



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

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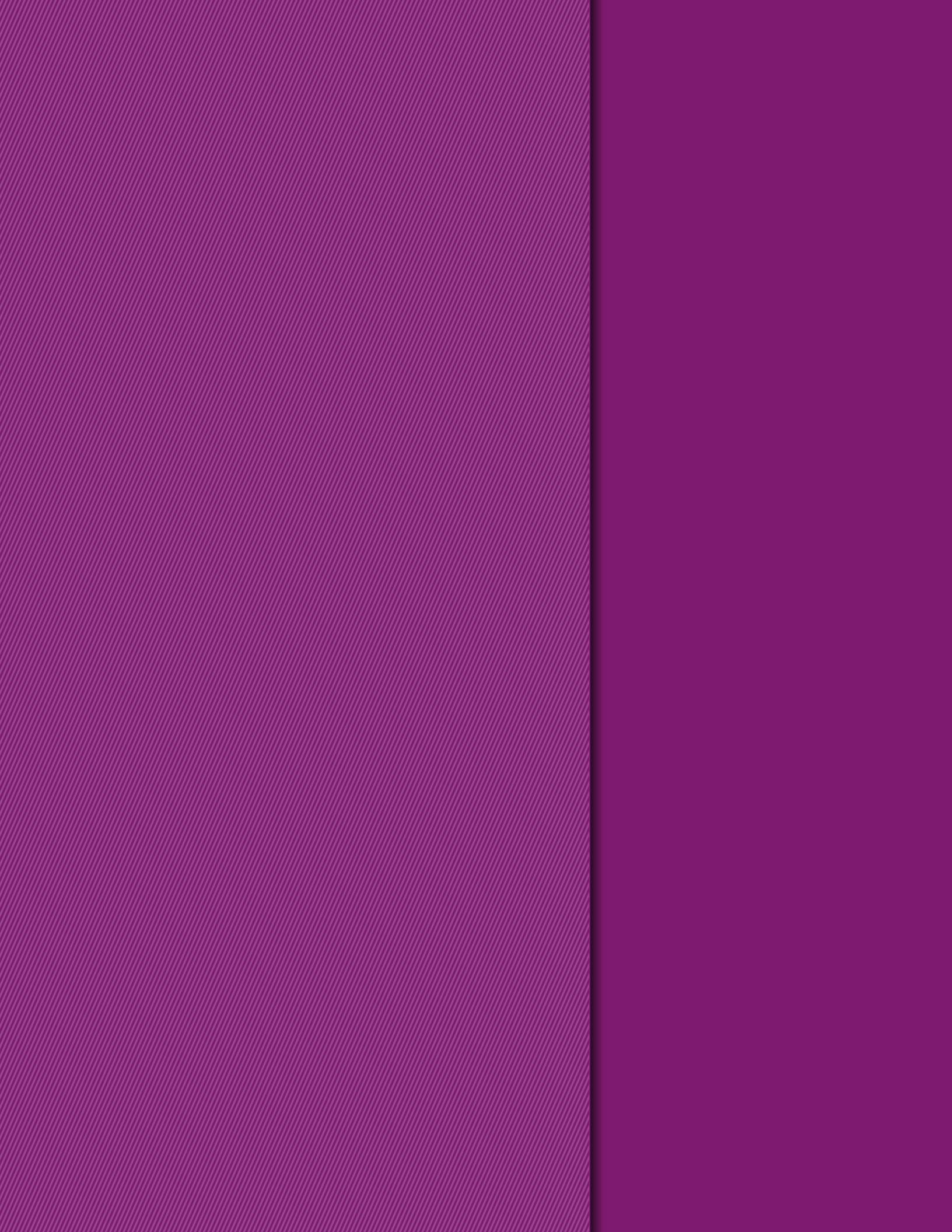
# Annual Review

# 2017— 2018

**DR PATRICK PRENDERGAST**  
PROVOST & PRESIDENT

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# Introduction from the Provost

It's hard to pick among the many highlights of the academic year 2017/18, which has seen such stand-out initiatives across the full range of our college activities. However, one of my favourite images of the year is the stack of books on my 'to read' list, all published by Trinity people in recent months - books by staff on history, literature, science and neuroscience, prize-winning novels and nonfiction by graduates; an essay by our Chancellor, and a memoir by one of our Senators. It's not easy trying to keep on top of what Trinity people are doing! And I'm also very proud of the news that Trinity secured €100.6 million in research funding in 2017. Four years ago, in 2013, that figure was €74 million, which means that in less than five years, we increased our research revenue by one third - and it was already by far the highest of any Irish university.

This achievement comes thanks to our significant success with national, EU and international funding bodies including the Irish Research Council (IRC), Science Foundation Ireland (SFI), Horizon 2020, the European Research Council (ERC) and the Wellcome Trust. Trinity has won half of all Irish ERC grants.

Research and scholarship is the foundation of our reputation as a university, which is why I pick out these achievements. Excellence in research enables world-class education, innovation, industry link-ups and public engagement and it gives us confidence to approach benefactors

with the message that Trinity is worth supporting because it performs so competitively and contributes so decisively to the world of knowledge.

In this Review, we give a brief snapshot of Trinity research - in **Chapter 4, Research Case Studies**, twelve of our researchers across our three faculties detail some of their research activities - from addressing social exclusion in the Irish higher education system to nanophotonics (light-matter interaction on the nanoscale); from how political-legal constitutions work to targeting MRSA; from digitizing bardic poetry to gauge theories from superstrings. And in **Chapter 12, New Professor Interviews** we talk to our four new professors - in Botany, Neurophysiology of Epilepsy, Translational Cancer Medicine and French - and hear about the exciting research they're doing in their disciplines.

Research and education are inextricably intertwined in Trinity, and that's education in its broader sense - what happens inside and outside the lecture room and library. This year was transformative for education - we signed a partnership agreement with Columbia University for a Dual BA programme, allowing students to graduate from both universities with two degrees over four years. The initial cohort of 40 students started in September 2018. In **Chapter 3, Trinity's Global Engagement** we look at the Columbia partnership and our other global student exchanges and research collaborations.



→ This year was transformative for education – we signed a partnership agreement with Columbia University for a Dual BA programme, allowing students to graduate from both universities with two degrees over four years.



Through the generations, Trinity students have always helped shape college traditions and transform campus life. That was certainly true this year when students voted to end single-use plastic on campus and successfully protested over a supplemental exam fee in the “Take Back Trinity” campaign. In **Chapter 8, The Student Experience** we focus on the many ways that students contribute outside the classroom, while in **Chapter 10, Developing a Sustainable Campus**, we look at college-wide efforts to live and work more sustainably. In February Trinity became the first university in Ireland to join the International Sustainable Campus Network, ISCN, a global forum of leading colleges, universities and corporate campuses exchanging information, ideas, and best practices for achieving sustainable operations and integrating sustainability into research and teaching.

In **Chapter 13, Philanthropy and Alumni Engagement**, we celebrate alumni engagement across 150 countries worldwide and the support that they and our benefactors give the college.

This year saw the single largest private philanthropic donation in the history of the state to Trinity, a gift of €25 million from the Naughton family for our ambitious new Engineering, Environment and Emerging Technologies Institute, E3, which will bring together engineers alongside natural scientists and computer scientists to strive for solutions to some of the greatest challenges facing our planet today.

E3 will be built in two stages – work on the E3 Learning Foundry will shortly commence on the site of the old Biochemistry building at the East-End of the campus. It will be followed by the E3 Research Institute which will be the lynchpin of a new Trinity tech campus on Grand Canal Quay – this will be developed as part of a new innovation district for Dublin. We talk about our plans for this new district in **Chapter 5, Trinity at Grand Canal Quay**.

As ever, public lectures, symposia, talks, exhibitions, films and performances were some of the key ways in which Trinity delivered on our commitment to engage wider

**ABOVE** – Among the contributors and representatives of areas included in this Provost’s Review are, standing (L-R) Sally-Anne Fisher, Head of Communications; Dr Diarmuid O’Brien, Chief Innovation & Enterprise Officer; Kate Bond, Director of Advancement, Trinity Development & Alumni; Michelle Tanner, Head of Sport & Recreation; John Coman, Secretary to the College; Ian Mathews, Chief Financial Officer; Prof John Parnell, Chair, Grounds and Gardens Advisory Committee; Prof Darryl Jones, Dean, Faculty of Arts Humanities and Social Sciences; 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.



→ One of my favourite images of the year is the stack of books on my ‘to read’ list, all published by Trinity people...

society. We talk about some of these in **Chapter 7, Public Engagement**. Some of my favourite events - choosing from a very competitive field - include Hillary Clinton’s inspirational public lecture in June addressing challenges to democracy, the role of women in politics and the power of young people to shape the future; also the Long Room’s exhibition on Oscar Wilde in October showcasing Wildean letters, photographs, theatre programmes, books and memorabilia from the Library’s collection; and Science Gallery Dublin’s spring exhibition FAKE, which looked at all the ways and things that we fake – not just news but taste, emotions, chemical signatures, facts, and trademarks.

It’s been another exceptional Trinity year. My thanks to the whole community - staff, students and alumni - for always achieving above and beyond expectations.

**Dr Patrick Prendergast**  
Provost & President

# Trinity at a Glance

Trinity is Ireland's  
No. 1 University

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





→ A 426 year old university in the heart of Dublin city centre

# 02

## Student Statistics

2018 | 2013

(6 year comparisons)



### ALUMNI

2018 | 2013

**140,695** | 100,277

REPUBLIC OF IRELAND	93,733	74,170
GREAT BRITAIN	12,958	9,616
NORTHERN IRELAND	5,990	4,621
USA	8,265	3,557
CANADA	1,630	1,162
REST OF WORLD	18,119	7,151

### CLUBS AND SOCIETIES

**49** | 49

SPORTS CLUBS

**126** | 112

STUDENT SOCIETIES

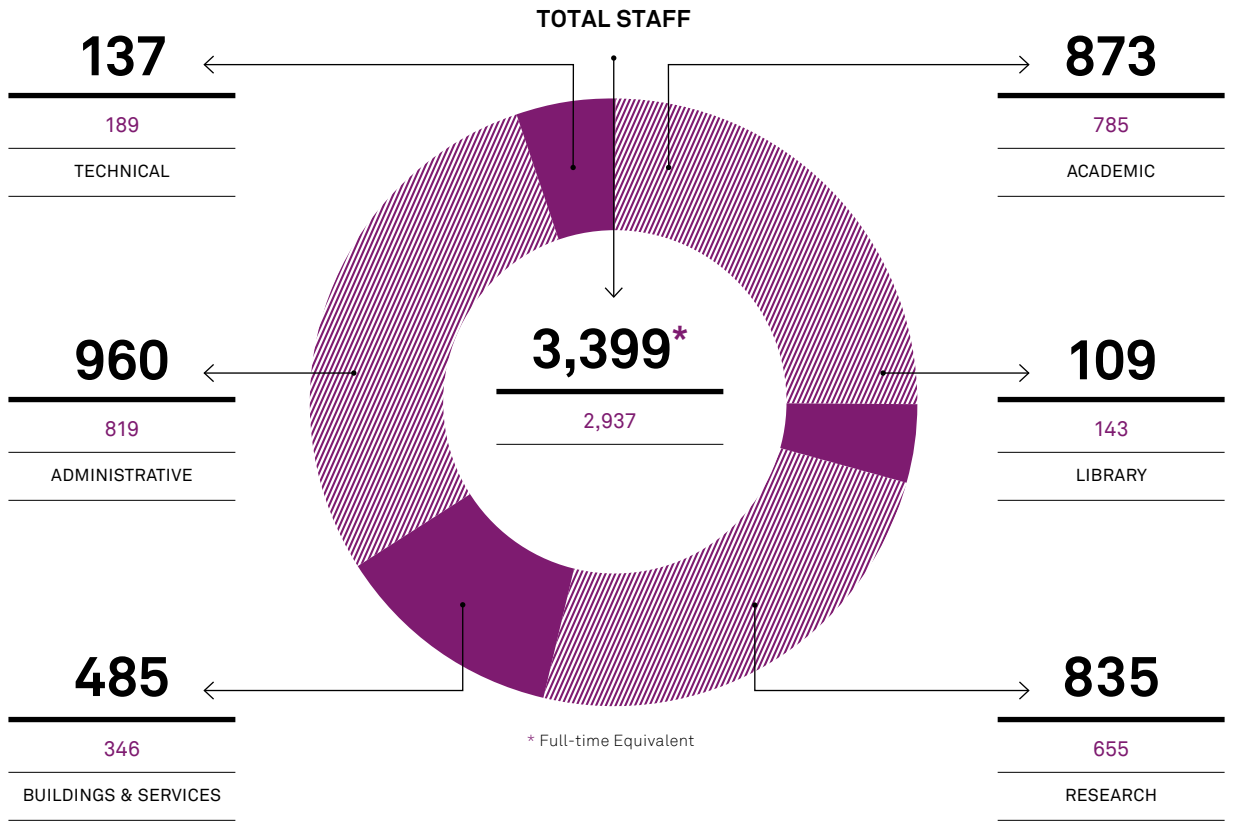
#### THE LARGEST SOCIETIES ARE:

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

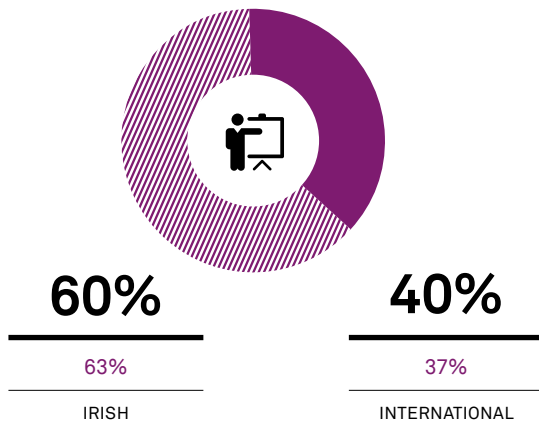
— The college historical society (the hist) is the oldest student society in the world, founded in 1770

## Staff Statistics

2018 | 2013  
(6 year comparisons)

