel Prize Winner in Economics, Angus Deaton. Students and academics alike filled the GMB to watch the Princeton Professor receive the Gold Medal for Outstanding Contribution to Discourse and hear his address.

Trinity's own 2015 Nobel Laureate in Medicine, William Campbell was honoured at a special reception in the Provost's House in September.

The painstaking conservation of one of the oldest surviving Irish manuscripts was viewed by US Ambassador to Ireland, Kevin O'Malley, during a behind-the-scenes visit to Trinity College Library's conservation laboratory. Ambassador O'Malley visited Trinity to review progress of a major project which will see four of the Library's most important early medieval Irish manuscripts conserved, digitised and made available online to the public and world of scholarship for the first time.

With the support of the African embassies accredited to Ireland, TIDI (Trinity International Development Initiative) hosted a panel discussion to mark Africa Day and celebrate the significant milestones in Africa's human rights story in May. The Provost hosted a lunch with ambassadors from Ethiopia, Morocco, and Kenya, representatives from the Egyptian and Nigerian embassies, TIDI, Front Line Defenders, UNU-Wider and the Africa Centre.

Other dignitary visits throughout the year included ambassadors from Mexico, Russia, Spain, Egypt, Japan, Israel, Chile, the Netherlands, Belgium, Australia, Germany, Greece, Italy, Croatia, Palestine, China, and the Lord Mayor of Dublin.

The global relations strategy continued to thrive in 2015/16 with numerous academic visits from delegations from China, Singapore, USA, India, Malaysia, Japan, Canada, Australia, South Africa, Germany, South Korea, Chile, Brazil, Austria, Vietnam, Czech Republic, UK and Mexico.

Artist Panti Bliss, Senator David Norris, social activist Fr Peter McVerry, holocaust survivor, Tomi Reichental and Mozambican politician and humanitarian, Graça Machel were conferred with honorary degrees at Trinity's Winter conferrals. Human Rights was the theme for this year and all five recipients have made a significant contribution in this sphere.

At the summer conferrals in June 2016, Nobel Prize winner and world leading physicist, Professor Peter Higgs who discovered Higgs Boson, along with renowned authors, JP Donleavy, Lia Mills, and human rights activist, Hina Jilani were conferred with honorary doctorates while Trinity's most senior student, the 97-year old Joe Veselsky was also awarded an Honorary Master of Arts Degree.



Creative Arts Catalyst

Releasing the creative potential of staff and students and encouraging a culturally creative environment on campus is central to Trinity's mission in education, research, innovation and public engagement.

Creativity is part of the curriculum through the Oscar Wilde Centre for Creative Writing, the Centre for Music Composition, the Lir Academy for Dramatic Art, which offers courses in acting, directing, playwriting and stage design, and other courses within the Arts and Humanities faculty, such as Film Studies, offering modules in creative practice.

Extra-curricular engagement comes through the myriad of student societies dedicated to drama, music, film-making, the visual arts, and computer gaming. And as part of Trinity's commitment to public engagement, we encourage the use of this beautiful campus for plays, concerts, exhibitions and talks on culture, all open to the public.

In September 2016 Trinity was named Europe's leading university for producing entrepreneurs by the research firm, PitchBook, based on the number of undergraduate alumni who go on to create companies that secure first-round venture capital funding. When we talk about entrepreneurship, we include of course the creative and cultural industries, which are key sectors for Dublin and Ireland. The University encourages and teaches innovation and entrepreneurship in these industries, as in others.

2015/2016 was a particularly significant year for creative arts practice with the launch of the first ever Trinity Creative Challenge.

RIGHT– *Cascando*, Pan Pan Theatre, one of the 2016 Trinity Creative Challenge award recipients. Photo by Ros Kavanagh.



→ Sponsored by the Provost and unveiled in May 2015, the Trinity Creative Challenge award was established to catalyse the creative and cultural arts in Dublin city and to support the development of the creative and cultural industries.

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Trinity Creative Challenge

Sponsored by the Provost and unveiled in May 2015, the Trinity Creative Challenge award was established to catalyse the creative and cultural arts in Dublin city and to support the development of the creative and cultural industries. Under the scheme, artists and practitioners across a range of creative forms including performance, visual art, music, film, design, new media, animation, gaming and creative technologies, were invited to apply for awards of up to €10,000 to develop an interdisciplinary creative arts project to be presented in 2016.