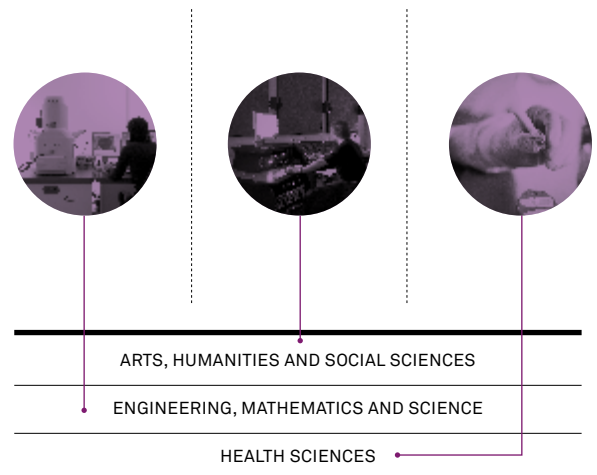


### ACADEMIC STAFF\*



\* Headcount

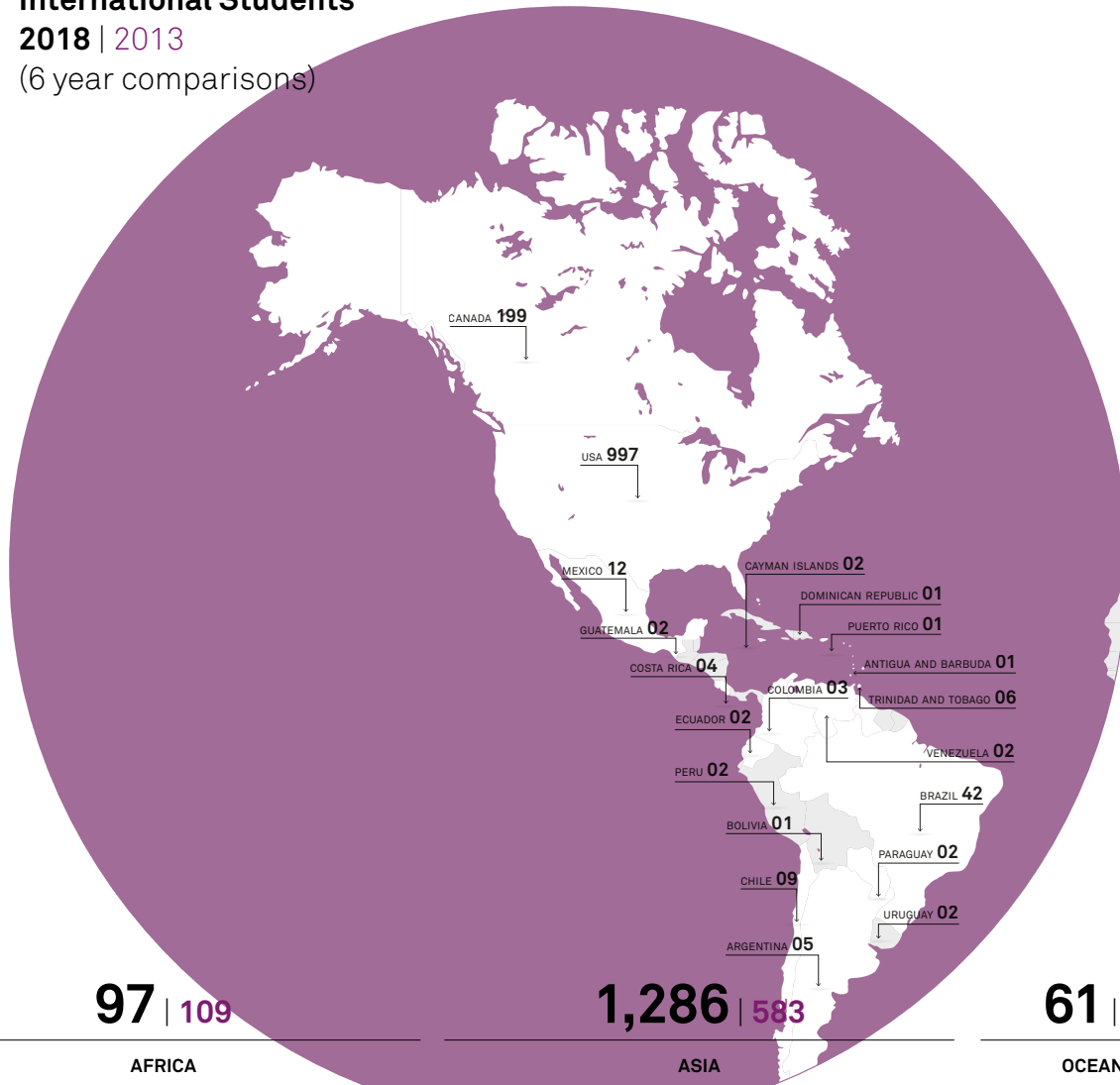
### FACULTIES



# 02 International Students

## 2018 | 2013

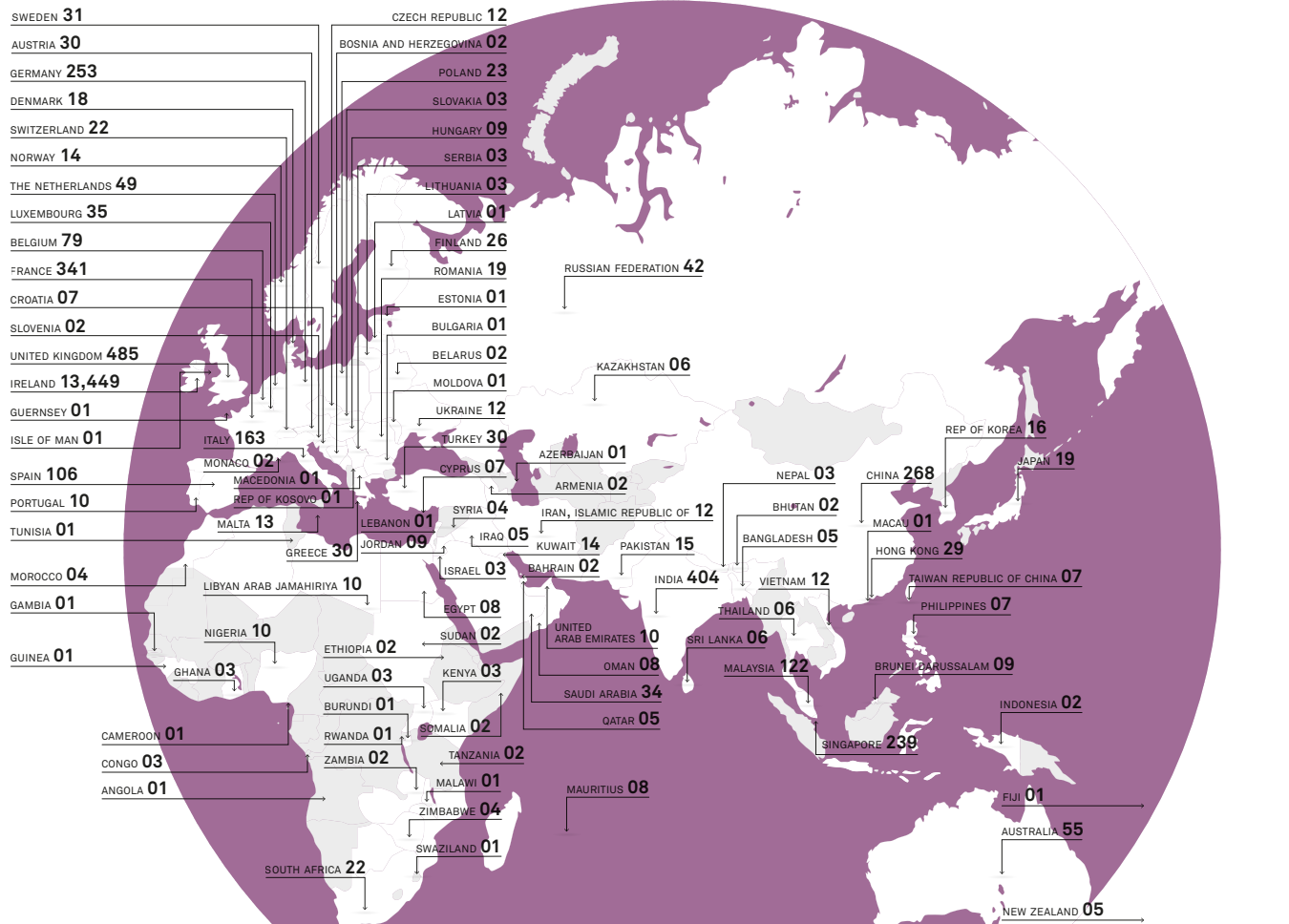
(6 year comparisons)



AFRICA			
ALGERIA	0		1
ANGOLA	1		0
BOTSWANA	0		5
BURUNDI	1		0
CAMEROON	1		1
CONGO	3		0
EGYPT	8		3
ETHIOPIA	2		3
GAMBIA	1		0
GHANA	3		0
GUINEA	1		0
KENYA	3		4
LESOTHO	0		1
LIBYA	10		6
MALAWI	1		4
MAURITIUS	8		7
MOROCCO	4		2
MOZAMBIQUE	0		1
NIGER	0		1
NIGERIA	10		33
RWANDA	1		1
SOMALIA	2		0
SOUTH AFRICA	22		18
SUDAN	2		6
SWAZILAND	1		0
TANZANIA	2		1
TUNISIA	1		0
UGANDA	3		3
ZAMBIA	2		3
ZIMBABWE	4		5
<b>TOTAL</b>	<b>97</b>	<b> </b>	<b>109</b>

ASIA			
ARMENIA	0		1
AZERBAIJAN	1		2
BAHRAIN	2		2
BANGLADESH	5		7
BHUTAN	2		0
BRUNEI DARUSSALAM	9		1
CHINA	268		99
HONG KONG	29		1
INDIA	404		90
INDONESIA	2		1
ISLAMIC REP OF IRAN	12		12
IRAQ	5		7
ISRAEL	3		1
JAPAN	19		16
JORDAN	9		6
KAZAKHSTAN	6		16
KUWAIT	14		8
LEBANON	1		1
MACAU	1		2
MALAYSIA	122		107
NEPAL	3		0
OMAN	8		3
PAKISTAN	15		17
PHILIPPINES	7		10
QATAR	5		1
REP OF KOREA	16		14
SAUDI ARABIA	34		24
SINGAPORE	239		120
SRI LANKA	6		2
SYRIAN ARAB REPUBLIC	4		1
TAIWAN REP OF CHINA	7		1
THAILAND	6		1
UNITED ARAB EMIRATES	10		6
VIETNAM	12		3
<b>TOTAL</b>	<b>1,286</b>	<b> </b>	<b>583</b>

OCEANIA	
AUSTRALIA	55   26
FIJI	1   0
NEW ZEALAND	5   7
<b>TOTAL</b>	<b>61   33</b>



**15,208** | 15,093

**EUROPE EU**

AUSTRIA	30		20	ISLE OF MAN	1		0
BELGIUM	79		61	ITALY	163		74
BULGARIA	1		3	LATVIA	1		3
CROATIA	7		0	LITHUANIA	3		11
CYPRUS	7		8	LUXEMBOURG	35		12
CZECH REPUBLIC	12		7	MALTA	13		4
DENMARK	18		11	POLAND	23		40
ESTONIA	1		1	PORTUGAL	10		10
FINLAND	26		18	ROMANIA	19		11
FRANCE	341		205	SLOVAKIA	3		6
GERMANY	253		190	SLOVENIA	2		1
GREAT BRITAIN	485		637	SPAIN	106		70
GREECE	30		22	SWEDEN	31		28
GUERNSEY	1		0	THE NETHERLANDS	49		35
HUNGARY	9		5	<b>TOTAL</b>	<b>15,208</b>		<b>15,093</b>
IRELAND	13,449		13,600				

**134** | 90

**EUROPE NON EU**

ALBANIA	0		2
ARMENIA	2		0
BELARUS	2		1
BOSNIA & HERZEGOVINA	2		1
CANARY ISLANDS	0		2
GIBRALTAR	0		1
ICELAND	0		1
MACEDONIA	1		0
MOLDOVA	1		3
MONACO	2		0
NORWAY	14		14
REPUBLIC OF KOSOVO	1		0
RUSSIAN FEDERATION	42		36
SERBIA	3		1
SWITZERLAND	22		19
TURKEY	30		8
UKRAINE	12		1
<b>TOTAL</b>	<b>134</b>		<b>90</b>

**1,225** | 718

**NORTH/CENTRAL AMERICA**

ANTIGUA AND BARBUDA	1		0
BAHAMAS	0		1
BARBADOS	0		1
BERMUDA	0		1
CANADA	199		158
CAYMAN ISLANDS	2		1
COSTA RICA	4		0
DOMINICAN REPUBLIC	1		0
GUATEMALA	2		0
HAITI	0		1
MEXICO	12		10
PUERTO RICO	1		0
TRINIDAD & TOBAGO	6		5
USA	997		540
<b>TOTAL</b>	<b>1,225</b>		<b>718</b>

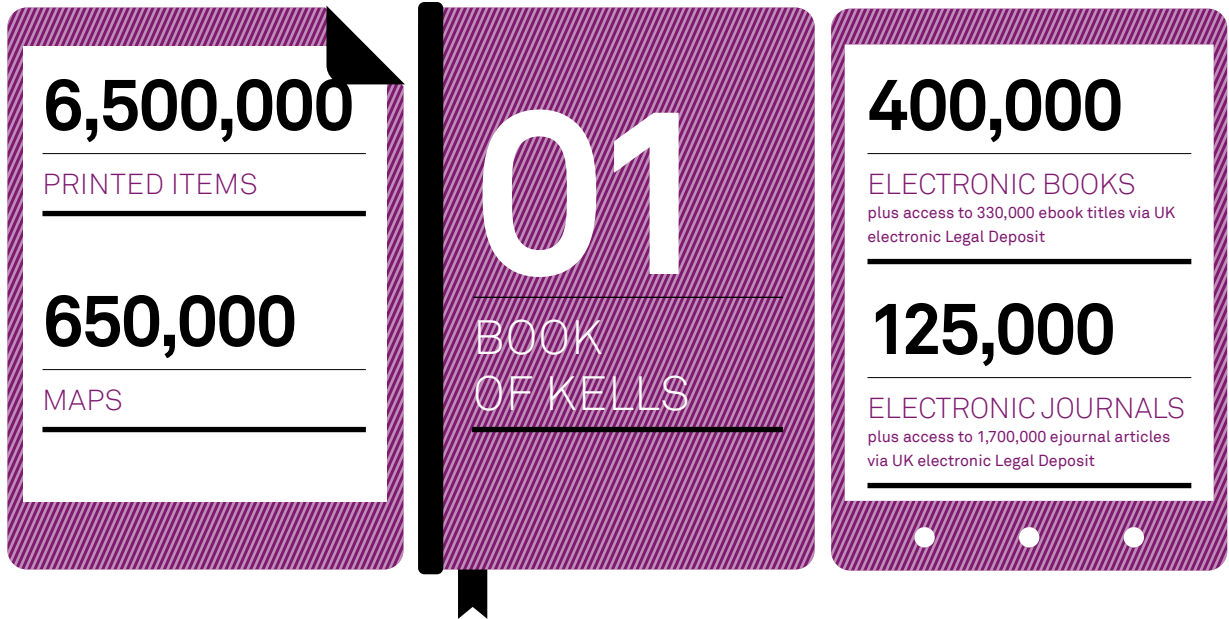
**70** | 19

**SOUTH AMERICA**

ARGENTINIA	5		0
BOLIVIA	1		0
BRAZIL	42		12
CHILE	9		4
COLOMBIA	3		2
ECUADOR	2		0
PARAGUAY	2		0
PERU	2		1
URUGUAY	2		0
VENEZUELA	2		0
<b>TOTAL</b>	<b>70</b>		<b>19</b>

## 02 Library

### LIBRARY COLLECTION HAS



### TRINITY'S RESEARCH THEMES

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

### 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

2018 | 2014

(5 year comparisons)

IN THE PERIOD 2013–2018  
(2009–2014)

**360** | 308

INVENTION DISCLOSURES

**137** | 81

LICENCES TO INDUSTRY

**23** | 37

TRINITY CAMPUS  
COMPANIES APPROVED

IN THE YEAR ENDED SEPTEMBER 2018  
(2014)

**05** | 04

TRINITY CAMPUS COMPANIES

**80** | 58

DISCLOSURES OF NOVEL INTELLECTUAL  
PROPERTY

**27** | 28

COMMERCIALISATION LICENCES  
TO INDUSTRY

**19** | 23

NEW PATENT APPLICATIONS FILED

**39** | 32

COLLABORATIVE RESEARCH  
AGREEMENTS WITH INDUSTRY EACH <€25K

**61** | 51

COLLABORATIVE RESEARCH  
AGREEMENTS WITH INDUSTRY EACH >€25K

## CONSOLIDATED FINANCIAL STATEMENTS

**€355.8M**

TOTAL INCOME FOR  
YEAR ENDED 2017  
(EXCLUDING GRANT  
AMORTISATION)

**€339.0M**

TOTAL INCOME FOR  
YEAR ENDED 2016  
(EXCLUDING GRANT  
AMORTISATION)

**€323.0M**

TOTAL INCOME FOR  
YEAR ENDED 2015  
(EXCLUDING GRANT  
AMORTISATION)

**€305.7M**

TOTAL INCOME FOR  
YEAR ENDED 2014  
(EXCLUDING GRANT  
AMORTISATION)

**€302.3M**

TOTAL INCOME FOR  
YEAR ENDED 2013  
(EXCLUDING GRANT  
AMORTISATION)

FINANCIAL YEAR	€m 2012	€m 2017
STATE GRANTS	€58.70	€44.50
ACADEMIC FEES	€113.80	€136.90
RESEARCH GRANTS AND CONTRACTS	€75.90	€100.10
COMMERCIAL REVENUE UNIT INCOME	€27.10	€42.10
OTHER INCOME	€22.40	€11.30
ENDOWMENT AND INVESTMENT INCOME	€6.60	€20.90
<b>INCOME (EXCLUDING GRANT AMORTISATION)</b>	<b>€304.50</b>	<b>€355.8</b>

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# Trinity's Global Relations

**In 2018 Trinity celebrated its most significant and wide-reaching university partnership to date with the launch, in February, of a dual degree programme with top Ivy League college, Columbia University in New York.**

Academics in the Faculty of Arts, Humanities and Social Sciences worked with colleagues in Columbia over 18 months to develop undergraduate programmes of study to lead to dual degrees in four humanities disciplines (see page 18). The response from prospective students was immediate, with applications received from over 20 countries. Trinity welcomed the first cohort of 40 students this September.

The dual degree programme with Columbia brings to the next level Trinity's global engagement which focuses on:

- Building global collaborations and partnerships;
- Ensuring a global student community with a truly diverse profile;
- Leveraging the global reach and impact of Trinity's research, education and innovation; and
- Supporting the continued delivery of a high-quality student experience.





→ The increase of students from around the world is thanks to sustained engagement by the Global Relations Team and academics from all schools on recruitment and partnerships activity.

## 03

### Global partnerships

As well as the ground-breaking agreement with Columbia University, Trinity signed a new strategic partnership with the University of Science and Technology Beijing. The UG 2+2 will allow students reading Physics to transfer into Junior Sophister year at Trinity. On successful completion of the programme, students will graduate with a University of Dublin award. The first intake of students is anticipated for September 2019.

In October 2017 the Provost led a delegation to the Middle East and Gulf states and visited Lebanon, Egypt, Kuwait, Oman and UAE. One of the objectives of this trip was to cultivate strategic relationships with the most prominent universities in the region including the American University of Beirut in Lebanon, Sultan Qaboos University in Oman, and the University of Kuwait. In addition to discussions on general academic collaboration there was particular focus on developing exchange agreements for students on the new undergraduate programme in Middle Eastern and European Languages and Culture (MEELC). The trips included engagement with alumni in all countries visited.

### A diverse and global student community

The student body continues to grow in terms of diversity and last year students from 124 countries registered in Trinity. In 2017/18, 4,632 students came from outside of Ireland and 2,874 students came from outside of Europe (approximately 26% and 16% respectively).

The increase of students from around the world is thanks to sustained engagement by the Global Relations Team and academics from all schools on recruitment and partnerships activity. The focus of direct recruitment continues to be US, Canada, Asia and the Middle East; however the success and reputation of the International Foundation Programme has led to students from Tanzania, Armenia, Russia, Ukraine and Swaziland. Though only in its second year, the Foundation Programme - a pre-university one-year programme to enable international students to prepare for university admission - is globally recognised and the number of students has exceeded initial expectations.

The US open days continue to be an important part of the annual schedule and last year saw a record number of potential students and parents attend. The open days also provide an opportunity for further engagement with alumni who assist in panel sessions and in advising parents and potential students. Trinity Development and Alumni also organised alumni events in Chicago and Boston where graduates were updated on recent developments including E3, the Trinity Business School and the Trinity Education Project.

**BELOW** – In addition to hosting 74 visits to Trinity by international universities, the Provost, the vice-president for Global relations and senior staff from her office made visits to the following universities:

<b>BRAZIL</b>	THE UNIVERSITY OF CAMPINAS THE UNIVERSITY OF SÃO PAULO THE FEDERAL UNIVERSITY OF RIO DE JANEIRO PONTIFICAL CATHOLIC UNIVERSITY OF RIO DE JANEIRO FLUMINENSE FEDERAL UNIVERSITY
<b>CHINA</b>	MINZU UNIVERSITY SOUTHEAST UNIVERSITY NANJING NORMAL UNIVERSITY BEIJING FOREIGN STUDIES UNIVERSITY TSINGSHUA UNIVERSITY CITY UNIVERSITY OF HONG KONG THE UNIVERSITY OF HONG KONG TONGJI UNIVERSITY UNIVERSITY OF SCIENCE AND TECHNOLOGY, BEIJING
<b>DENMARK</b>	UNIVERSITY OF COPENHAGEN
<b>FRANCE</b>	UNPC PARIS
<b>SPAIN</b>	UNIVERSITY OF BARCELONA
<b>INDIA</b>	THAPAR UNIVERSITY MANIPAL UNIVERSITY ASHOKA UNIVERSITY OP JINDAL UNIVERSITY BITS PILANI
<b>USA</b>	COLUMBIA UNIVERSITY BARNARD UNIVERSITY NEW YORK UNIVERSITY
<b>VIETNAM</b>	VIETNAM NATIONAL UNIVERSITY HANOI VIETNAM NATIONAL UNIVERSITY HCMC UNIVERSITY OF INFORMATION TECHNOLOGY JON VAN NEUMANN INSTITUTE HCMC UNIVERSITY OF TECHNOLOGY UNIVERSITY OF ECONOMICS HCMC

### Impactive global research, education & innovation

Trinity has enjoyed particular success in securing European research funding over recent years - winning 35 European Research Council PI grants since 2007, worth nearly €64 million in funding. Trinity is currently 28th in Europe out of over 900 higher education institutions in terms of numbers of ERC awards secured during Horizon 2020. The university recognises the particular importance of engaging with European partners as the UK prepares to exit the EU. The Provost led a number of high level visits to European universities over the last year, including to the universities of Copenhagen, Barcelona and Paris-Sorbonne, and Trinity is currently advancing plans and approaching partner institutes to develop a European Universities Network, as envisaged by the European Council in 2017 to be part of FP9.

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**BELOW LEFT** – International students enjoying Freshers Week

**BELOW RIGHT (L-R)** – HE Dr Rawya AlBusaidi, Oman's Minister of Higher Education meets the Provost, Dr Patrick Prendergast



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The Trinity Access Programme (TAP) is collaborating with the Oxford University college, Lady Margaret Hall, to bring the TAP Foundation Year to Oxford in a four-year pilot scheme. The second cohort of students started in September 2017; two other Oxford colleges are now interested in joining the scheme.

The new Trinity Centre for Literary and Cultural Translation (TCLCT) launched in April. The first Centre of its kind in Ireland and only the second in UK and Ireland, it showcases the university's proficiency in modern languages and is building relationships with other cultural institutions in Dublin to host events that place translation and global languages centre-stage.

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#### **A high-quality student experience**

Trinity aims for students to gain international experience, where possible, and on campus, to enjoy an enriching cosmopolitan experience through curricular and extracurricular activities, organised by the Global Room and student societies.