From 140 applicants, the judging panel, which included filmmaker, Lenny Abrahamson, composer Ben Schleppey-Connolly, and the director of IMMA, Sarah Glennie, selected five winning projects, which were presented on campus in and around Trinity Week in April 2016:

Composer Enda Bates launched on 8th April with his newly composed multi-movement, *From Within, From Without* for Trinity Orchestra, Cue Saxophone Quartet, Miriam Ingram, and 8-channel loudspeaker.

The following week (14th April), Fiona Hallinan & Kate Strain held a symposium on 'The Department of Ultimology', an arts research project exploring the evolution and disappearance of forms of knowledge within academic disciplines.

Artist Grace Weir's film 'A reflection on light' telling the history of a painting, *Let there be Light* by Mainie Jellett, which hangs in the School of Physics, was screened on 14th and 15th April.

Artist Declan Clarke's *The Hopeless End of a Great Dream*: a film exploring the social and political heritage of contemporary Ireland through the lens of Trinity, was shown on campus on 20th April and screened in the Temple Bar Gallery from 21st April to 18th June.

Theatre company Pan Pan's staging of Samuel Beckett's *Cascando*, a deathmatch in the void between radio and poetry, words and music, voices and silence, was performed in the Samuel Beckett Theatre from 19th to 24th April.

All the Creative Challenge projects were open to the public, received good media coverage and contributed strongly to cultural and creative life on campus. In July the call went out for applicants for Creative Challenge 2017, and we look forward to presenting the winning project on campus this coming spring.

Educating for Creativity

Creative Technologies in Trinity was given a boost thanks to the appointment of Aljosa Smolic as SFI Professor of Creative Technologies, with a €4.5 million grant under the Science Foundation Ireland (SFI) research professorship programme to work on the V-SENSE visual computing project.

The new professor joins Trinity from Disney Research in Switzerland. A recognised leader in his field of visual computing, with particular expertise in computer graphics, multimedia and video signal processing, his work has had significant impact on 3D video technology. His appointment is part of a strategy to establish Dublin and Ireland as a global centre of creative industries and production.

LEFT – 2016 Rooney Prize
winner, Doireann Ní Ghríofa.

Another significant appointment in the creative space was novelist and critic Ian Sansom as Associate Professor in Literary Practice in the School of English and Director of the Oscar Wilde Centre of Creative Writing. Ian Sansom is author of the popular 'Mobile Library' and 'Country Guides' mystery series, and is a frequent contributor to the *London Review of Books*.

The Riverdance Trinity College International Summer School was held in July. Taught by Riverdance professional dancers, the participants of the six-day summer school learnt the iconic choreography from the show, and were trained in all aspects of professional dancing, from nutrition to fitness, and choreographing new dance routines.

Showcasing Creativity

In addition to the Creative Challenge, this year saw the usual abundance of creative projects on campus – plays, concerts, art exhibitions, films, and multi-media installations, produced by staff and students.

The Provost's Fund for Visual and Performing Arts provides grants to staff and students, individually or as societies, to promote music, theatre, dance, cinema and visual arts events taking place on campus. Grants do not in general exceed €2,500. In 2015/16 fourteen grants were awarded to projects taking place this year and next year.

The centenary of 1916 was commemorated on campus with creative projects, including two supported by the Provost's Fund for Visual and Performing Arts: *An Tocailín Donn*, an Irish language play (performed 27th February and 8th & 10th March) which follows the 1905 court case of Irish language activist, Neil Mac Ghiolla Bhríde, who was represented in court by Pádraig Pearse; and a stage adaptation by student Tim Scott of Jamie O'Neill's classic novel, *At Swim Two Boys*, set against the backdrop of the Easter Rising.

Other creative responses to 1916 included the Trinity 1916 Festival, a collaboration between two student societies, Players and The Phil, with a mix of events, including historical recreations, readings of letters and poems, murder mysteries and panel discussions. In summer the Making Peace exhibition saw 124 photographs mounted on 100 panels addressing issues including disarmament, conflict resolution, human rights and sustainable development.

Stefan Hutzler, Associate Professor in Trinity's School of Physics, and a Leonardo adviser to the Science Gallery helped showcase Trinity's commitment to SciArt when he collaborated with British photographer Kym Cox on a video showing the colourful evolution of a cylindrical foam structure and its display of interference patterns, as it drains under gravity. The video was shown at the Magic Gallery in

London during the summer in an exhibition organised by the Royal Photographic Society.

Other creative highlights of the year include an online exhibition of the Clarke Stained glass studio collection, a collaboration between Trinity's Library and Google Cultural Institute. Launched on the birthday of Harry Clarke, St Patrick's Day, the online exhibition featured highlights from the Clarke stained glass studio archive, now held in the Library, including pencil drawings, ink and wash designs, and photographs. A larger digital resource, featuring some 15,000 items from the archive, including stained glass designs and architects' blueprints, is now freely available online through Trinity's Digital Collections.

In October, Suas – together with the Students' Union, the Trinity International Development Initiative (TIDI) and Trinity Fashion Society – held its annual development-funded photo exhibition and arts festival. Images from five international photographers, focusing on consumerism, climate change, and solutions to development challenges, were displayed outside the Berkeley Library.

Among the distinguished guests invited to the Music Composition Centre and the Music at Trinity seminar series were composer Christopher Fox, Professor of Music at Brunel University in London, who collaborates closely with instrumental groups the Ives Ensemble and KNM Berlin, and vocal ensembles The Clerks and EXAUDI; and Chris Watson, a leading recorder of wildlife and natural phenomena, who has worked with David Attenborough.

At the *Ideopreneurial Entrephonics Festival of Sound Art and Electronic Instruments* held in Freemasons' Hall on 23rd–24th April, Richard Duckworth, assistant professor in the Department of Music, presented the debut performance of his electronic group Analogon, formed in 2015 to explore early electronic voicings.

Finally, the Rooney Prize celebrated its 40th anniversary in 2016. The Prize was established by Dr Dan Rooney of the Pittsburgh Steelers and his wife, Patricia, to reward an emerging Irish writer of poetry, fiction or drama. Since 2007 the Prize has been administered by the Oscar Wilde Centre of Creative Writing in Trinity. To mark the occasion of the 40th anniversary, Trinity hosted a special event in the Dining Hall in September where bilingual Cork poet, Doireann Ní Ghríofa was announced as the 2016 winner. Former recipients of the Prize were present, including Anne Enright, Frank McGuinness, Bernard Farrell and Medbh McGuckian, and there were readings from each decade, and a commemorative book was presented to the Rooneys, with extracts from the writings of all previous winners.

Governance

Trinity College Dublin is committed to maintaining high standards of corporate governance and has put in place the appropriate governance structures consistent with such objectives.