During the academic year 2017/18, over 830 undergraduate students studied abroad as part of mobility programmes, research placements or clinical placements – this represents approximately 30% of all third-year undergraduates.

The next stage of the Trinity Education Project – involving semesterisation and elective modules - widens opportunities for students to spend a term or year in a university abroad, doing a combination of core and approved modules.

→ **In 2017/18, 4,632 students came from outside of Ireland and 2,874 students came from outside of Europe**

Trinity continues to expand college-wide student exchange programmes through signing new agreements with peer universities, and also plans to increase such exchanges with a number of key partners. There are currently eight new student exchange agreements being mapped with universities in US, Brazil, Middle East, Japan, Singapore and Vietnam.

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#### **The Global Engagement Awards**

Every year since 2015, the Provost has hosted annual Global Engagement awards in recognition of outstanding contributions by academic and professional staff.

The recipients of the 2018 Global Engagement Awards are: Professor Zuleika Rodgers as Programme Director for the Dual Degree programme with Columbia University and a joint award for Professor Charles Patterson and Prof Hongzhou Zhang to recognise their work in the development of a partnership with University of Science and Technology Beijing (USTB).

## 03

**BELOW LEFT** – Columbia University**BELOW RIGHT** – Students at the inaugural BA Dual Programme orientation day in Trinity**RIGHT** – Columbia University's Executive Vice President and Dean of the Faculty of Arts and Sciences, Prof David Madigan with Trinity Provost, Dr Patrick Prendergast**Dual BA Programme with Columbia University**

The Provost, Dr Patrick Prendergast and Columbia University's Executive Vice President and Dean of the Faculty of Arts and Sciences, Professor David Madigan signed the partnership agreement for Dual BA Programmes at a special event in Columbia University in February 2018, with academics from both institutions in attendance, along with Trinity alumni and Irish-Americans based in New York.

The Dual BA Programmes between Trinity and Columbia offer students the opportunity to immerse themselves in two elite research universities whose academic, social and cultural environments allow students to take advantage of the best that both Dublin and New York have to offer.

The newly launched programmes are unique in that students will graduate from the two leading universities with two degrees over the course of four years. The inaugural cohort of 40 students started in September 2018 at Trinity, studying one of four areas—English Studies, European Studies, History, or Middle Eastern and European Languages and Cultures – and they will go on to study at Columbia for their final two years, completing a core curriculum and several majors.

During their time in the programme, Dual BA students will be part of two vibrant academic communities with access to abundant extracurricular options on campus and beyond, as well as internship and entrepreneurial opportunities in both Dublin and New York City. In year four,

the research project, co-supervised by academics in Trinity and Columbia, will give students the opportunity to develop their interests.

The programme proved a winner from the outset, with high competition for places. Over 150 applications were received from Belgium, Bulgaria, Ireland, France, Sweden, UK, Australia, China, India, Philippines, Russia, Turkey and the US.

The initiative is a first for Trinity but builds on the success of two other dual degrees that Columbia University has with the prestigious Paris Institute of Political Sciences (Sciences Po) and City University of Hong Kong.

There is a rich shared heritage between Dublin and New York and between Trinity and Columbia that the Dual Programme can draw on: both universities were founded centuries ago by royal charter from British monarchs – Trinity in 1592 by Elizabeth I and Columbia in 1754 by George II – and both are multidisciplinary, urban universities, committed to academic freedom and progressive values and proud to serve their regions culturally, socially and economically.

The Dual BA Programme is Trinity and Columbia's way of giving students the international experience they will need to take advantage of opportunities in an ever more globalised, adaptive and flexible world. And both universities recognise the importance, in the world today, of making common cause with peer institutes, developing a sense of interrelated international intellectual life and a sense of togetherness and solidarity for shared values.



LEWISOH

# Research Case Studies

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**01** Áine Kelly

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**02** Anne-Marie Brady

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**03** Brendan Tangney

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**04** Eoin Mac Cárthaigh

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**05** Joan Geoghegan

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**06** Louise Bradley

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**07** Na Fu

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**08** Nicholas Johnson

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**09** Oran Doyle

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**10** Paul O'Grady

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**11** Paula Mayock

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**12** Sergey Frolov

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**BACK (L-R)** – Louise Bradley,  
Paul O’Grady, Na Fu, Oran Doyle,  
Brendan Tangney, Eoin Mac Cárthaigh,  
Paula Mayock, Sergey Frolov,  
Nicholas Johnson, Joan Geoghegan

**FRONT (L-R)** – Anne-Marie Brady,  
Provost Patrick Prendergast, Áine Kelly

## 04 Protecting the brain with exercise

Áine Kelly

The effects of ageing on brain function vary widely in different people, resulting in differing impacts on quality of life. Some older adults develop mild cognitive impairment that may progress to increasingly severe stages of dementia, while many of their peers maintain their youthful cognitive ability throughout life.

Solving the biological puzzle of why some people age more successfully than others has major health and societal consequences for our ageing population and is my key research interest. It appears that the lifestyle choices we make, including the frequency and duration of participation in physical activity, influence how well our brains function in old age.

Worryingly, the latest available data (World Health Organisation, 2013) show that only 31% of Irish adults aged 16 to 65 meet the recommended physical activity guidelines for good health, namely at least 30 minutes/day of moderate intensity activity on five days/week (or 150 minutes/week). This is despite the fact that regular exercise is a 'polypill' that can prevent and/or treat many chronic diseases including coronary heart disease, hypertension and type 2 diabetes. Of greatest interest to my laboratory, sedentary behaviour is linked with increased risk of dementia and cognitive impairment in old age.

**Cellular changes stimulated by exercise** – My work is focussed on assessing the specific impact of exercise on brain health at the cellular level. I investigate how neurogenesis, the birth of new neurons in the adult brain, is stimulated by exercise and may contribute to conferring resilience against age-related cognitive decline. I am also interested in the mechanisms by which exercise can modulate age-related neuroinflammatory changes, measured by assessing the proliferation and activation of glial cells in the brain, that can lead to impaired brain function.

The main experimental strategy in my laboratory, based in the Trinity College Institute of Neuroscience (TCIN), is to assess structural, functional and neurochemical changes in the brain following different periods of exercise. For example, we have recently found that exercising regularly early in life can protect against the cognitive effects of sedentary behaviour later in life. We saw that mice that are sedentary throughout their lives display progressive cognitive decline from middle-age onwards and by old age show evidence of damaging inflammation and decreased neurogenesis in the brain. In contrast, mice that exercised from youth to middle age had better cognitive function, fewer numbers of pro-inflammatory reactive astrocytes and microglia,

more new neurons and increased brain size when compared to their life-long sedentary peers. This indicates that exercise undertaken earlier in life has physical effects on brain structure that persist long after exercise ceases and that protect against age-related decline in function. In similar experiments, we have seen that early exercise can slow cognitive symptoms in a mouse model of Alzheimer's Disease.

Our present work, in collaboration with Prof. Marina Lynch, Professor of Cellular Neuroscience, is probing the anti-inflammatory ability of exercise further, assessing how exercise can modulate metabolic pathways in astrocytes and microglia that are characteristic of the pro- or anti-inflammatory state. Several other strands of research in my laboratory have an exercise focus. Recent projects have assessed the impact of exercise of differing intensities on cognitive function in human subjects, while an ongoing multi-disciplinary international collaborative project aims to identify cognitive and blood-borne markers of brain health and injury that may aid in the management of sports-related concussion.

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Áine Kelly is Associate Professor in Physiology in the School of Medicine and Associate Dean of Undergraduate Science Education. A Trinity graduate, she was awarded a B.A. (Mod) in Physiology and College gold medal in 1995, a PhD in 1999 and was elected to fellowship in 2009. She has been a principal investigator in the Trinity College Institute of Neuroscience since 2002. Her research expertise lies at the interface of exercise physiology and neuroscience and she assesses how lifestyle factors including physical activity can enhance and protect brain function throughout the lifespan.

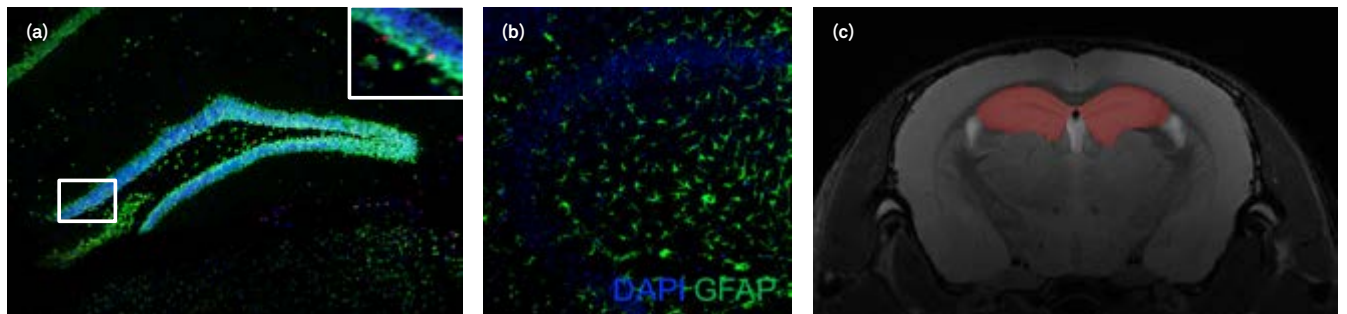
Contact: [aikelly@tcd.ie](mailto:aikelly@tcd.ie)



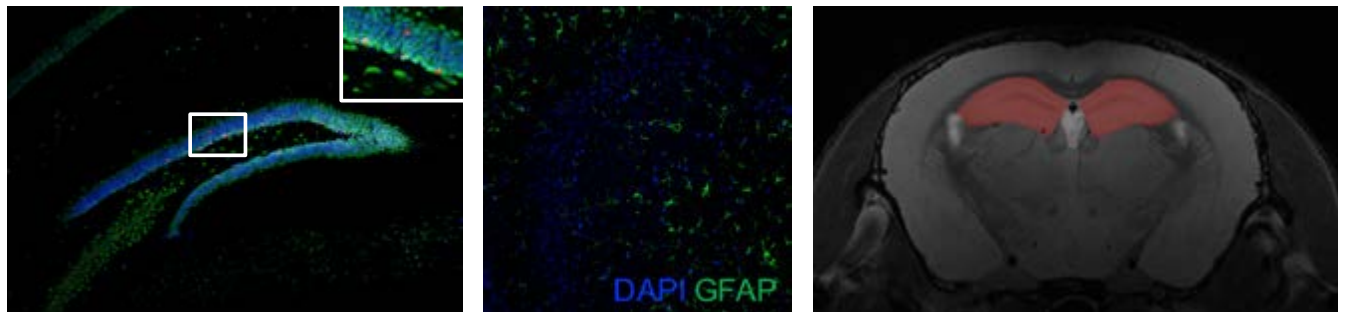
**BELOW**– Early-life exercise protects the brain in old age. Compared with sedentary mice that never exercised, mice that exercised regularly until middle-age, but were then sedentary until old age, had (a) more new neurons (red) (b) fewer reactive astrocytes (green) and (c) a larger brain size (MRI scan; hippocampus highlighted in red).

→ It appears that the lifestyle choices we make, including the frequency and duration of participation in physical activity, influence how well our brains function in old age.

SEDENTARY



EXERCISED



## 04 Innovating care for people living with chronic illness

Anne-Marie Brady

Demand for healthcare has increased exponentially as a result of individuals living longer with chronic illness and surviving conditions like cancer; this has produced considerable complexity in terms of integration of care and timeliness of response for health services.

Recent research into persons with dementia and cancer survivors has revealed considerable unmet needs across the continuum of care, due to challenges in providing integrated and patient centred care in constrained modern health services. We are successfully treating and caring for people suffering from chronic illnesses and preventing deaths that would have occurred in previous generations but unmet needs is an unfolding area of chronicity and a research concern. Increased numbers of people now survive but are left to cope with the lasting and challenging effects of their treatment.

The emerging view is that dependency on hospitals to provide care to ever increasing numbers of older people and those living with chronic illness or cancer is no longer feasible. At the core of healthcare reform is a realisation that it is time for a fundamentally new approach to the organisation of healthcare work. Professional role boundaries in the future will be more fluid so care can be optimized for service users. The need to develop evidence based and innovative ways to

deliver healthcare at the lowest point of acuity has informed my research agenda.

**Evaluating integrated care** – The focus of my research is largely in the sphere of implementation science and the development of healthcare systems, quality improvement and workforce development, informed by insight into systems-thinking in healthcare delivery. I am engaged in research studies in collaboration with health service providers to examine issues around patient related outcome measures, workload measurement, practice development, work redesign, patient safety and competency among health care workers.

I am currently leading a national, multi-site evaluation of integrated care within acute care for people with dementia across three major academic teaching hospitals in Ireland. I am complementing this with an evaluation of community care projects which test innovative ways to transform the deployment of home care packages thus retaining people with dementia at home for longer. A national study, arising from this evaluation, is currently investigating transformation in organisation culture within community healthcare organisations.

**Managing chronic illness** – I am a co-applicant and member of the coordinating

team on a Horizon 2020 project, ProAct-Evaluation of a Digital Integrated Care ecosystem for the management of multi-morbidity. This study targets Europe's 50 million multimorbid patients to proactively self-manage, thus offsetting the EU's annual €700 billion cost of chronic disease management.

Working with the HSE and UCC, I will be leading on a national project to evaluate and determine the impact of an increase in the use of Advanced Nursing Practitioner roles to reduce waiting lists in chronic illness. Over the next few years I will continue to work and expand this programme of research to determine innovative ways to enhance integration of care in chronic illness.

**Recent research into persons with dementia and cancer survivors has revealed considerable unmet needs across the continuum of care, due to challenges in providing integrated and patient centred care in constrained modern health services**

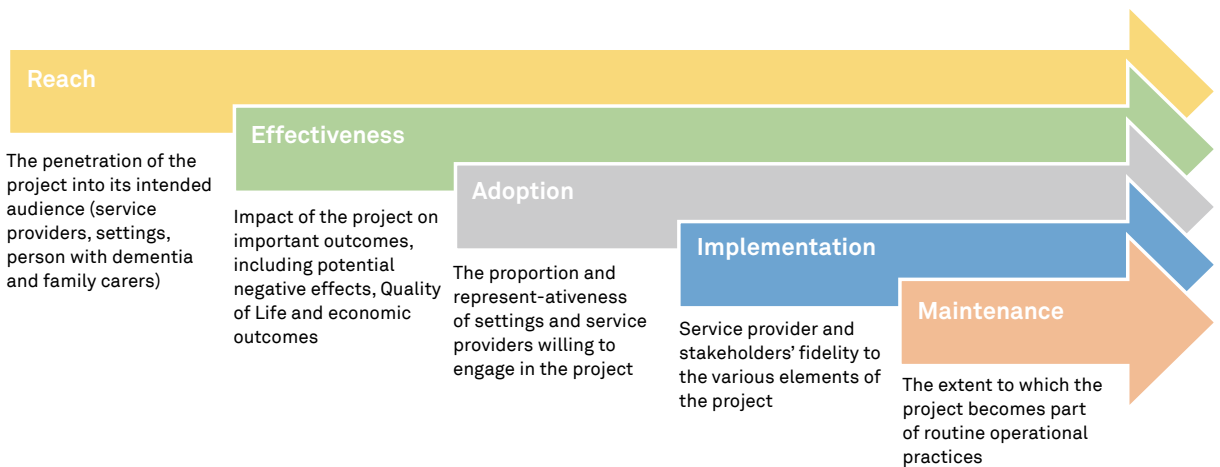
**Anne-Marie Brady** received her MSc from North Eastern University in Boston and PhD from Trinity. She joined the School of Nursing & Midwifery in 2002 and is now Professor of Nursing & Chronic Illness and PI with Trinity Centre for Practice and Healthcare Innovation. A Registered General Nurse, she has over 30 years of clinical practice, education and research experience in nursing and health care management in Ireland and abroad. Her research focuses on producing and evaluating complex interventions and innovation in care for people who live with chronic illness.

Contact: [Anne-Marie.Brady@tcd.ie](mailto:Anne-Marie.Brady@tcd.ie)

**BELOW** – RE-AIM Framework for Evaluation in Integrated Dementia Care

**BOTTOM** – Remaining at home/Reablement in Dementia Care

→ At the core of healthcare reform is a realisation that it is time for a fundamentally new approach to the organisation of healthcare work.



## 04 Addressing social exclusion in the Irish higher education system and promoting 21st century Teaching & Learning

Brendan Tangney

Education systems around the world are faced with a myriad of challenges arising from the need to respond to the complexities of globalization, inequality (in all its forms) and the pervasiveness and ever increasing power of information technology. Common themes in educational reform are the promotion of student centred learning, the utilisation of information technology and the development of the so called '21st century skills': communication, collaboration, critical thinking, creativity and problem solving. Educational reform is not something which happens quickly but is a slow process which involves coordinated changes at all levels in the system from curriculum development through teacher training to changes in what is assessed and how.

**Bridge21** – My research is centred on the exploration of a particular model of collaborative, project based, technology-mediated learning, known as Bridge21, which has been developed through extensive practice, over a ten year period involving the participation of over 14,000 students, in a purpose designed learning space on campus. Encouraged by the success of the model when used in an informal setting, research over the past six years has focused on how the model can be adapted for use in formal settings and in secondary schools in particular. This requires an applied approach to research since the goal is to help both individual schools, and the system at large, to meet the challenges outlined above.

Following what can be broadly termed a design based research approach, a suite of interconnected activities are being carried out involving:

- student workshops (on topics ranging from English through sexual consent to computer programming);
- input into the education of new teachers via Trinity's Professional Masters in Education (what used to be the H.Dip);
- professional development for practising teachers (a post graduate certificate in 21st century teaching and learning offered by the School of Education);
- workshops with school principals and dialogue with policy makers (I chair the Ministerial Advisory Group on the Implementation Strategy for Digital Technology in Schools).

The common theme running through this work is that collaborating and working in partnership with relevant stakeholders is a fruitful way for Trinity to contribute to the national agenda.

While the original impetus for this research came from work on developing computer-based tools for teaching and learning, it soon became obvious that technology is just one component of a complex educational system and that collaboration with other areas in the college was necessary to help bring about systemic change.



Brendan Tangney received a BSc from the NUI, an MSc from the University of Dublin and a PhD from the University of Bolton. He joined the academic staff in Trinity in 1985, was elected to fellowship in 2006 and is currently a Professor in the School of Computer Science and Statistics. He is a recipient of the Provost's Teaching Award and has co-authored over 100 publications. His research focuses on technology in education and educational reform. In 2017 he was invited to chair the Ministerial Advisory Group on the Implementation Strategy for Digital Technology in Schools.

Contact: [tangney@tcd.ie](mailto:tangney@tcd.ie)

**LEFT** – Students at their CodePlus graduation playing a game they developed which uses physical gestures to control the game

**BOTTOM** – Students in a 'team-pod' in the Bridge21 learning space in Oriel House

**Trinity Access 21 (TA21)** – Bridge21 is now part of a very large umbrella project in Trinity known as Trinity Access 21 (TA21) which involves not just Computer Science but also the Trinity Access Programmes (TAP), the School of Education, and the Department of Sociology. This is a longitudinal research project aimed at bringing about systemic change in the Irish Education system with a particular emphasis on addressing social exclusion

and promoting 21st Century Teaching & Learning.

Phase one of the project (2014-2017) involved:

- engagement with, and the longitudinal tracking of, 1,100 secondary school students from 11 TAP linked schools;
- 320 teachers (including 80 from the 11 link schools) completing the Certificate in 21st Century Teaching & Learning;

— a further 700 teachers engaging with project related professional development opportunities.

A report on the impact of CodePlus, which involves running Bridge21-based workshops to encourage more girls to study computer science, was launched in March 2018 and the project received \$100,000 from Salesforce.org.



→ Educational reform is not something which happens quickly but is a slow process which involves coordinated changes at all levels in the system

## 04 Bringing bardic poetry into the light

Eoin Mac Cárthaigh

Bardic poetry dominated the Irish literary landscape for four centuries, from 1200 to 1600, before entering into a period of decline. The standardised language and metres developed for it – and the poets' sophisticated analysis of these – are among the outstanding achievements of Irish learning, on a par with more tangible products of Irish culture like the Book of Kells or the Ardagh Chalice.

Although the poetry is of great interest and beauty, and although it is a rich source of historical and linguistic material, many of the most important poems have yet to be fully edited and we still lack such basic infrastructure as a dedicated dictionary for the period. This is a challenging field with huge potential for further research.

Trinity has a long and distinguished track record in the field – from Eleanor Knott's pioneering publications 90 years ago, to Katharine Simms' comprehensive online index of poems and their contents, to the digitisation of published and unpublished poems under the direction of Damian McManus. (The index and the poems are now available at [bardic.celt.dias.ie](http://bardic.celt.dias.ie))

My work builds on this tradition of scholarship, mainly by editing bardic poems – a complex and demanding task involving the painstaking collation of manuscript copies and the application of a wide range of palaeographical, metrical, linguistic and cultural knowledge and skills to restore the poet's original.

**1641 through bardic eyes** – I am currently editing the poems of Gofraidh Óg Mac an Bhaird, a witness to the cataclysmic 1641 war. As well as their artistic and linguistic value as compositions from the end of the bardic period, these offer the historian a valuable insight into the perspective of the Gaelic nobility engaged in the conflict. For instance, an elegy on the death of the Donegal nobleman Maghnas Ó Domhnaill (brother of a Trinity student and son of the infamous Sir Niall Garbh) gives a detailed account of his military career from the outbreak of hostilities until his death at the Battle of Benburb in 1646. This complements and counterbalances English-language sources available from the time, including Trinity's own 1641 Depositions, which are hostile to 'Manus Ó Donnelle' and describe him as one of

the 'principall Rebels in the present Action in this Kingdome'.

The purpose of a bardic poem, composed in a turbulent society where life was precarious and no physical monument could be expected to last, was to immortalise its subject, and it gives me great satisfaction to be helping to do this by bringing poems back to public notice and by making them accessible to a modern audience.

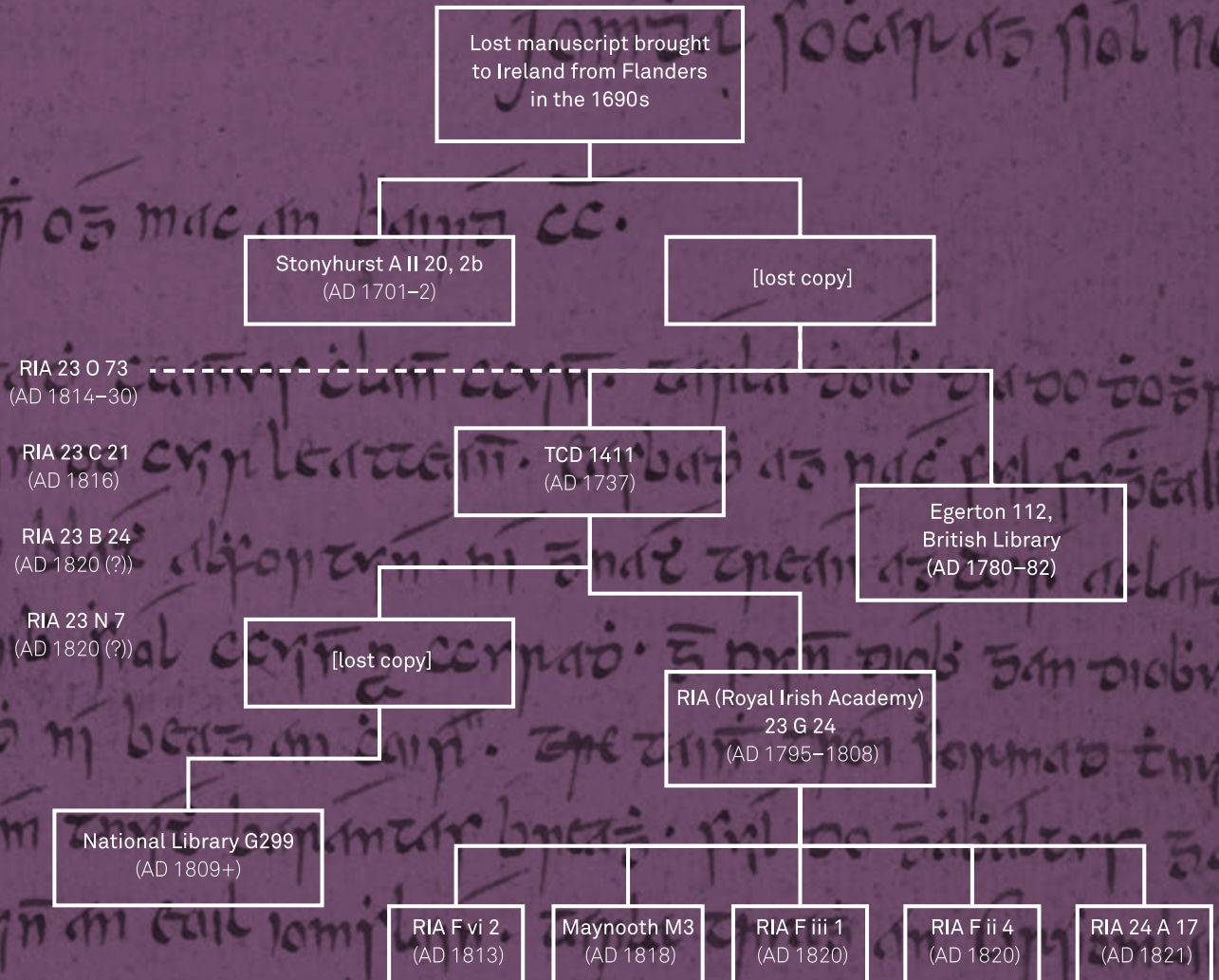
**Digital Humanities** – I am also working with Prof. Elaine Uí Dhonnchadha, an expert in corpus linguistics in Trinity's Centre for Language and Communication Studies, on a project which brings 21st-century technology to bear on bardic poetry, using sophisticated language analysis tools to annotate each word in the Irish Department's corpus of poetry with automatically generated linguistic information. We hope that this will revolutionise the study of the language of the poems.

Eoin Mac Cárthaigh received his BA and PhD from Trinity and joined the Department of Irish as a lecturer in 1998. He is an Associate Professor and Head of the Department of Irish. He was elected to fellowship in 2016 and is the author of *The Art of Bardic Poetry* (Dublin Institute for Advanced Studies, 2014), an edition of one of the most important and challenging texts from the Early Modern Irish period.

Contact: [emaccart@tcd.ie](mailto:emaccart@tcd.ie)

**BACKGROUND IMAGE** – An image from TCD manuscript 1411 (H.6.7) showing the start of one of Gofraidh Óg Mac an Bhaird's poems.

**BELOW** – A stemma (family tree) of manuscript copies of the same poem by Gofraidh Óg. If the Flanders manuscript had not survived long enough to be copied, this and many other poems would have disappeared with it. As its owner was told: 'noble is the ship's cargo that you brought across the sea since, were it not for that great love you had for your native tongue, we would have lost this worthy work forever on top of every other loss!'



## 04 Filíocht na scol a thabhairt chun solais

### Eoin Mac Cárthaigh

Sméar de sméara mullaigh litríocht na Gaeilge is ea filíocht na scol, a bhí i mbarr a réime ó thart ar 1200 go dtí gur tháinig meath uirthi le tubaistí na 17ú haoise. Tá teanga chaighdeánach agus meadarachtaí na filíochta seo – agus an taifeach a rinne na filí orthu sin – ar na príomhsheoda a tháinig anuas chugainn ó ré na sean. Ar a n-ealaíontacht agus ar a léanntacht, tá siad inchurtha le leithéidí Leabhar Cheanannais agus Chailís Ardach.

In ainneoin áilleacht na ndánta is a spéisiúla is atá siad, in ainneoin a dtábhachta mar fhoinsé do scoláirí staire agus teanga, tá cuid mhaith acu nár cuireadh in eagar riamh agus níl foclóir againn atá dírithe go sonrach ar theanga na tréimhse. Is dúshlánach an gort taighde é seo gan dabht, ach is torthúil agus is spreagúil an gort é freisin.

Is fada scoláirí Choláiste na Tríonóide ag saothrú an ghoirt seo – ó fhoilseacháin cheannródaíochá Eleanor Knott 90 bliain ó shin, go hinneacs cuimsitheach Katharine Simms de na dánta agus dá bhfuil iontu, go digitiú na ndánta foilsithe agus neamhfoilsithe faoi stiúir Damian McManus. (Tá an t-inneacs agus na dánta ar fáil ar líne ag [bardic.celt.dias.ie](http://bardic.celt.dias.ie))

Tógann mo chuid oibre ar an traidisiún scoláireachta seo. An chloch is mó ar mo phaidrín faoi láthair ná dánta a chur in eagar. Is é sin, iarracht a dhéanamh bunleaganacha na bhfilí féin a athchruthú, agus is iomaí sin scil a theastaíonn chuige sin, idir léamh agus tiomsú leaganacha lámhscríbhinne agus eolas ar theanga, ar mheadarachtaí agus ar chúla stairiúil na ndánta.

**An file mar fhinné** – Faoi láthair táim ag obair ar na dánta a chum Gofraidh Óg Mac an Bhaird, file gairmiúil a bhí beo le linn chogadh coscrach 1641. Chomh maith lena n-áilleacht mar shaothair ealaíne agus lena dtábhacht mar dhánta ó dheireadh ré fhilíocht na scol, tugann siad seo léargas luachmhar don staraí ar dhearcadh roinnt de na Gaeil a ghlac páirt sa choimhlint. Mar shampla, tugann marbhna a chum Gofraidh Óg ar Mhaghnas Ó Domhnaill (ar fhreastail a dheartháir ar an gColáiste seo agus ar bhásaigh a athair, Niall Garbh, i dTúr London) mionchuntas ar a chaithréim ó thús an éirí amach go dtí lá a bháis sa bhliain 1646 i gCath na Binne Boirbe. Cabhraíonn sé seo linn le pictiúr níos iomláine den

chogadh a tharraingt, go háirithe mar mhalairt ar fhoinsí Béarla ón am, ina measc Teistíochtaí 1641 i Leabharlann an Choláiste, atá naimhdeach le 'Manus Ó Donnelle', duine de na 'principall Rebels in the presente Action in this Kingdome'.

An ré chorrach ina raibh na filí beo, ní mhairfeadh séadchomharthaí saolta i bhfad, ach thabharfadh dán buaine don té a bhí á mholadh. Is mór an sásamh a bhainim as bheith ag comhlíonadh mhian na bhfilí trína gcuid dánta a thabhairt ar ais chun solais agus a chur ar a súile do mhuintir an lae inniu.

**Daonnachtaí digiteacha** – Chomh maith leis sin, táim ag obair i gcomhar leis an Oll. Elaine Uí Dhonnchadha, saineolaí teangeolaíochta corpais i Lárionad Léinn Teanga agus Cumarsáide Choláiste na Tríonóide, ar thionscnamh a thugann an dán díreach isteach sa 21ú haois. Tá uirlisí sofaisticiúla anailíse teanga á n-úsáid againn chun gach focal i gcorpas filíochta Roinn na Gaeilge a anótail le heolas teangeolaíochta ríomhghinte. Táimid ag súil leis go gcuirfidh sé seo go mór le tuiscint scoláirí ar theanga na ndánta.

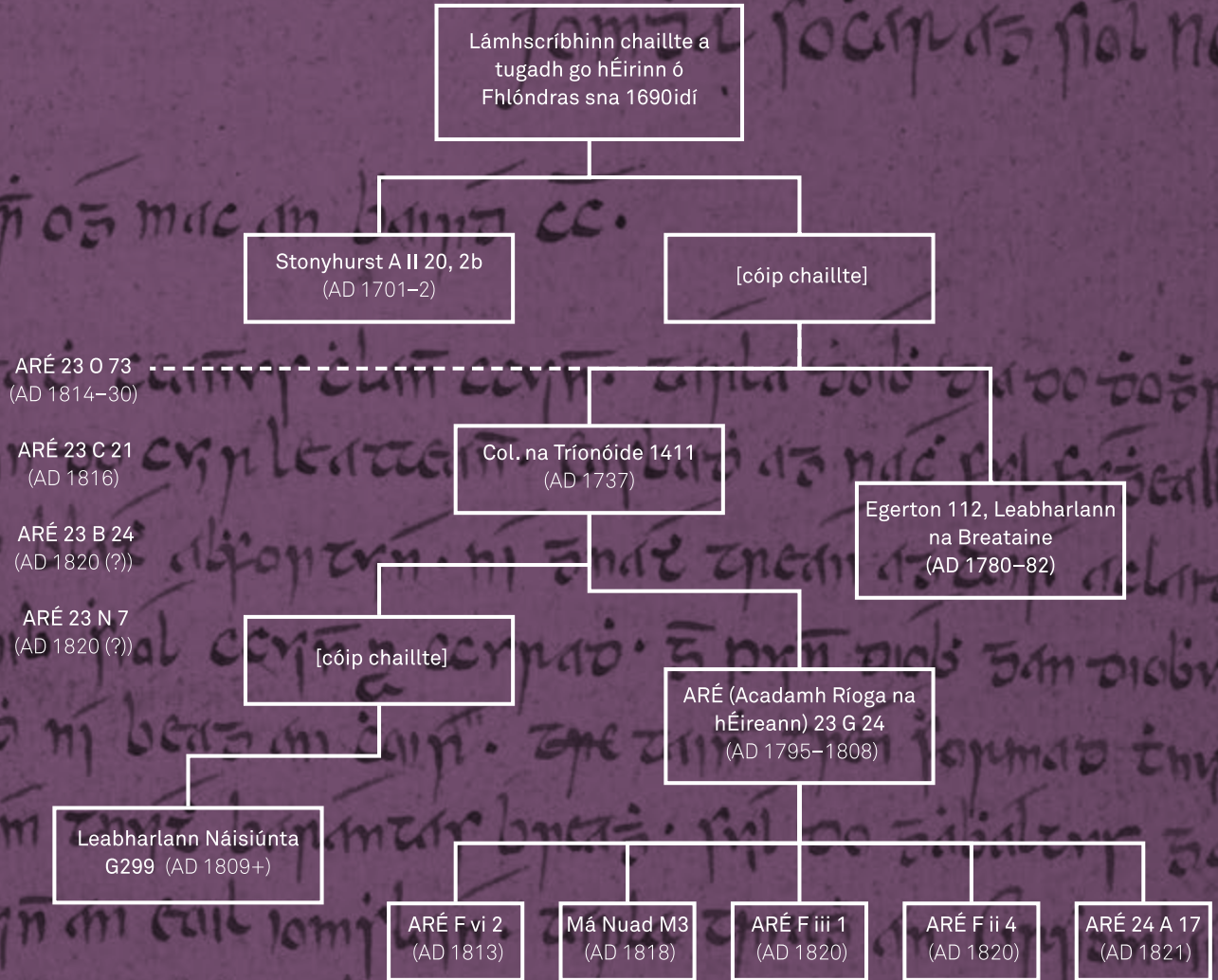
Coláiste na Tríonóide a bhronn a bhunchéim BA agus a dhochtúireacht ar Eoin Mac Cárthaigh. Ceapadh ina léachtóir i Roinn na Gaeilge é sa bhliain 1998, mar a bhfuil sé ina Ollamh Comhlach agus ina Cheann Roinne anois. Toghadh ina chomhalta é in 2016 agus is é a scríobh *The Art of Bardic Poetry* (Institiúid Ard-Léinn Bhaile Átha Cliath, 2014), eagrán de cheann de na téacsanna is tábhachtaí agus is dúshlánaí ó ré na Nua-Ghaeilge Moiche.

Teagmháil: [emaccart@tcd.ie](mailto:emaccart@tcd.ie)



**CÚLRA** – Gofraidh Óg Mac an Bhaird a chum: tús dáin dá chuid i lámhscríbhinn 1411 (H.6.7), Coláiste na Tríonóide.

**THÍOS** – Stemma (crann ginealaigh) na gcoipeanna lámhscríbhíne a tháinig anuas chugainn den dán sin le Gofraidh Óg. Murach an lámhscríbhinn a tugadh ó Fhlóndras go hÉirinn, agus murach na cóipeanna a rinneadh di sin, ní bheadh fhios againn gurbh ann don dán seo riamh, ná do rinnt mhaith dánta eile. Mar a dúradh leis an bhfear a thug an lámhscríbhinn leis ó Fhlóndras (le simpliú in áiteacha ar an litriú): ‘is uasal an last loinge tugais leat tar farraige, ar an ábhar, muna mbeith an searc-chumann sin do bhí agat dod theangain nádúrtha, do chaillfeamaois go brách an saothar suáilceach so i gceann gach díobháil eile’.



## 04 Understanding and targeting antibiotic resistant bacteria

Joan Geoghegan

The prevention and treatment of infectious disease is a major challenge to healthcare worldwide. The threat of rising antibiotic resistance in bacteria means that new measures for controlling and treating infection are urgently needed.

My laboratory at the Department of Microbiology at Trinity studies antibiotic resistant bacteria, in particular, methicillin resistant *Staphylococcus aureus* (MRSA). MRSA is a leading cause of serious life-threatening infections in hospitals and serious skin infections in the community. We study proteins attached to the surface of the bacteria that interact with human cells and proteins. These interactions are important because the bacteria need to attach to sites in the body to begin to establish an infection. After they attach, the MRSA bacteria can begin to link to each other to build accumulations of bacteria called “biofilm”. These biofilm communities grow on heart valves, artificial joints, human skin and other tissues and are able to avoid being killed by antibiotics and the human immune system.

Work in my laboratory has provided new insights into this process

and has contributed to the identification of the parts of the bacterial proteins that are crucial for attaching to surfaces and building the biofilm. This information gives us the opportunity to precisely target the molecular interactions occurring between bacteria and the human body. In the laboratory setting, it has proved possible to prevent adhesion and biofilm formation by bacteria by blocking binding sites on bacterial proteins. This approach works even when conventional antibiotics are not effective due to resistance. The next steps will involve identifying new drugs with the same mechanism of action that are suitable for use in the treatment of human patients.

We are also interested in understanding how infectious bacteria avert the normal killing mechanisms of human immune cells. For example, we have recently found that the bacterial genes that allow MRSA to resist the antibacterial effects of copper also help the bacteria to withstand killing by human immune cells. Our ongoing research on this topic will hopefully inform the future development of new drugs to treat human infections caused by antibiotic resistant bacteria.