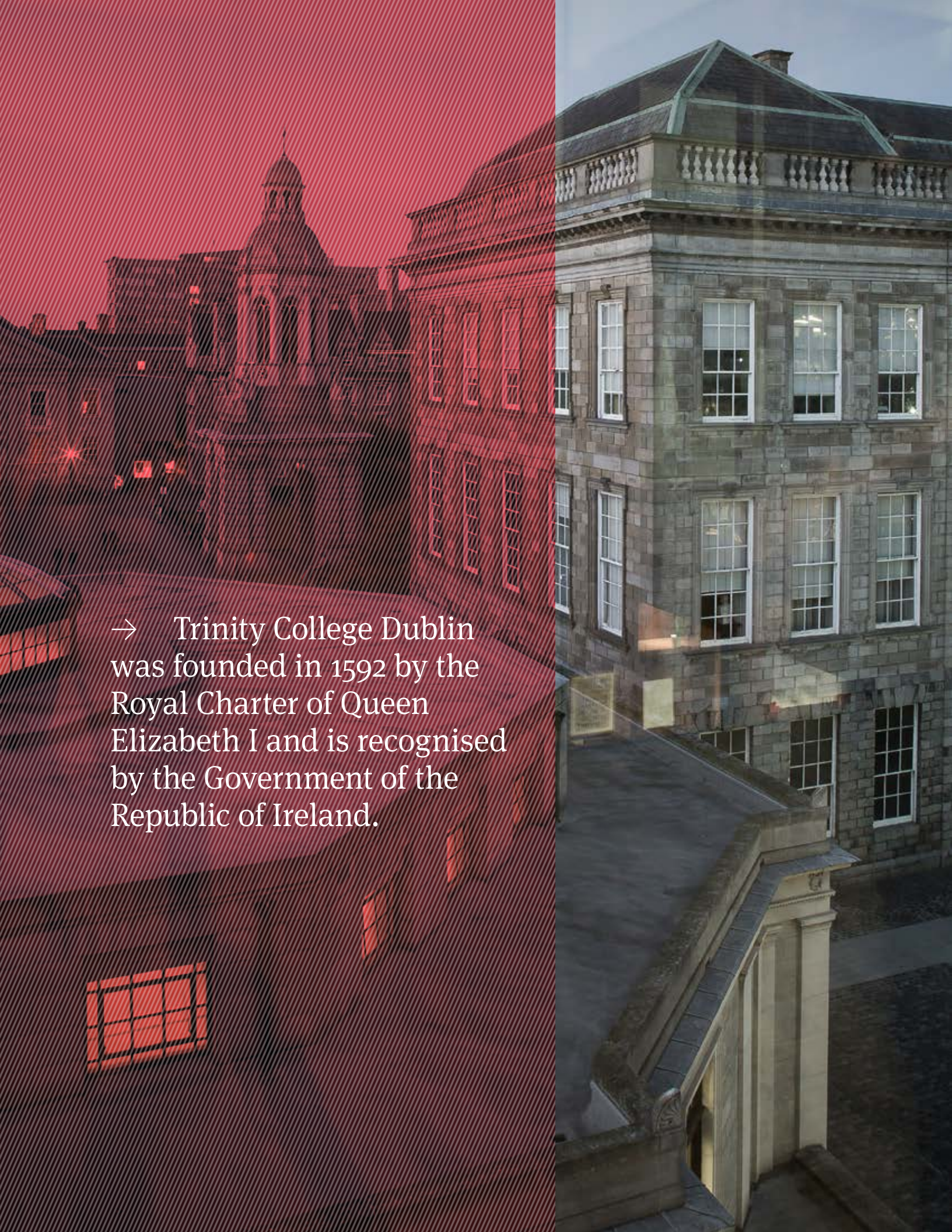
The University has adopted the Trinity College Dublin Code of Governance 2013 (www.tcd.ie/about/content/pdf/TCD_Code_of_Governance_2013.pdf) which is based on the Code of Governance for Irish Universities 2012, as agreed between the Higher Education Authority (HEA) and the Irish Universities Association.

Establishment

Trinity College Dublin was founded in 1592 by the Royal Charter of Queen Elizabeth I and is recognised by the Government of the Republic of Ireland, through its designation under the Higher Education Authority Act, 1971, the Universities Act, 1997 and the Trinity College, Dublin (Charters and Letters Patent Amendment) Act, 2000.

Provost

The Provost is the Chief Officer of the University and a member of the Body Corporate. The role of the Provost is defined in the relevant legislation and in the Statutes (www.tcd.ie/registrar/statutes) and the Provost is appointed after an election by academic staff and student representatives for a ten year term.



→ Trinity College Dublin was founded in 1592 by the Royal Charter of Queen Elizabeth I and is recognised by the Government of the Republic of Ireland.

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→ The total number of Board meetings held during the year was 13 (including a joint meeting of Board and the University Council on 20th January 2016).

Board

The Board is the governing authority of Trinity College Dublin, the University of Dublin. The Chairperson of Board is the Provost. Information on Board meetings, Agendas, Minutes, Schedules and membership can be found on the Committee's website (www.tcd.ie/committeepapers/board/papers).

University Council

The University Council is the academic council of the University, and subject to financial constraints, is responsible for College's academic affairs including curriculum development and academic appointments.

Information on Council meetings, Agendas, Minutes, Schedules and membership can be found on the Committee's website (www.tcd.ie/committeepapers/council/papers).

Major decisions of Board in 2015/16:

Research and Education:

- Approval to participate in the Global Brain Health Initiative, which works to reduce the scale and impact of dementia around the world by training and supporting a new generation of leaders to translate research evidence into effective policy and practice. This project is the largest funded research programme ever in Ireland and is being delivered in conjunction with the University of California, San Francisco.
- Approval to establish the Al Maktoum Centre for Islamic Studies, with support from the Al-Maktoum Foundation.
- Approval of the Thapar University Partnership agreement, a major collaboration with a university in India to promote educational and research activities.
- Progress with the Trinity Education Project, which includes a fundamental review of the Trinity approach to education, learning, graduate attributes and student outcomes based

on international best practice and Trinity's strong track record and experience.

- Trinity Creative Challenge delivered as part of Trinity's role as a Creative Arts Catalyst.

Campus development:

- Intensive consultation with external and internal stakeholders, resulting in the approval of a process for the development of the Estates Strategy Implementation Plan, designed to protect, safeguard and enhance Trinity's unique estates heritage.
- Work started on the new Trinity Business School including Board approved site clearance and demolition works, which began in April 2016.
- Intensive engagement with donors and potential donors to support capital and other developments.
- Work underway to greatly enhance the Trinity Visitor Experience, with the Book of Kells among Ireland's top 5 visitor attractions.
- Phase 1 of the Tobacco Free Trinity initiative was approved and implemented.

Governance:

- Approval to incorporate Trinity's commercial subsidiary company (Trinity Brand Commercial Services Limited) to develop and enhance the brand and reputation of Trinity at home and abroad.
- Revision of the Chapters and Schedules of the Statutes that govern the University.
- Appointment of Professor Christopher Morash as the Vice-Provost/Chief Academic Officer, with effect from 1 July 2016.
- Approval of in excess of 18 major policies. A complete listing of policies is available at www.tcd.ie/about/policies.

Board Meetings

The total number of Board meetings held during the year was 13 (including a joint meeting of Board and the University Council on 20th January 2016).

ATTENDANCE

BOARD MEMBER		ELIGIBLE TO ATTEND	NO. ATTENDED
S.P.A. ALLWRIGHT	REGISTRAR	13	13
O. BRAIDEN	EXTERNAL MEMBER	13	10
V.A. CAMPBELL	BURSAR/DIRECTOR OF STRATEGIC INNOVATION	13	13
C. CLANCY	STUDENT REPRESENTATIVE (WELFARE OFFICER OF THE STUDENTS' UNION)	13	11
F.M. COWZER	NON-ACADEMIC STAFF	13	13
P. COXON	FELLOWS AND FELLOW PROFESSORS	1	1
K. CROWTHER	STUDENT REPRESENTATIVE (PRESIDENT OF THE GRADUATE STUDENTS' UNION)	13	13
W.J. DOWLING	NON-FELLOW ACADEMIC STAFF	13	10
S.M. DRAPER	FELLOWS AND FELLOW PROFESSORS	13	11
E.P. DREW	FELLOWS AND FELLOW PROFESSORS	13	10
S. DUNPHY	NON-ACADEMIC STAFF	13	11
D. FROST	NON-FELLOW ACADEMIC STAFF	13	11
G.J. GARRAHAN	NON-ACADEMIC STAFF	13	9
R. GILLIGAN	FELLOWS AND FELLOW PROFESSORS	12	12
L. HOGAN	VICE-PROVOST/CHIEF ACADEMIC OFFICER	13	13
M. KENNY	STUDENT REPRESENTATIVE (EDUCATION OFFICER OF THE STUDENTS' UNION)	13	11
T. KEOHANE	EXTERNAL MEMBER	11	10
B.M. LUCEY	FELLOWS AND FELLOW PROFESSORS	13	12
G.S. MARTIN	DEAN OF UNDERGRADUATE STUDIES/SENIOR LECTURER	13	12
C. McCABE	NON-FELLOW ACADEMIC STAFF	13	13
J.F. McGILP	FELLOWS AND FELLOW PROFESSORS	13	13
C. O'FARRELLY	FELLOWS AND FELLOW PROFESSORS	13	11
D. O'NEILL	NON-FELLOW ACADEMIC STAFF	13	09
M. Ó SIOCHRÚ	FELLOWS AND FELLOW PROFESSORS	13	13
D.R. PHELAN	FELLOWS AND FELLOW PROFESSORS	13	13
P.J. PRENDERGAST	PROVOST AND CHAIR OF THE BOARD	13	13
L. RUANE	STUDENT REPRESENTATIVE (PRESIDENT OF THE STUDENTS' UNION)	13	12
A. SEERY	NON-FELLOW ACADEMIC STAFF	13	12
IN ATTENDANCE			
I. MATHEWS	TREASURER/CHIEF FINANCIAL OFFICER (IN ATTENDANCE, <i>EX OFFICIO</i>)	13	13
J. COMAN	SECRETARY TO THE COLLEGE (IN ATTENDANCE, <i>EX OFFICIO</i>)	13	13
G. RUANE	CHIEF OPERATING OFFICER (IN ATTENDANCE, BY INVITATION)	13	13
J. HUSSEY	VICE-PRESIDENT FOR GLOBAL RELATIONS (IN ATTENDANCE, BY INVITATION)	13	12
V. BUTLER	ASSISTANT SECRETARY TO THE COLLEGE (IN ATTENDANCE)	6	6
S. KAVANAGH	ASSISTANT SECRETARY (ACTING) (IN ATTENDANCE)	7	7