**Preventing skin infection in atopic dermatitis** – Atopic dermatitis (a form of eczema) is the most common skin disease in children. Skin infections are a frequent problem for children with atopic dermatitis and occur when bacteria begin to grow on the skin. This increases symptoms such as redness and inflammation. The most usual cause of infection is *Staphylococcus aureus*.

Our research team are currently interested in learning how *Staphylococcus aureus* attaches to cells on the outermost surface of human skin known as corneocytes. We have identified a number of bacterial proteins that recognise skin proteins exposed on corneocytes in the skin of atopic dermatitis patients. We hope that by understanding the interactions between *Staphylococcus* and the skin we can target these to develop new therapies to reduce skin infection in atopic dermatitis.

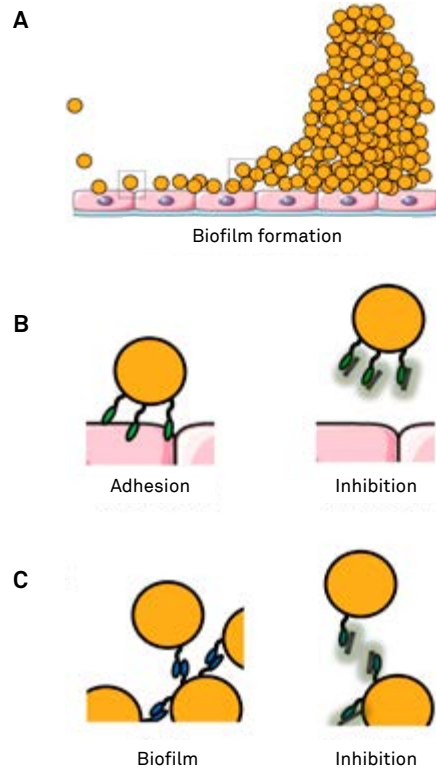
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Joan Geoghegan received her BA and PhD from Trinity and was appointed Lecturer in Microbiology in 2012. She is Assistant Professor at the School of Genetics and Microbiology and leads the Pathogenesis research group. Her research is funded by the Irish Research Council, British Skin Foundation and European Union Horizon 2020. She has published more than 50 articles in peer-reviewed journals. Her research focuses on understanding how antibiotic resistant bacteria cause infection in humans.  
Contact: [geoghegj@tcd.ie](mailto:geoghegj@tcd.ie)

**Fig 1** – Biofilm formation by *Staphylococcus aureus* (A). The bacteria (gold) attach to a surface inside the body (such as human cells, shown here) during the initial stages of infection. Once they attach, the bacteria begin to grow and link together. They build large accumulations of bacteria known as biofilms. Precisely targeting the binding sites on bacterial proteins can prevent attachment to the host surface (B) or prevent linkages from forming during biofilm formation (C).

**Fig 2** – False colour scanning electron micrograph of *Staphylococcus aureus*.

→ We study proteins attached to the surface of the bacteria that interact with human cells and proteins. These interactions are important because the bacteria need to attach to sites in the body to begin to establish an infection.



**Fig 1**



**Fig 2**

## 04 Nanophotonics – light on the nanoscale

Louise Bradley

Nanophotonics is the study of light-matter interaction on the nanoscale, where nanoscale is a millionth of a millimetre. It is a truly twenty-first century field of scientific investigation, which has only become possible due to the recent advances in nanomaterials, nanofabrication and measurement techniques. The exciting and multidisciplinary field deals with the generation, propagation, manipulation and detection of light with nanoscale structures. The reduced length scale gives rise to opportunities for miniaturization of optical devices to sizes comparable to the components in electronic circuits. Photonic integrated circuits offer advantages such as higher speed and lower power consumption.

In the past photonics has primarily focussed on the propagating components of light, known as the far-field, but nanophotonics provides an unprecedented opportunity to study and exploit the near-field components of the electromagnetic radiation which remain tightly confined to the structure.

Metal nanostructures act as nano-antenna and provide large enhancement of the near-field, responsible for surface enhanced Raman scattering and enhanced fluorescence. Metal based nanophotonics is known as the field of plasmonics. The near-field properties are determined by the choice of the nanoscale

material, dimensions and shape, as well as the choice of surrounding medium of the structures. Plasmonic structures can be tailored to have resonances at specific colours in the spectrum.

**Applications: bio-sensing, light harvesting, imaging, ICT** – My own research is focussed on the optical properties of coupled nanomaterial systems. One key topic has been near-field energy transfer in quantum dots. These nanoscale light emitters and this energy transfer mechanism are important for applications in bio-sensing, light emitting devices and light harvesting. Previously, I investigated the energy transfer mechanism and the conditions under which theory could be quantitatively applied to quantum dots, taking account of their specific properties.

My team, the Bradley Group, was the first in the world to demonstrate plasmon-enhanced energy transfer between quantum dots, showing increased interaction distance, energy transfer efficiency and rate. We, subsequently, showed that this could be extended to other hybrid nanomaterial systems and devices. Work on implementation in a range of optical devices is on-going.

Another exciting area of research is to discover ways to achieve dynamic tuning of plasmonic properties. A current limitation of plasmonic structures is that

once fabricated their properties cannot be tuned. Through a Science Foundation Ireland funded project I am investigating coupling plasmonic structures with a phase change material, vanadium dioxide, to provide electrical control of the near-field interaction. Vanadium dioxide transitions from a semiconducting to metallic phase under certain conditions. This is expected to present new physics and to generate new concepts for nano-optic components with novel functionalities and improved performance.

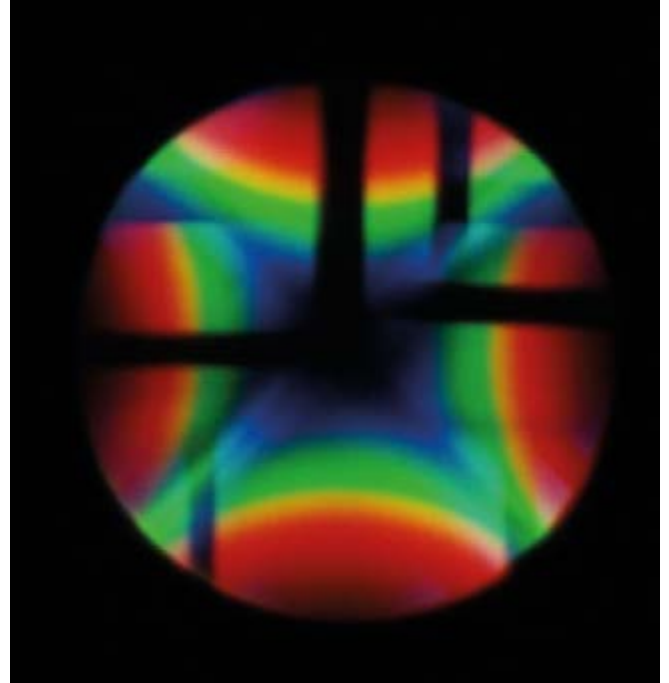
Other challenges in the field are around discovering new materials with superior properties, such as lower losses, and identifying the best routes to translate the new science and capabilities to the wide range of possible applications across sensing, imaging, and information communication technologies.

**Louise Bradley** received her BSc from University College Dublin and MSc and PhD from Trinity College Dublin. She joined Trinity's School of Physics as a Lecturer in 2001 and is now Professor in Physics. She was elected Fellow of Trinity College in 2009. She has published over 145 scientific papers, including almost 100 peer-reviewed journal articles. Her research focuses on the physics of light-matter interaction on the nanoscale and how these processes can be harnessed for information communication technologies, light harvesting and sensing applications. She has been awarded funding from Science Foundation Ireland, Enterprise Ireland and the Irish Research Council.

Contact: [bradl@tcd.ie](mailto:bradl@tcd.ie)

**TOP RIGHT** – Image of an aluminium (Al) metasurface taken with a dark-field microscope. 20 nm thick Al is deposited on 100 nm high polymer pillars. The top Al disks have a 200 nm diameter and are arranged in a square lattice with a 400 nm pitch

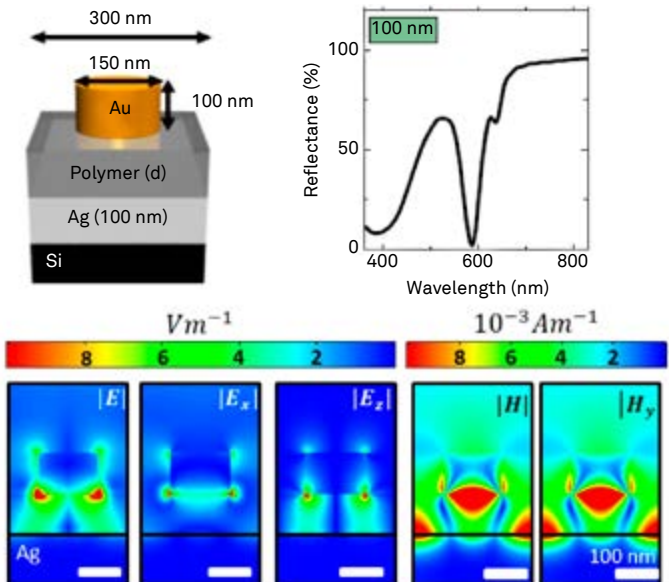
→ We are developing an understanding of how to manipulate the interaction between light and matter on the nanoscale, as well as identifying how this can be used for new technologies.



Two metal metasurface. Schematic of a unit cell: Square arrays (300 nm pitch) of gold nanodiscs (100 nm high and 150 nm in diameter) on a back-reflector substrate consisting of a polymer thin film on top of a 100 nm thick silver (Ag) layer on silicon.

Reflectance spectrum for a 100 nm thick polymer layer showing near-zero reflectance dip at 585 nm.

Electric and magnetic field distributions at 585 nm along the vertical cross section (x-z plane) through one unit cell of hybrid structure. The near-zero reflection arises due to efficient light trapping in the polymer layer.



## 04 Paradox navigators wanted Managers in implementing human resource management

Na Fu

When was the last time you had a very good conversation with your manager about your work and career? Such conversations are very important for motivating or demotivating us. People do not leave companies, they leave their managers. A lot of research has found evidence for the importance of leadership. My research doesn't focus on the leadership of teams but on the paradoxical role played by managers - in particular, line managers who interact with people on a daily basis in implementing varied human resource management practice. The research was motivated by a friend of mine who constantly got confused about why his manager treated everyone differently. In some cases, it's a good thing that team members receive individualised consideration. However, some consistency should be maintained to ensure team members' satisfaction.

Working with Professor Patrick Flood of Dublin City University, Professor Denise Rousseau of Carnegie Mellon University, and Professor Tim Morris of University of Oxford, we published the first study that explores how a line manager's human resource management (HRM) implementation influences individual and team outcomes, using a paradox perspective. Paradox theory is rooted in the Taoist symbol of yin yang. It argues those seemingly contradictory yet interrelated elements can co-exist simultaneously and also evolve

over time. Treating members in a consistent way but considering individual difference is a paradox. If managed effectively, doing both will promote high performance.

The Head of Talent/Senior consultant in a large consulting firm helped us with data collection from 60 project teams. In this firm, as in most organisations, line managers now share increasing responsibilities for implementing HRM practices, including selecting members into the team, providing mentoring, managing performance and promoting teamwork.

**Line managers' consistent but individually considered approach** — As paradox navigators, line managers have to take a consistent approach with all team members but also need to consider

individual difference when they implement HRM practices. In our study, we provide examples showing how line managers manage the consistency-individual responsiveness paradox. One example of best practice is that when training programmes are introduced, line managers inform all members about the general opportunities and purpose of the programme while considering individual contributions and likely benefits for each team member in attending the training. In the case of developmental feedback, best practice involved line managers communicating with each team member while varying the mode and nature of the feedback according to the individual's abilities, relational orientation and past performance.



Consistency (equality)



Individual responsiveness (equity)

Na Fu received her BSc from Northeastern University (China) and PhD from DCU. She joined Trinity Business School as an Associate Professor in Human Resource Management in 2016. The recipient of an Irish Research Council Post-doc Fellowship, Na was the multi-award winner from the Academy of Management Emerald, Irish Academy of Management, and Labour and Employment Relations Association, and was awarded as the Dragon 100 Young Chinese Leader in 2013. Her research focuses on strategic HR management issues, knowledge exchange and service innovation in both private and public sectors.

Contact: [funa@tcd.ie](mailto:funa@tcd.ie)

**LEFT** – ‘Line Managers as Paradox Navigators in HRM Implementation: Balancing Consistency and Individual Responsiveness’ Fu, N., Flood, P.C., Rousseau, D., & Morris, T. (2018) *Journal of Management*

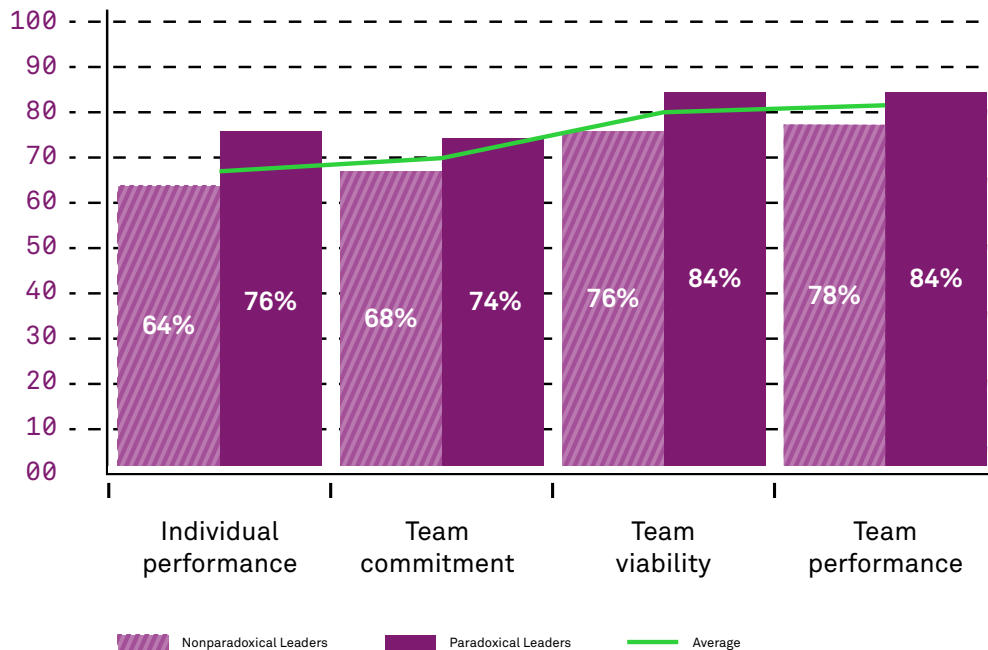
**BOTTOM** – Individual and Team Outcomes Comparison between Paradoxical and Nonparadoxical Leaders

A key solution to building organisational competitive advantage is through the development of people. Our findings confirm the critical role of line managers in motivating team members’ effective job performance and we establish that, with the right approach, consistency and individual responsiveness can be achieved. Our study, ‘Line Managers as Paradox Navigators in HRM

Implementation: Balancing Consistency and Individual Responsiveness’ was published in the *Journal of Management* (2018). Its findings provide a potentially valuable resource for organisations looking to improve team and organizational outcomes. This research will benefit managers, front line employees and HR professionals to promote a motivating environment in the organisations.

Our research establishes that line managers as paradox navigators need to be upskilled in ways to balance consistency and individual responsiveness in their implementation of HRM practices. Future research is needed to explore other ways in which organizations can improve line managers’ abilities, motivation and opportunities in HRM, ultimately improving team and organizational outcomes.

→ Paradox theory is rooted in the Taoist symbol of yin yang. It argues those seemingly contradictory yet interrelated elements can co-exist simultaneously and also evolve over time.



## 04 Rethinking borders in Beckett studies and beyond

Nicholas Johnson

Perhaps because I grew up on the border between the US and Mexico, I have always been drawn to the limits and edges of discourses, and have tended to question where and how boundaries can be made more porous. I use the creative arts, especially the tradition of the “performance laboratory”, to collaborate across disciplines, as well as using studio techniques to build bridges between different methodologies. I identify myself as a “scholar-artist” who regularly generates both peer-reviewed publications and theatrical events, and I engage drama and performance in addressing the most urgent human questions of our century.

**Beckett studies** — The most durable through-line in my practice and research has been Samuel Beckett. I have spent the last decade publishing on Beckett in performance, directing Beckett projects internationally, and contributing to the scholarly infrastructure of international Beckett Studies. These activities culminated in the 2017 establishment of the Trinity Centre for Beckett Studies to consolidate our research, integrating the Samuel Beckett Laboratory, a space founded in 2013 by myself and Jonathan Heron (Warwick) for fundamental research into Beckett in performance, with the Samuel Beckett Summer School, an annual event at Trinity since 2011 that I co-direct with Sam Slote (English).

How Beckett is received, taught, and understood is being expanded by the work that we do on experimental, inter-medial, intercultural, and other forms of “applied” Beckett, and the international reach of the Beckett Summer School makes a public contribution. In 2017 I directed *Virtual Play*, a virtual reality version of Beckett’s 1963 *Play* (in partnership with V-SENSE) that went on to win 1st Prize at the New European Media awards and has led to many publications beyond my discipline. I lectured extensively around Europe this year and facilitated performance workshops in Poland, Ireland, and Mexico. With Jonathan Heron, with whom I co-edited the 2014 “Performance Issue” of the *Journal of Beckett Studies* (23.1), I am currently editing the “Pedagogy Issue” (29.1, 2020); our co-written book *Experimental Beckett* is scheduled to be published in 2019 with Cambridge University Press.

### Practice-as-research beyond Beckett

Drawing on insights from this research into Beckett, in recent years my work has pivoted to more interdisciplinary research projects in the areas of pedagogy (with Education), acting theory (with Neuroscience), VR and AI (with Computer Science), cultural trauma (with Sociology), and medical humanities (with both Medicine and Nursing/Midwifery). In my capacity as convener of the Creative

Arts Practice research theme, I have discovered many opportunities to extend the impact of my “disciplinary” insights from within Drama.

My ambition is to help make Trinity College Dublin one of Europe’s leading universities for practice-led creative arts research. Art has the capacity and responsibility to amplify voices that are muted, to expose difficult or unsavoury histories, to elevate thoughts and opinions that fall outside those easily affirmed, and to work to engage conflicting philosophies — first and foremost by bringing people together. Each time I step into the theatre or the studio, I am re-invigorated in my desire to engage with challenging work, to place our ensemble practices at the heart of social change. This speaks to a wider strategy for creative arts at Trinity, where freedom of imagination represents a truly radical potential in what a university can be, while extending the power of what art itself can do.