Financial Elements 2015–16

In many countries State financial support for higher education institutions is declining and a greater proportion of the funding requirement has transferred from public to private sources. State funding for higher education has been in decline in Ireland since 2008 with some, but not all of the decline having been taken up by an increase in the student charge, with increases being set by the State itself.

Declining State support has focused the University on financial sustainability independent of exchequer sources. Trinity has identified and is focused on key areas of non-Exchequer income generation to diversify and grow its income streams. An additional challenge is that State capital and infrastructure renewal funding has been suspended in recent years and the University must therefore provide for infrastructure renewal from within its own resources and provision for this has now been made apparent since the University moved to GAAP accounting (prior to this financial reporting had been via the Higher Education Authority (HEA) funding statements which took no account of infrastructure renewal). As a result, and despite a strong balance sheet and net assets of c. €900m, moving from a deficit to a surplus is a challenge that will take several years to complete when provision for infrastructure renewal is taken into account.

Under GAAP accounting, Trinity is projecting a financial deficit of around €34m (2014–15: €24.1m) for the financial year 2015–16. This figure includes two once-off exceptional items in respect of the demolition of Luce Hall and Oisín House, a significant provision for infrastructure renewal along with strategic and operational investments. It is important to note that the assets being written off will be replaced by more productive assets, such as the Trinity Business School and new Student Residences, in due course.

In line with the requirements of Section 37 of the Universities Act 1997, the University notified the HEA in July 2016, that expenditure will exceed income in 2015–16. Trinity has a financial plan to eliminate the deficit; however, even after allowing for continued investment in approved income generation and cost reduction strategies along with an ongoing provision for asset renewal, it is anticipated that the University will report reducing deficits in the coming years.

As a result, we continue to review and maximise the return on our investment in income growth strategies (including non-EU recruitment, online courses, philanthropy and commercial initiatives) and critically challenge our existing cost base in order to return to surplus. The University must also continue to generate sustainable funding sources and press for a fit for purpose remuneration framework and operational flexibility mirroring that experienced by our international peers to enable it to invest in the new academic initiatives identified in the University's Strategic Plan 2014–2019 (and beyond) and to continue to compete globally.

Furthermore, given the ambition and scale of the University's Strategic Plan 2014–2019, the University is focusing on the prioritisation of major projects and adopting a coherent approach to deliver the key projects as envisaged in the Plan.

In the years ahead, there is no doubt that the financial environment will continue to provide significant challenges to the University. However the outputs from the Cassells' Report of the Expert Group on Future Funding for Higher Education, published in July 2016, may help to mitigate these challenges in due course.

The Consolidated Financial Statements for the year ended 30 September 2015 were approved by the Board in March 2016 and the summary financial position is set out below.

15 Summary Financial Position 2011–15

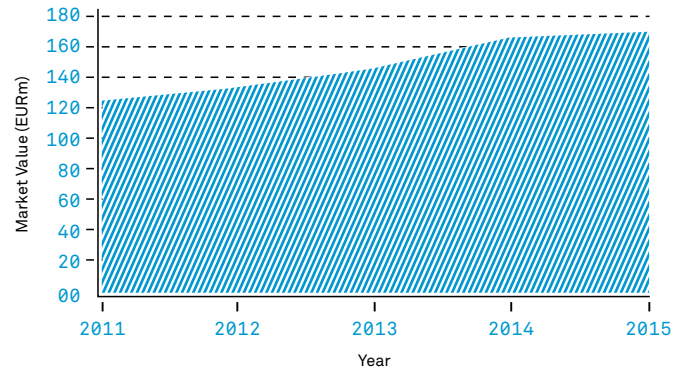
	2015 €m	2014 €m	2013 €m	2012 €m	2011 €m
State grants	44.5	47.3	54.5	58.7	66.7
Academic fees	128.9	124.2	116.1	113.8	111.9
— EU UG	71.3	70.6	68.7	68.4	66.0
— EU PG	23.1	22.1	23.1	22.7	22.2
— Non EU UG	22.7	21.0	17.1	16.1	16.7
— Non EU PG	7.4	6.7	5.8	5.2	5.2
— Other	4.4	3.8	1.4	1.4	1.8
Research grants and contracts	85.2	78.0	74.7	75.9	78.5
CRU Income	29.1	25.2	23.3	23.3	21.2
Other income	23.3	24.0	27.3	26.2	23.6
Endowment and investment income	10.2	15.8	9.3	11.0	10.1
Income (excluding grant amortisation)	321.2	314.5	305.2	308.9	312.0
Staff costs	230.7	225.7	221.8	220.9	219.6
Other operating expenses	94.5	89.4	87.6	92.4	84.3
Total operating expenses	325.2	315.1	309.4	313.3	303.9
Operating (deficit)/surplus before interest costs and net depreciation	(4.0)	(0.6)	(4.2)	(4.4)	8.1
Less:					
Depreciation (net of grant amortisation)	16.0	17.0	14.1	12.0	13.0
Interest payable	4.1	4.2	4.2	4.8	4.1
Deficit for the year	(24.1)	(21.8)	(22.5)	(21.2)	(9.0)

A combination of strong student recruitment, increasing research activity and significant profits by the Commercial Revenue Unit (CRU) helped to deliver consolidated income, excluding grant amortisation, for 2014/15 of €321.2m (2013/14: €314.5m) which represents an increase of 2.1% on the prior year. Consolidated expenditure, excluding depreciation and interest payable, for the year amounted to €325.2m (2013/14: €315.1m).

Consistent with our plans, the Consolidated Financial Statements for 2014/15 report an operating deficit before net depreciation and interest costs of €4.0m which reflects the University’s upfront investment in approved income generating strategies. The total planned deficit of €24.1m reflects the University’s provision for infrastructure renewal by way of a net depreciation charge of €16.0m.

As reported in the Consolidated Balance Sheet, the net assets amount to €887.2m at 30 September 2015, a decrease of €22.1m since 2013/14. There were cash balances of €178.6m at 30 September 2015 (2014: €169.7m) and a €75.0m loan facility with the European Investment Bank, all of which was drawn down at 30 September 2015. The University complied with all of its bank covenants at the year end. Post year-end, on 1 October 2015, a second EIB loan in the amount of €70.0m was drawn down which will fund future capital projects including the new Business School and Oisín House student accommodation developments.

The value of the Endowment Fund was €168.7m at 30 September 2015, showing strong progress towards the target value set out in the University’s Strategic Plan. The market value of the Fund has steadily increased over the last 5 years as set out below with total cumulative returns for the last 1, 3 and 5 years of 5.2%, 31.8% and 51.9% respectively. The gross contribution made by the Endowment Fund to the University, of €6.6m in 2014/15, continues to be a significant source of income, enabling the University to maintain the quality and integrity of academic and support programmes eg: academic posts, prizes, scholarships, research, financial assistance, Library and IT transformation projects.



The level of research activity for 2014/15 recorded in the Consolidated Financial Statements (measured on the basis of expenditure activity during the year and not income received) amounted to €85.2m (2013/14: €78m). The value of new awards entered into in the year amounted to €105m, an increase of 57% on the prior year (2013/14: €67m). Trinity was the most successful Irish institution under the EU Framework 7 Programme and has had a successful start to Horizon 2020 particularly with grants from the European Research Council. In 2014/15 the Exchequer/non-Exchequer split of research income was 65:35 (2013/14: 66:34). The research environment remains very competitive and current projections for research income to remain at c. €85m over the next 3–4 years are dependent on the continuing success of the Research Diversification Strategies (which focus on EU, Industry and other non-Exchequer funding).

Trinity Development & Alumni, having worked with the University to generate new gifts/pledges amounting to €53m, receipted a total of €14m in project funds in 2014/15. A total amount of €8m was transferred to the University in the year to support academic posts, student access, scholarships, research and capital infrastructure.

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