**I use the creative arts, especially the tradition of the “performance laboratory”, to collaborate across disciplines, as well as using studio techniques to build bridges between different methodologies.**

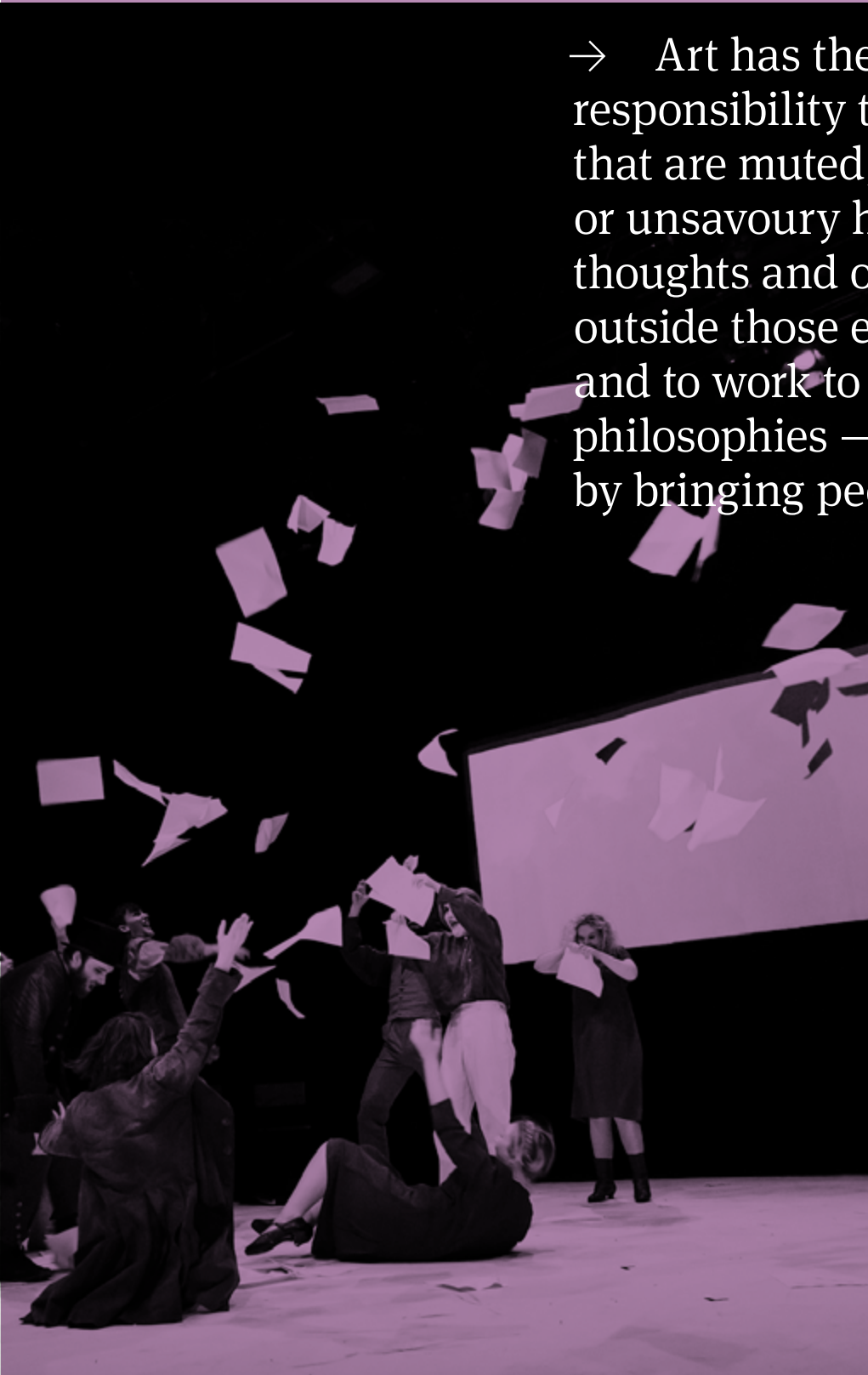
Nicholas Johnson holds a B.S. in Theatre from Northwestern University and a PhD from Trinity College Dublin. He joined Trinity in 2004 as a George J. Mitchell Scholar and has held visiting research positions at Freie Universität Berlin and Yale University. He convenes the Creative Arts Practice research theme, co-founded the Trinity Centre for Beckett Studies, and has published widely on Samuel Beckett and interdisciplinary performance. In addition to numerous practice-as-research projects, he continues to work in the professional theatre as a director, dramaturg, and literary translator.

Contact: [johnson@tcd.ie](mailto:johnson@tcd.ie)



**BELOW** – Ensemble from *The David*  
*Fragments after Bertolt Brecht,*  
Samuel Beckett Theatre, June 2017  
(Photo © Kasia Kaminska)

→ Art has the capacity and responsibility to amplify voices that are muted, to expose difficult or unsavoury histories, to elevate thoughts and opinions that fall outside those easily affirmed, and to work to engage conflicting philosophies — first and foremost by bringing people together.



## 04 How constitutions work

Oran Doyle

Constitutions exist at the intersection of law and politics. They reflect fundamental aspects of their political communities: not just the moral values implicit in constitutional rights but also the identity of the people and the territory to which they belong. My scholarship explores what constitutions are and how they work.

### Ireland: ongoing constitutional evolution

The standard account of the Irish constitution is that it was enacted in 1937 and establishes a tripartite separation of powers between Government, Oireachtas, and courts empowered to enforce constitutional rights. The constitution is seen as a rule-book for politics, amendable by referendum.

In *The Constitution of Ireland: A Contextual Analysis* (Hart 2018), I present a very different account. I show how the 1937 constitution wasn't a foundational event but rather an important moment in an ongoing constitutional evolution. As important are the other rules, principles and practices that supplement and modify the constitutional text. This approach shows more clearly how the constitution really works and changes over time.

The constitution's real separation of powers is a bipartite one, between the Government and the courts. This balance shifts over time as the courts

recalibrate their willingness to overturn Government decisions. In 1974, the Supreme Court overturned the legislative ban on contraceptives. Nowadays, however, the Court defers much more to democratic choices on contested social issues, an attitude that results from legal and political concern that courts had become too powerful. This may change in the future but at present the deference of the courts empowers the Government. This makes it all the more important that legislators pay close attention to draft legislation and are willing to hold Government to account. Concerned citizens should be alert to the fact that the courts do not play the same role as in the past.

The constitution used to be distinguished by a nationalist vision of an all-Ireland state and reliance on Roman Catholic natural law theory. These strains have now been bled out by a mixture of formal amendment, judicial interpretation, and simply ignoring constitutional provisions that seem out of place, such as that valuing the role of women in the home.

For all these reasons, the Constitution leaves more decisions to the ordinary political process. This may explain its continued success, or at least longevity.

**Constitutions and territory** — In my other work, I explore how constitutions

in general function, considering issues such as judges' reliance on foreign cases and how constitutional systems guard against democratic decay.

At present, my focus is on territory. The Catalonian independence movement has refocused attention on how constitutions respond to secessionist claims that deny the legitimacy of the constitution itself. I carried out an empirical study of all the constitutions in the world, showing that most rely on a silent pre-constitutional understanding of territory.

This silence can help constitutions respond flexibly to independence claims, as illustrated by the Scottish referendum and the Canadian Supreme Court's approach to Quebec. However, 31% of countries declare their territorial integrity to be inviolable. In the Spanish case, this has heightened the political stakes of Catalonia's demands.

I have presented the results of this research at conferences internationally and my article in *The International Journal of Constitutional Law* has been selected as the open-access article for that volume. I am now working on a monograph, engaging with federalism, secession and territorial disputes.

Oran Doyle received his LLB and PhD from Trinity and his LLM from Harvard. He joined the Law School in 2004, where he is currently an Associate Professor. Elected a Fellow of Trinity College Dublin in 2010, he has published widely on Irish constitutional law, legal theory and comparative constitutional law. His research addresses the problems that are common to constitutional systems across the world. This research informed his work as constitutional law advisor to the Citizens' Assembly that considered the Eight Amendment to the Constitution.

Contact: [oran.doyle@tcd.ie](mailto:oran.doyle@tcd.ie)

**BELOW** – Supporters and campaigners for marriage equality gather in Dublin Castle to mark the first anniversary of the passing of the marriage referendum

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→ The constitution used to be distinguished by a nationalist vision of an all-Ireland state and reliance on Roman Catholic natural law theory. These strains have now been bled out by a mixture of formal amendment, judicial interpretation, and simply ignoring constitutional provisions that seem out of place, such as that valuing the role of women in the home.



## 04 Philosophy and basic assumptions

Paul O'Grady

When we act, make decisions, identify and evaluate facts, we operate with a host of assumptions and modes of thinking that may or may not be correct – even when doing 'objective' science. The task of philosophy is to make these implicit structures of thought explicit and to test them for truth and rationality. However, because these assumptions are so basic and fundamental there is much disagreement and debate about them.

The part of philosophy that examines the nature, scope and methods of knowledge is epistemology. Within that field I have a long-standing interest in making sense of intellectual diversity: how it is that people may reasonably take very different assessments and stances on the nature of reality? My research has focused on relativism, religious belief, and latterly the notion of wisdom.

### Relativism and philosophy of religion

Relativism has been seen by many as emancipatory: escaping the tyranny of a one-eyed vision and a monolithic conception of the world. It has also been viewed with suspicion as the possible justification of 'alternative facts'. A significant part of my work has been to explore ways in which intellectual diversity and plurality can co-exist with rigorous critical methods – is it possible to foster plurality without descending into chaos and fake news? I brought together my first thoughts on

this important theme in my monograph, *Relativism* (Routledge 2002).

One of the diverse ways of engaging with reality is religion. Philosophy of religion explores the meaning, diversity and rationality of religious beliefs. It is a field inhabited by atheists, agnostics, theists, polytheists and those who reject all such designations. My work in this field has been to critically examine the arguments of Thomas Aquinas, a major figure in the evolution of Christian thought and western culture, using the techniques of analytic philosophy. I wrote *Aquinas's Philosophy of Religion* (Palgrave 2014) as an exploration of these issues.

### The nature of wisdom: virtue epistemology

My current work draws on both these strands (relativism and Aquinas) and is an investigation of the notion of wisdom. This is the species of knowledge associated with living well and it is basic to the very nature of philosophy (which has been traditionally defined as 'love of wisdom'). It was a central topic in ancient and medieval thought – with Aquinas producing one of the most developed accounts of the nature of wisdom in the western tradition – but it dramatically disappeared in 20th century thought. I'm interested in understanding why it disappeared and in engaging with the small but growing number of contemporary philosophers who are seeking to rehabilitate it.

A very recent movement – Virtue Epistemology – has brought discussions of wisdom into dialogue with mainstream epistemological issues. The main innovation of virtue epistemology is that it focuses primarily on the person holding a belief rather than on the abstract belief itself. Good properties of the person (e.g. reliability, thoroughness, courage) transfer to the belief and give it positive status. The topic of wisdom has been rehabilitated in this framework. It is therefore of interest to researchers in positive psychology, religious studies and education, and indeed to anyone who wishes to reflect on his or her own life uncovering their own assumptions and guiding principles.

When these guiding principles contribute to living well, they count as wisdom. I am currently working on clarifying the nature of that desirable goal through writing a book on the topic.

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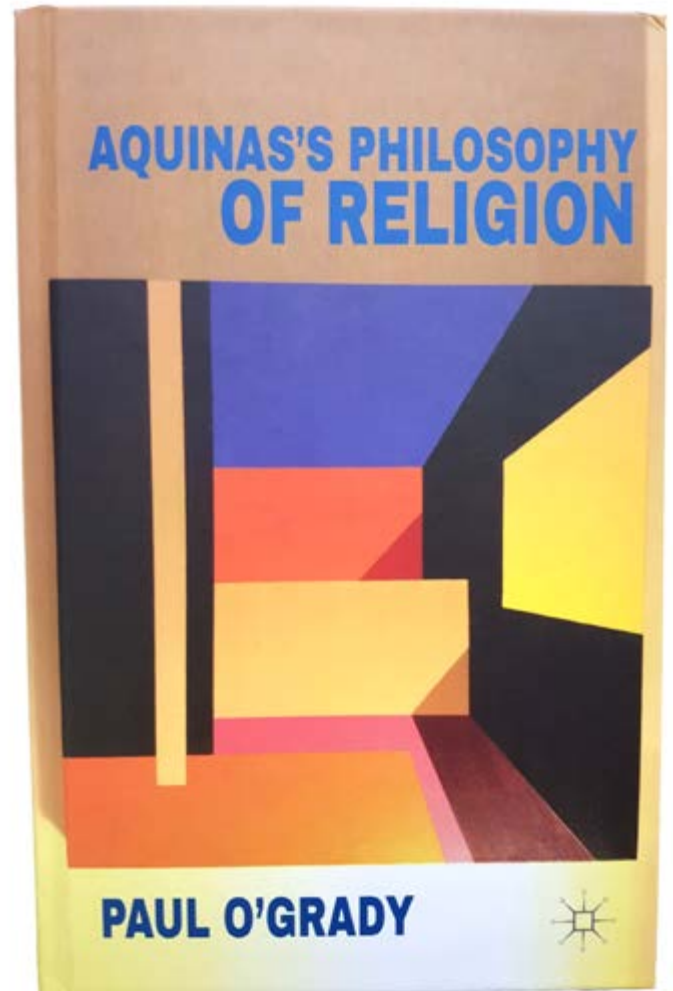
Paul O'Grady received his BA and MA from UCD and his PhD from Trinity before going to a lectureship at St Catherine's College Oxford. He joined the Department of Philosophy as a lecturer in 1997, where he is now Head of Department and Professor. He was elected to fellowship in 2003. He won prizes from the American Philosophical Association and the Bertrand Russell Society and has published *Relativism* (Routledge 2002), *Philosophical Theology* (Priory 2008), *Aquinas's Philosophy of Religion* (Palgrave 2014) and over 40 papers in theory of knowledge and philosophy of religion.

Contact: [pogradey@tcd.ie](mailto:pogradey@tcd.ie)

**RIGHT** – *Aquinas's Philosophy of Religion* by Paul O'Grady (Palgrave 2014)

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→ One of the diverse ways of engaging with reality is religion. Philosophy of religion explores the meaning, diversity and rationality of religious beliefs.



## 04 Making women's homelessness visible

Paula Mayock

Growing numbers of women are experiencing homelessness throughout Europe and, in Ireland, this is happening at an accelerated rate – 44 percent of individuals who are currently homeless in Ireland are women, a figure well above the European norm of 20 to 30 percent. The crisis of family homelessness in Ireland has particularly impacted women who are parenting alone, with recent figures reporting that 96 percent of homeless families are headed by a single mother. Women's homelessness is now a major social problem across Europe but national homelessness policies have largely failed to engage with the notion that women who become homeless have distinct experiences.

These are just some of the critical findings documented in *Women's Homelessness in Europe* (Palgrave, 2016) which I edited with a colleague from the Centre for Housing Policy, University of York. The volume, which examines women's homelessness using a comparative pan-European approach, is the first international collaboration between leading homelessness researchers co-operating through the Women's Homelessness in Europe Network (WHEN) [www.women-shomelessness.org](http://www.women-shomelessness.org). I established WHEN in 2012 with the help of funding from the Irish Research Council's (IRC) 'New Ideas' Award.

The research evidence presented in *Women's Homelessness in Europe* highlights several gendered dimensions of women's homelessness. Critically, it draws strong attention to the role of domestic and other forms of gender-based violence in women's homelessness. Intimate (male) partner violence is the reason why many women are forced to leave their homes; these women essentially find themselves choosing between domestic violence and homelessness, which means that women may delay leaving an abusive home situation.

**The invisibility of women experiencing homelessness** — A distinctive feature of women's homelessness is the extent to which it remains concealed and invisible

within public, academic and policy discourses. The reasons for this invisibility are complex and multi-dimensional. Firstly, women are less likely to be 'counted' as homeless because they frequently occupy spaces of 'hidden' homelessness, meaning that they live temporarily with family members, friends or acquaintances. Thus, available figures are likely to underestimate the extent of women's homelessness. Secondly, women may rely on informal networks because they distrust homelessness services (see below). Finally, and importantly, there is a particular stigma attached to the notion of a homeless or 'unaccommodated' woman because it challenges traditional normative beliefs about femininity, family and motherhood.

→ “I ended up homeless but I wouldn't go stay in any hostels because the stories I heard of them were terrifying ... I never had to resort to anything like that in my life and I didn't want to kind of let people see that I was weak” (Gráinne, age 31).

Paula Mayock holds a BEd from St. Patrick's College, Drumcondra, an MEd from University College Dublin and a PhD from Trinity College Dublin, where she is an Assistant Professor at the School of Social Work and Social Policy. Paula is a National Institute on Drug Abuse (NIDA) INVEST Post-doctoral Fellow and an Irish Research Council (IRC) Research Fellow. Her research focuses primarily on the lives and experiences of marginalised adult and youth populations, covering topics including homelessness, substance use and mental health.

Contact: [pmayock@tcd.ie](mailto:pmayock@tcd.ie)

**Homeless women's distrust in the apparatus of the state** — An important dimension of women's homelessness relates to their distrust of homelessness and other support services, a finding that emerged strongly from a national study of women's homelessness that I led a few years back. Funded by the IRC's Research Fellowship Scheme, the project employed a multi-method design involving interviews with 60 homeless women alongside ethnographic observation undertaken in several homeless hostels. The women's stories revealed the extent to which


they avoided homelessness services because they felt threatened and unsafe in these male-dominated environments. Women's perception that their autonomy and decision-making capacities were not recognised also acted as drivers of their invisibility. Many preferred to leave hostels to enter into situations of 'hidden' homelessness.

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**Better services and preventative policies**

Homelessness policy and service provision, historically resistant to the notion of gendered homelessness and primarily oriented

towards the image of the stereotypical homeless male needs to engage with the distinct situations, experiences and requirements of women. There is strong evidence in Ireland and other European countries that homelessness services are currently failing to respond adequately to the needs of women and their children. A core aim of my research is to provide policy makers with a strong evidence base on the causes and consequences of women's homelessness that will inform the development of more effective services and preventative policies.



→ “The word homeless, it shows a picture of somebody sleeping on the streets, not a nice picture” (Tereska, age 25).

## 04 Gauge theories from superstrings

Sergey Frolov

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. It is a quantum gauge theory. Its theoretical predictions have been verified by the collaborative effort of scientists at experiments such as the Large Hadron Collider at CERN in Europe where the Higgs boson was found in 2012. This discovery completes the Standard Model, however further discovery is anticipated. The Standard Model does not describe gravity and many of the more complete theories also predict new 'supersymmetric' particles.

If elementary particles interact weakly then the physical properties of the theory can be understood via perturbative calculations, mathematical methods for finding an approximate solution to a problem, by starting from the exact solution of a related, simpler problem. However, nonperturbative methods are necessary to explain strong coupling phenomena such as quark confinement. Understanding nonperturbative dynamics of gauge theories remains a daunting challenge of theoretical physics (this was in fact one of the Millennium Prize Problems established by The Clay Mathematics Institute, USA to celebrate mathematics in the new millennium and to record some of the most difficult problems being grappled with at the turn of the second millennium).

String theory, an approach to model the four known fundamental interactions—gravitation, electromagnetism, strong nuclear force, weak nuclear force—together in one theory, at present is the only known consistent theory of quantum gravity which has been the main motivation for studying strings.

The anti-de Sitter/conformal field theory correspondence, sometimes called Maldacena duality or gauge/gravity duality, is a conjectured relationship between two kinds of physical theories. On one side are anti-de Sitter spaces (AdS) which are used in theories of quantum gravity, formulated in terms of string theory or M-theory. On the other side of the correspondence are conformal field theories (CFT) which are quantum field theories, including theories similar to the Yang–Mills theories that describe elementary particles.

This AdS/CFT correspondence or duality conjectured by Juan Maldacena in 1997 provides us with a new reason to explore string theory. The AdS/CFT correspondence is a remarkable conjecture because it relates a theory of gravity to a quantum gauge theory with no gravity at all. Understanding the connection of gravity to gauge theory is the most interesting problem in high energy theory. Additionally, the duality relates nonperturbative gauge theory problems to questions in string theory. This has opened up new ways to study nonperturbative gauge theory by using string theory methods.

**Scaling dimensions** — One example of the AdS/CFT correspondence is the duality between the maximally supersymmetric four-dimensional gauge theory, and superstrings propagating in a curved space-time which is the product of a five-dimensional anti-de Sitter space-time (AdS) and a five-dimensional sphere. An equal-time slice of AdS is a hyperbolic space, Figure 1. The product structure means that to any point of AdS one attaches a sphere, e.g. the product of a line and a circle is a cylinder.

The properties of gauge theory are encoded in scaling dimensions of local operators and structure constants. According to the AdS/CFT correspondence, the scaling dimension of a local operator is equal to the energy of a string excitation dual to the operator. The gauge theory has two parameters – number of colours and 't Hooft coupling. It simplifies in the planar limit where the number of colours goes to infinity. The planar gauge theory is dual to the classical superstring theory which appears to be exactly solvable. This has allowed us to compute the exact spectrum of string energies, and, therefore, exact scaling dimensions of local operators of the planar gauge theory, Figure 2.

The solution of the AdS spectral problem has so far been one of the major successes of the AdS/CFT correspondence. The next goal is to calculate structure constants which determine three-point correlation functions of local operators. This problem is currently under investigation by many researchers, including myself and colleagues in Trinity.

**Sergey Frolov** received his MSc from the Physics Department of Moscow State University and his PhD from Steklov Mathematical Institute. He joined Trinity in 2006 from Max-Planck Institute, Potsdam, Germany. He is now Professor in Mathematics and was elected to fellowship in 2013. His research area is theoretical and mathematical physics. March/April 2005 issue of ScienceWatch recognized his research in 2003-2004 as the "hottest research" in physics. He has published almost 100 articles which have been cited over 8200 times, and his h-index is 48 (InSPIRE).

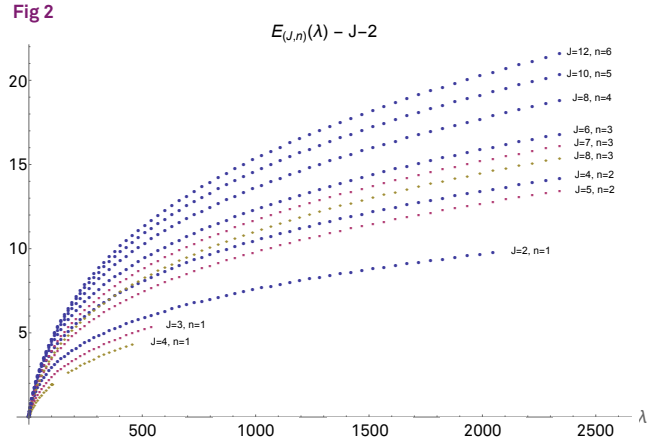
Contact: [frolovs@tcd.ie](mailto:frolovs@tcd.ie)



**Fig 1** – Two-dimensional hyperbolic space can be described as a distorted disk called the Poincaré disk. All of the angels (and devils) living in the hyperbolic world are actually of the same size. M.C. Escher's 'Circle Limit IV' © 2018 The M.C. Escher Company-The Netherlands. All rights reserved. www.mcescher.com

**Modified supergravity equations** — Other examples of the AdS/CFT correspondence can be obtained by deforming the five-dimensional anti-de Sitter space-time and sphere where superstrings propagate. My research, in collaboration with researchers from DESY (Hamburg), Imperial College (London), ETH (Zurich) and Penn State University (USA), has involved studying one of these deformations and we found out that the deformed space-time satisfies modified type II supergravity equations which have never appeared before. These equations have attracted experts' attention but their meaning and implications are still unclear.

**Fig 2** – Scaling dimensions (as functions of the 't Hooft coupling constant  $\lambda$ ) of some local operators of the gauge theory obtained by solving the mirror TBA equations encoding the spectrum of energies of string excitations.



**Fig 1**



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# Trinity at Grand Canal Quay

**In July 2018, in partnership with government and Dublin's other universities, Trinity launched its plan for the creation of a globally competitive innovation district for Ireland, centred on a new Trinity campus to be developed at Grand Canal Quay.**

The Grand Canal Innovation District (GCID) is a national project with a vision for how Ireland can transform its innovation offering and renew its enterprise and educational offering for the benefit of the whole country.

At the launch, An Taoiseach Leo Varadkar, TD said that “the plan to develop Silicon Docks as an Innovation District, involving a collaboration of business, government and the university sector, speaks eloquently to our vision of making Ireland the tech capital of Europe and our plans to ensure that the jobs of the future are created first here in Ireland.

“We have to ask ourselves; how can we market Ireland and Dublin as the ideal location for the next wave of investment? As the world changes around us, we must continuously adapt and future-proof our economy. The development of the Grand Canal Innovation District is an exciting opportunity to build a world-class innovation district where companies, researchers and entrepreneurs link up, to identify new products or services.”

**RIGHT (L-R)** – An Taoiseach, Leo Varadkar, TD with the Provost, Dr Patrick Prendergast and representative of the local community, Betty Ashe at the announcement of the Grand Canal Innovation District



→ The development of the Grand Canal Innovation District is an exciting opportunity to build a world-class innovation district where companies, researchers and entrepreneurs link up...

Grand Canal  
Innovation District  
Members

## 05



### What is an innovation district?

An innovation district is a new kind of urban centre where research-oriented institutions, high growth companies and tech and creative start-ups are embedded in an amenity-rich residential and commercial environment. Over the past decade the development of these districts in cities such as London, Barcelona, Toronto and Boston have enabled both rapid innovation and economic growth.

Innovation districts work by bringing together a critical mass of talent, finance, innovation and enterprise. They are located in a concentrated urban environment and provide the proximity, density and scale of activities that are essential for international competitiveness. They are integrated with the local community, providing new employment and education opportunities, and are connected to local and cultural groups.

A key characteristic of a successful innovation district is that a world-class university is located in the heart of the district as an anchor tenant. As well as acting as the focal point for the district, the university provides stability and connects companies to talent pipelines of graduates, faculty and researchers, whilst adding to the overall social, cultural and continuous learning fabric of the district.

### Trinity's vision for Dublin and Ireland

Trinity is located in the heart of the city centre, close to government buildings, retail and cultural institutions and to the multinationals and tech start-ups clustered around Grand Canal Dock. Understanding that this convergence of research, education, government, retail, culture, industry and innovation, taken together with Ireland's progressive policy environment, presents ideal conditions for an innovation district, Trinity began making plans in 2017.

The university held over 150 meetings in twelve months with key organisations in Ireland and internationally. An important part of this process was engaging and listening to the needs and concerns of the local community. The new Trinity campus at Grand Canal Dock, and the urban regeneration project that it enables, must provide benefits across multiple factors for the local community and beyond, including enhanced employment, education and cultural opportunity. Consultation will be ongoing and is a core value of this initiative.

In March 2018 Trinity organised for a group of thirty key stakeholders to spend two days in Kendall Square in Cambridge, Massachusetts, which is recognised as the world's premier innovation district. This group included the presidents of Dublin's universities (DCU, UCD and Trinity) and the CEOs of the HEA and SFI, as well as key representatives

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**LEFT** – The starting point for Ireland's innovation district

**BELOW** – The Provost, Dr Patrick Prendergast signing a MOU at the Innovation District launch with (left) Prof Andrew Deeks, President, UCD and Prof Brian MacCraith, President, DCU witnessed by Iseult Ward, Co-founder & CEO, FoodCloud and Melissa Ablett, the General Manager of CIC Rotterdam

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from the IDA, EI, Dublin City and industry. The group visited MIT and civic initiatives like District Hall and Venture Café and met with academics, entrepreneurs and business leaders, seeing first-hand how a collective vision can enable a transformational agenda for a city.

The Kendall Square trip proved inspirational for all involved, creating a determination for Ireland to transform its innovation offering and trigger growth to the benefit of our whole country.

In the spirit of the national significance of the project, Trinity, DCU and UCD signed an MOU at the innovation district launch in July 2018, agreeing to work together with government and key state agencies on developing a common innovation vision for Dublin and on the creation of GCID.

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### **Progressing the vision**

The next step in progressing the vision is for the special advisory group, appointed by the Taoiseach, and chaired by the Secretary General at the Department of An Taoiseach, Martin Fraser, to develop a roadmap for the Grand Canal Innovation District. This was the structure used to enable the creation of the Irish Financial Service Centre (IFSC) in the 1980s, and it should enable the rapid evolution of Trinity's vision for a globally competitive innovation district for Ireland.

→ **In the spirit of the national significance of the project, Trinity, DCU and UCD signed an MOU at the innovation district launch in July 2018...**

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# Innovation and Industry Engagement

Trinity has placed innovation and entrepreneurship at the heart of its strategy – from planning the development of the Grand Canal Innovation District, to the establishment of a University Bridge venture fund to enable investment in new start-up companies, to the creation of Tangent, Trinity’s Ideas Workspace, to enable student and graduate entrepreneurship.

Tangent, an exciting new initiative for the college supported by the Bank of Ireland, will provide cutting-edge innovation and entrepreneurship education, start-up company acceleration programmes, community events and supports for fledgling to mature entrepreneurs across Ireland and beyond. Examples of new programmes Tangent will run include the first ever undergraduate certificate in innovation and entrepreneurship, a national roll-out of postgraduate courses, and pan-European early-stage business accelerator programmes.

Tangent brings together Trinity’s existing programmes and initiatives including LaunchBox, Tangent’s Student Accelerator Programme, Blackstone LaunchPad, the EIT Knowledge Innovation Communities, the Innovation Academy, and the Women Who Wow mentorship programme; and it introduces new ventures: Tangent Pioneers, an international accelerator, and Entrepreneurs in the Arts, a mentorship programme for Trinity’s Arts & Humanities students.

At a time when two thirds of all new jobs are being created by companies less than five years old and new technologies are disrupting mature businesses it is critical we empower staff, students and graduates with the skills and understanding to succeed in this changing world.

**RIGHT** – At the launch of Tangent, Trinity’s Ideas Workspace were Provost Dr Patrick Prendergast, Chief Innovation & Enterprise Officer, Dr Diarmuid O’Brien, Co-Founder of Change Donations & Launchbox 2018 winner, Lizzy Hayashida, and Co-Founder of SeaPunk & Launchbox 2018 runner up, Tommy Torrades



**Tangent** Trinity's Ideas  
Workspace



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

## 06

For the fourth year running, Trinity is ranked 1st in Europe for producing entrepreneurs, according to *The Universities Report* published September 2018 by private equity and venture-focused research firm, Pitchbook. Trinity graduates have raised US \$3.26 billion in funding across 212 companies between 2006-18. Trinity is the only European university in Pitchbook's Top 50 for producing venture-backed entrepreneurs from its undergraduate programmes.

Trinity interacts with 400+ industry partners annually, ranging from multi nationals like Huawei to student start-ups such as Foodcloud. Trinity's collaborators in 2017/18 include multinationals Nokia, GSK, Intel, DePuy, AbbVie and Pfizer, and Irish SME's Kastus Technologies, Ceramicx, Inflection Biosciences and Kora. Trinity approved the formation of five new campus companies this year, Volograms, DataChemist, Junction Therapeutics, CroiValve and DANALTO.

Trinity was successful in the SFI Industry Fellowship Programme calls for joint projects with companies including Kastus Technologies, AbbVie Pharmaceuticals, Boston Scientific, DePuy Synthes, Nokia Bell Labs, and Glanbia. SFI research and IDA/EI technology centre awards represent significant state investments in industry collaborative research. With international peer review, they provide clear validation that Trinity research is world-class and directly impacts industry.

There were six Enterprise Ireland Innovation Partnership agreements signed, seven Technology Innovation Development Awards awarded, and 15 Enterprise Ireland Innovation Vouchers completed.

Trinity interacts with all 12 SFI research centres and leads three of these centres (AMBER, CONNECT and ADAPT). It also hosts the Learnovate EI/IDA technology centre, participates in iCrag (Centre for Research in Applied Geosciences), LERO (The Irish Software Research Centre) and CÚRAM (Centre for Research in Medical Devices).

ENABLE, a new €14.5 million SFI research programme led by Trinity was launched this year and will examine how the Internet of Things can improve the quality of life for citizens living in urban environments.

A new research partnership with global ICT leader Huawei was announced in December as part of its growing R&D footprint in Ireland. This will focus on Video Intelligence and the potential impact of artificial intelligence on society.

### Staff innovation

Trinity's success with innovation and entrepreneurship is inextricable from its success in research. Last year Trinity won €100.6 million euro in research funding, an increase of €26 million in just four years.

AMBER, the SFI-funded materials science institute headquartered at Trinity, launched 'TRANSITION', a five year research collaboration with DePuy Ireland Unlimited Company and Johnson & Johnson Services, Inc. The collaboration, led by Professor Danny Kelly, involves academics from Trinity, RSCI, DCU and UCD and aims to develop a new class of 3D-printed biological implants that will regenerate diseased joints.

Trinity won a major prize at the 2017 Knowledge Transfer Ireland Awards when Dr Emily Vereker, Senior Patents and Licensing Manager and Technology Transfer Case Manager for Life Sciences, Trinity Research & Innovation, was honoured with the 'Knowledge Transfer Achiever Award'. Trinity was also nominated in another category, the 'Licence2Market Impact Award' for a genetic testing patent licence in collaboration with UCD for equine performance company, Plusvital Limited.

Trinity spin-out and Augmented Reality-Virtual Reality (AR and VR) company, Volograms Ltd, secured seed investment of c.€600,000. The funding round, led by Atlantic Bridge and the University Bridge Fund will enable further commercialisation development in order to bring Volograms' next generation technology to market.

DataChemist, a Trinity campus company that uses semantic AI techniques to transform enterprise data into valuable intelligence, was officially launched by Tánaiste and Minister for Foreign Affairs and Trade, Simon Coveney, TD in August. The company raised c.€900,000 of seed funding led by Atlantic Bridge with support from Enterprise Ireland enabling them to expand their team and further develop their platform.

Trinity spin-out and medical device company ProVerum raised c.€3.5 million in series A funding. ProVerum has developed a novel, minimally invasive treatment for patients with symptomatic Benign Prostatic Hyperplasia (BPH) as an alternative to invasive surgery. This successful funding round has enabled their first human trials to start and brings their total funding since being established in 2015 to €4.6 million.

In June, an inaugural event that brought alumni and leading Trinity researchers and entrepreneurs together to showcase current work, discuss future trends and explore opportunities for engagement and collaboration was curated by Trinity's Research and Innovation unit and Trinity Development and Alumni. Life Sciences was its focus during which panellists Dr Conor Harkin of ProVerum, Dr Lucy O Keeffe of CroiValve, an early stage medical device company focused on developing a minimally invasive device for the treatment of a heart condition, and Dr Matthew Campbell, PI and entrepreneur at the Smurfit Institute of Genetics were interviewed by Professor Luke O'Neill.

At this year's Trinity Innovation Awards, Professor of Biochemistry, Luke O'Neill won the highest accolade, the



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Provost Innovation Award for his outstanding contribution to innovation throughout his career. He was joined by eight other winners:

- Professor of Engineering and Arts, Linda Doyle, Professor of Medical Gerontology Rose Anne Kenny, and Dr Sabina Brennan, Principal Investigator in E-Health at ADAPT all won awards for innovative research of significant societal impact;
- Professor in Genetics Jane Farrar and Adjunct Professor Frank Boland were recognised for innovative research of significant socio-economic and commercial impact;
- Dr Matthew Campbell, Research Fellow at the School of Genetics and Microbiology and Dr Parvaneh Mokarian, Senior research fellow at the School of Chemistry and AMBER were awarded prizes in the 'ones-2-watch' category;
- The Lifetime Achievement Award went to Fellow Emeritus, Professor Tim Foster at the School of Genetics and Microbiology.

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#### The University Bridge Fund

The University Bridge Fund, a €60m fund which is exclusively focused on investing in research and intellectual property coming out of Irish Higher Education Institutions invested in three Trinity companies this year - ProVerum, Volograms & DataChemist



#### Student innovation

Since its inception in 2013, the hugely successful student incubator programme LaunchBox, Tangent's Student Accelerator has created 70 startups that have gone on to raise over €9 million in funding and investment.

Ten student-led start-up teams were selected for LaunchBox this year – benefitting from coaching, expert advice, seed funding and access to incubator space and facilities. Some of the teams – including *Change Donations* and *Work Smarter* - have moved on to next-stage entrepreneur development programmes and kick-started operations with paying customers.

*Change Donations* is creating a platform that allows users to donate to the charity of their choice efficiently and conveniently by rounding up payments made on your debit card. Since leaving LaunchBox, *Change Donations* have become Dogpatch Labs residents, been accepted on to the Prince's Trust Enterprise Programme and placed as one of just three Best Early-Stage Concepts for the Responsible Innovation Summit. *Work Smarter*, which combats late payments in the construction and freelance industries, offers a comprehensive toolbox for small business owners and freelancers that combines work management tools and a unique escrow payment solution. Since finishing LaunchBox they have been accepted on the Huckletree Alpha programme, and are beta testing their platform.

LaunchBox is just one avenue through which Trinity students nurture entrepreneurial skills. The Blackstone LaunchPad campus entrepreneurship programme operates from the Berkeley Library, connecting student entrepreneurs with the startup ecosystem. Over 230 student startups have registered since LaunchPad opened in 2016, and more than 40 student startups have progressed on to early-stage funding.

The Innovation Academy, an initiative of Trinity, UCD and Queen's University Belfast, offers innovation and entrepreneurial training to postgraduates. It won this year's GradIreland Postgraduate Course of the Year for Design and Innovation for the Postgraduate Certificate in Innovation & Entrepreneurship.

Computer Science and Statistics Masters students, Team Imbibe, won the Dragon's Den final of Citi's upStart Student Entrepreneurship Programme. Team Imbibe's start-up idea for digitized interactive psychotherapies delivered over web and mobile enabled by Amazon-Alexa won out against seven other finalist teams from innovation courses across Ireland.

# Public Engagement

**Trinity engages with the public through diverse activities. The university is committed to furthering public debate, showcasing research through public talks, exhibitions, events and making it available online as well as welcoming visitors to our beautiful campus. Engaging wider society is central to Trinity's mission and Strategic Plan.**

'PROBE: Research Uncovered', a pop-up festival returned in September with a packed programme of talks, experiments, and interactive workshops showcasing the best of Irish research. Over 3,000 visitors came to Front Square and contributed to live research experiments and joined workshops dealing with a range of topics. PROBE, a collaboration between Trinity and Science Gallery Dublin in partnership with the British Council, was part of European Researchers' Night, taking place in cities across the continent.

The inaugural Registrar's Civic Engagement Award, established to recognise exceptional contributions made by staff to civic engagement, was won by School of Engineering Assistant Professors, Kevin Kelly and Conor McGinn. The pair are group leaders in the Robotics and Innovation Lab (RAIL) and were recognised for their contribution to Trinity's engagement with wider society through their teaching and research, running an Engineering Summer School for girls, and interacting with companies and not-for-profit organisations in their engineering projects. One of their projects was the design of 'Stevie' — an elder-care robot and navigation device for people living with intellectual disability.

**RIGHT** – Hillary Rodham Clinton delivering a public lecture with the Chancellor of the University, Mary Robinson



→ Hillary Rodham Clinton,  
the former US Secretary of  
State, delivered a public  
lecture in June...

## 07

→ The ‘Behind the Headlines’ discussion series offers background analyses to current issues. Among the topics in 2017/18 were: ‘#MeToo – Then and Now’, ‘The Future of Policing’, ‘The Future of Europe and its Borders’, ‘The Banking Crisis – a Decade On’ and ‘Dublin Housing – Now and Then’

#### Public lectures

Hillary Rodham Clinton, the former US Secretary of State, delivered a public lecture in June in which she addressed the power of young people to shape the future, challenges to democracy and the role of women in politics. Secretary Clinton was awarded an honorary doctorate during her visit.

Former President of Ireland, Mary McAleese discussed ‘Ireland-UK relations, past, present and future’ at the annual Henry Grattan lecture in conversation with RTÉ’s Northern editor, Tommie Gorman. The lecture was hosted by the Embassy of Ireland in London in association with the School of Social Sciences and Philosophy.

Prof Margaret MacMillan, Oxford Professor of International History and best-selling author, delivered the annual Trinity Long Room Hub Edmund Burke Lecture on the theme of ‘Sometimes it Matters who is in Power’ in October.

Internationally acclaimed artist Michael Craig-Martin gave a public talk the following month about the ideas that have been expressed through his artwork and teaching at an event hosted by the Trinity Irish Art Research Centre (TRIARC) in association with Trinity’s student-run Visual Arts Society.

The Faculty of Engineering, Mathematics and Science hosted 2018’s Trinity Week with a public programme of lectures, symposia and activities around the theme *Energy*. Age-Friendly Trinity organised a photo exhibition on ‘Energy at Any Age’ to coincide with the week.

Irish writer Sebastian Barry was among participants in a public reading of the work of Italian author Primo Levi organised by Trinity’s Herzog Centre and Centre for Literary Translation in collaboration with the Italian Institute of Culture, Dublin to

mark International Holocaust Remembrance Day in Trinity.

The Trinity Centre for Asian Studies hosted a series of public lectures as part of the Dublin Chinese New Year Festival with different perspectives on the significance and years of the dog in Chinese culture.

The Trinity Long Room Hub’s ‘Behind the Headlines’ discussion series offers background analyses to current issues. Among the topics in 2017/18 were: ‘#MeToo – Then and Now’, ‘The Future of Policing’, ‘The Future of Europe and its Borders’, ‘The Banking Crisis – a Decade On’ and ‘Dublin Housing – Now and Then’.

‘Who reads poetry?’ was the provocative question explored by Ireland’s Professor of Poetry Eiléan Ní Chuilleanáin at the annual Ireland Chair of Poetry lecture as part of the post’s public engagement programme.

*Year Zero*, a symposium celebrating the 40th anniversary of The Clash’s historic concert at Trinity took place in October. When The Clash played in Trinity they were fresh from a cancelled show and mini riot at Belfast’s Ulster Hall the night before. Bringing the white heat of UK Punk Rock to an Irish audience for the first time, the Trinity gig was a seminal moment in the Irish music scene.

#### Exhibitions

World class spaces for innovative public exhibitions are provided by the Old Library’s Long Room and Science Gallery Dublin. In 2017/18, Science Gallery’s three shows IN CASE OF EMERGENCY, FAKE and LIFE AT THE EDGES attracted over 374,650 visitors.

The first major Irish exhibition on Oscar Wilde, one of Trinity’s most famous alumni, featuring letters, photographs,

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**BELOW LEFT** – Winners of the Civic Engagement Award, Assistant Professors Kevin Kelly (left) and Conor McGinn are congratulated by the Registrar, Prof Paula Murphy

**BELOW RIGHT** – At the launch of the Oscar Wilde exhibition were actor Rupert Everett and Senator David Norris



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theatre programmes, books and memorabilia was on display in the Long Room in October. Entitled ‘From Decadence to Despair’, the exhibition and accompanying [online exhibition](#) mapped out the Anglo-Irish playwright’s meteoric rise to fame and also his dramatic fall from grace. Actor and writer Rupert Everett participated in a public interview to mark the opening.

Marking the centenary of women’s suffrage in Ireland, an inter-institutional online exhibition - [Violence, ridicule and silence](#) - curated by Trinity’s Library plotted Irish women’s road to the vote in 1918. It highlighted how it was an all-island activity and influenced by events in England; demonstrated how violence and ridicule was used to prevent women from making their voices heard; and illustrated the deep disappointment at the misogynistic 1937 Constitution which reneged on the equality ideals of the early activists.

Also marking the centenary, the *Story Spinners: Irish Women and Children’s Books* exhibition showed the central role that women played in Irish history, politics, and culture, including literary arts. It offered a glimpse into the wealth of material produced for young readers over several centuries and formed part of Children’s Books Ireland’s nationwide BOLD GIRLS initiative, which seeks to celebrate strong, confident, intelligent, brave women and girls in children’s books.

Precious Irish-language manuscripts were showcased at an exhibition in May including medieval Brehon law texts detailing bee-keeping laws and the Irish ‘book of

genesis’. Trinity Library’s collection of over 200 medieval and early modern manuscripts written in the Irish language is ranked as one of the most important collections in the world.

Another exhibition on display in the Long Room was one of 70 handmade books written and illustrated by Dublin primary schoolchildren. It marked the culmination of the *Bookmarks* programme which sees pupils write and illustrate their own books over two months with the help of authors, artists and children’s book specialists from Trinity. Inspiring children to become the next generation of storytellers, artists and creatives, *Bookmarks* is organised by the Trinity Access Programmes (TAP) which supports students from under-represented backgrounds to progress to further education.

The ‘War and Revolution: Framing 100 years of Cultural Opposition in Ukraine’ exhibition in the Trinity Long Room Hub looked at Ukraine’s complex historical legacies, as well as various modes of cultural resistance through striking works produced by several generations of writers and artists.

The Suas 8x8 Photographic Exhibition was displayed outside the Berkeley Library as part of a development-focused arts festival organised by STAND with Suas Trinity, DU Amnesty and Q Soc – Trinity LGBT. With the theme ‘Identity & Discrimination’ issues surrounding LGBT rights, women’s rights, ageism, health status, immigrant rights, ethnicity, religion and poverty were explored.

## 07

**Beyond the campus**

Trinity called on the nation to get creative and be inspired by one of Ireland's greatest cultural treasures, the Book of Kells, in the first Trinity Book of Kells Creative competition. A phenomenal 1,500 budding artists and writers, aged from 3 to 83 entered, representing students from 52 primary schools and 42 secondary schools, from every county in Ireland, as well as the US and UK.

A ground-breaking project, 'Beyond 2022: Ireland's Virtual Record Treasury' which will digitally recreate the building and contents of the Public Record Office of Ireland, destroyed by fire at Dublin's Four Courts at the outset of the Irish Civil War, was launched in February. The Irish Research Council funded collaboration led by Trinity with its four archival partners - The National Archives of Ireland, The National Archives (UK), The Public Record Office of Northern Ireland and The Irish Manuscripts Commission - has the potential to transform how we understand Ireland's past and will be of great interest to the Irish diaspora and anyone tracing their Irish roots.

This year Trinity partnered with *The Irish Times* on an exciting Citizen Science initiative. Members of the public were encouraged to contribute by answering online questionnaires around different scientific topics, with their responses then used to inform real research. A new online questionnaire appeared every few weeks, alongside an article penned by a scientist, to raise awareness of this increasingly important approach to research.

→ A ground-breaking project, 'Beyond 2022: Ireland's Virtual Record Treasury' will digitally recreate the building and contents of the Public Record Office of Ireland...

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**LEFT** – Cara Pilbeam, aged 15, from St Vincent's, Dundalk, Co Louth, 1st prize winner of the secondary school section in the Trinity Book of Kells Creative competition

**BELOW** – Members of the public enjoying LIFE AT THE EDGES exhibition at Science Gallery Dublin



# The Student Experience

**Students had a profound impact on campus life - and indeed on Dublin life - this year when they voted through a student-led campaign, to end single-use plastic on campus. This means all cafés, eateries, Schools and departments on campus are now getting rid of disposable plastic cups, bottles, straws, and cutlery. This will impact visitors as well as staff and students and it's a great example of how Trinity students shape the college's traditions and take responsibility for the environment around them.**

Students are represented on the college Board, and along with fellow Board members, they safeguard Trinity's distinctiveness and good governance. Their role was reinforced last year with the introduction of Ireland's first Student Partnership Policy, an agreement by the university and students' unions to develop and support effective student partnership, engagement and representation. Student protests, entitled 'Take Back Trinity', against a proposed increase in the fee for supplemental exams took place in March and the Partnership Policy contributed to finding a solution through effective dialogue.

What we call the Trinity Education is centred on the curricular and the extracurricular - the lecture room and the playing fields, the lab and the debating theatres, the library, 'the ramp' and the Pav. The Student Experience refers to all the ways that Trinity students grow and develop through co- and extra-curricular activities, including sports clubs and societies, volunteering, activism and the Students' Union.

The strength of these activities is that they are student-led, reflecting the passions and interests of the students themselves and allowing them to achieve and recognize benefits for themselves and others outside the academic sphere. Students involved in at least one activity outside the classroom are happier, better-adjusted, enjoy college life more, create broader networks of friends, perform better academically, and are better prepared for life after graduation.



→ Much work was done this year within the Trinity Education Project to ensure students have the opportunities to develop and enhance the graduate attributes...



## 08



Much work was done this year within the Trinity Education Project to ensure students have the opportunities to develop and enhance the graduate attributes - to think independently, to communicate effectively, to develop continuously, and to act responsibly - through engaging in co-curricular and extracurricular activities as well as academic exchanges and internships.

The Dean of Students champions the student experience, integrating the out-of-class activities of students with the academic mission of the university to ensure that the years in Trinity provide students with a vast array of opportunities for involvement, leadership, and personal exploration.

### Orientation & transition to Trinity

The student experience really starts with orientation and Freshers' Week. This year the transition to Trinity has been further developed through the 'Trinity in 12 Weeks' initiative which runs themed weeks of activities and information sessions through first semester to ensure a successful transition to college life. These include Healthy Living, Managing Money, Study Skills, Healthy Relationships, and Making the most of College. The Counselling Service, in cooperation with the Students' Union, ran very successful consent workshops for over 800 first year students as part of a healthy relationships initiative. The workshops are being rolled out to even more students and have been modelled by other institutions.

### Student societies

This year Trinity offered 126 student societies and 49 sports clubs. As every year, Freshers' Week showcased the huge diversity of Trinity clubs and societies including political, musical, cultural, volunteering and professional as well as plain fun and entertainment. It was followed by a very successful 'Fourth Week' at the end of October that allows the entire College community to try out societies they may have missed joining.

International guests are a feature of many societies – including notably the Hist, the Phil, the Law Society and SOFIA. This year 20 ambassadors joined students at SOFIA's annual Ambassador's Ball. The Historical Society had a wide range of speakers ranging from US civil rights activist Rev. Al Sharpton to author Jung Chang to Catherine Day, former Secretary-General of the European Commission.

At the 2017 Student Achievement Awards Ireland, Trinity organisations and individuals did very well:

- James Cotter, Aontas na Mac Léinn, won Feachtas Gaeilge na Bliana
- Outstanding Contribution to Student Media went to Dominic McGrath from The University Times. The University Times also won Student Media Outlet of the Year
- Student Leader of the Year saw both Alice Macpherson and Kevin Keane of the TCDSU nominated with Kevin Keane taking home the honours.

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**LEFT** – Winner of the Trinity Legacy Award for Volunteering, Tom O'Malley, president of Trinity St Vincent de Paul with the Dean of Students, Prof Kevin O'Kelly and Minister for Children and Youth Affairs, Katherine Zappone, TD

**BELOW LEFT** – Paul Molloy, Auditor of The Historical Society with Rev Al Sharpton, US civil rights activist

**BELOW RIGHT** – A student enjoying one of the new student spaces, Zón Mac Léinn



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Trinity College Dublin Students' Union (TCDSU) celebrated its 50th anniversary at a gala dinner in the Dining Hall in June at which 70 TCDSU alumni came together to mark the occasion.

### Volunteering

This year the Dean's Roll of Honour recognized one outstanding student for the Trinity Legacy Award for Volunteering, 26 students for the Dean of Students Leadership Award for Volunteering, and 62 for the 2018 Dean's List for Volunteering. The awards were presented by the Minister for Children and Youth Affairs, Katherine Zappone, TD. The Legacy Award went to Tom O'Malley, president of Trinity St. Vincent de Paul. Among his many long-lasting achievements were developing links with Friends of the Elderly, establishing Teen Club for young children and a second branch of Trinity Club for adults with intellectual disabilities.

### Student Spaces

A campus-wide network of student spaces, 'Zón Mac Léinn', continues to be developed with the three new student spaces being completed, one in the Trinity Biomedical Sciences Institute (TBSI), one in D'Olier Street and one outside the planned 24-hour Hamilton library. A new space in Tallaght hospital is also being explored. Spearheaded by the Student Life Committee and the Students' Union, these are spaces designed for students to spend time between classes and relax with their fellow students wherever they are.

**This year Trinity offered 126 student societies and 49 sports clubs, As every year, Freshers' Week showcased the huge diversity of Trinity clubs and societies including political, musical, cultural, volunteering and professional as well as plain fun and entertainment.**

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# Strengthening Initiatives in Education

**In a rapidly transforming world – where technology is continually evolving, workplace practices and career models are in flux and the planet confronts global challenges like climate change and biodiversity loss - universities must evolve in the way that they educate students and prepare them for successful careers and lives of active citizenship.**

In Trinity we are conscious of our responsibility to educate students of the future and we are putting in place initiatives and programmes to develop the skills, approach and mindset that graduates will need to flourish in the 21st century.

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## **E3**

The new Engineering, Environment and Emerging Technologies development, E3, is a ground-breaking initiative which equips the university to do three things simultaneously: create new curricula in engineering and the sciences; enable new research around areas of global challenge, and build new infrastructure that attracts more students to come to Trinity.

E3 will expand education and research across three of Trinity's schools: Engineering, Natural Sciences, and Computer Sciences & Statistics. It will facilitate an increase of 1,800 students leading to a total of 4,800 in these three schools and respond to the national and international demand for highly-skilled scientists and engineers.

E3 will position Ireland at the forefront of fields of research in Science, Technology, Engineering, and Mathematics (the STEM disciplines), that are crucial for future economic competitiveness. It will educate engineers and scientists for employment in existing and new technology sectors, equip them with the skills and attributes to lead in the creation of new businesses, and place Ireland in a leadership role globally for the quality of graduates in the STEM disciplines.

**RIGHT** – Science students reviewing notes

→ We are putting in place initiatives and programmes to develop the skills, approach and mindset that graduates will need to flourish in the 21st century...



## 09



The span of E3 research will encompass six research themes: Environment, Resources, Production, Data, Well-being, and Cities. New postgraduate courses will be created in these areas.

Plans for the first phase of E3 – the E3 Learning Institute – were unveiled in May. The initiative is made possible through a major private philanthropic donation by the Naughton family together with Government funding from the Department of Education and Skills.

### Tangent

In spring 2019 the Trinity Business School (TBS) will move into its new €80 million building beside Science Gallery, facing out to Pearse Street.

Co-located with TBS in this state-of-the-art building will be Tangent, Trinity's Ideas Workspace, offering students, staff, and the wider innovation ecosystem a place to come together to collaborate, build and innovate.

As a European leader in student entrepreneurship, Trinity launched Tangent this year as a new initiative for the college, supported by the Bank of Ireland. Providing cutting-edge innovation and entrepreneurship education, Tangent offers a suite of certified and professional education programmes that aims to motivate and inspire students, academics and industry professionals. It specialises in idea generation, translation and validation; creative problem solving (including design thinking); storytelling and communications; lean business methodologies; new venture planning and leadership development.

Adapting tools from design, theatre, psychology, business and the arts, the Tangent education experience is both interactive and immersive. Its programmes aim to produce graduates equipped with an entrepreneurial mindset, well positioned to succeed in creative and commercial endeavours.

### Trinity Education Project

A university-wide initiative to renew the undergraduate curriculum, known as The Trinity Education Project, is at the implementation phase. It's due to complete in September 2020. The most ambitious renewal of our undergraduate curriculum in a century, the Trinity Education Project will ensure that students are prepared appropriately for global changes in the workplace and in society, including more flexible job practices and the growth of the digital workplace.

#### Some of the changes being made include:

- more diverse styles of assessment – moving away from exams to other means of appraisal, such as peer-to-peer assessment;
- all students will complete an independent "capstone" research project in their final year;
- a more flexible programme structure
- more opportunity for students to take modules outside their core discipline – the 'Trinity Electives' mean that science students can now take modules in arts and humanities, and vice versa and
- continued emphasis on extra-curricular learning through participation in clubs and societies.

**LEFT** – Discussions in the School of Computer Science and Statistics

**BELOW LEFT** – Students catching up between lectures

**BELOW RIGHT** – Enjoying the sun in Fellows' Square



These changes aim to prepare graduates for a world that is ever more global, entrepreneurial, and technological, and more flexible in terms of jobs and career-building. The Trinity Education Project is about encouraging students to develop a mindset premised on four Graduate Attributes:

- To think independently
- To communicate effectively
- To develop continuously
- To act responsibly

These attributes encompass the qualities, skills and abilities that our students have the opportunity to develop throughout their entire university experience – both in and outside the classroom in activities such as internships and volunteering.

#### **Provost's PhD Project awards**

The inaugural Provost's PhD Project Awards, providing 40 fully funded PhD positions across a wide variety of disciplines, were launched this year. These doctoral awards are generously funded through unrestricted alumni donations and profits derived from Trinity's Commercial Revenue Unit.

Open to all Assistant/Associate Professors, there were nearly 200 applications from PIs across the university. The 40 chosen projects showcase the range, depth and quality of research in Trinity including areas such as: 'China, Ireland and Empire', 'Modularity in Quantum Gravity and String Theory', 'Calcium supplementation and its effects on the pathogenesis

of cardiovascular disease', 'ExStream: Freshwater Ecosystems under Global Change', and 'Improving the Psychological Treatment of Refugees and Asylum Seekers who have experienced torture and other forms of extreme trauma'.

The awards signal the college-wide commitment to Trinity's PhD students who will be given the opportunity to work with and learn from global leaders in research, to benefit from their experience and networks.

**The inaugural Provost's PhD Project Awards providing 40 fully funded PhD positions across a wide variety of disciplines, were launched this year. These doctoral awards are generously funded through unrestricted alumni donations and profits derived from Trinity's Commercial Revenue Unit.**

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# Developing a Sustainable Campus

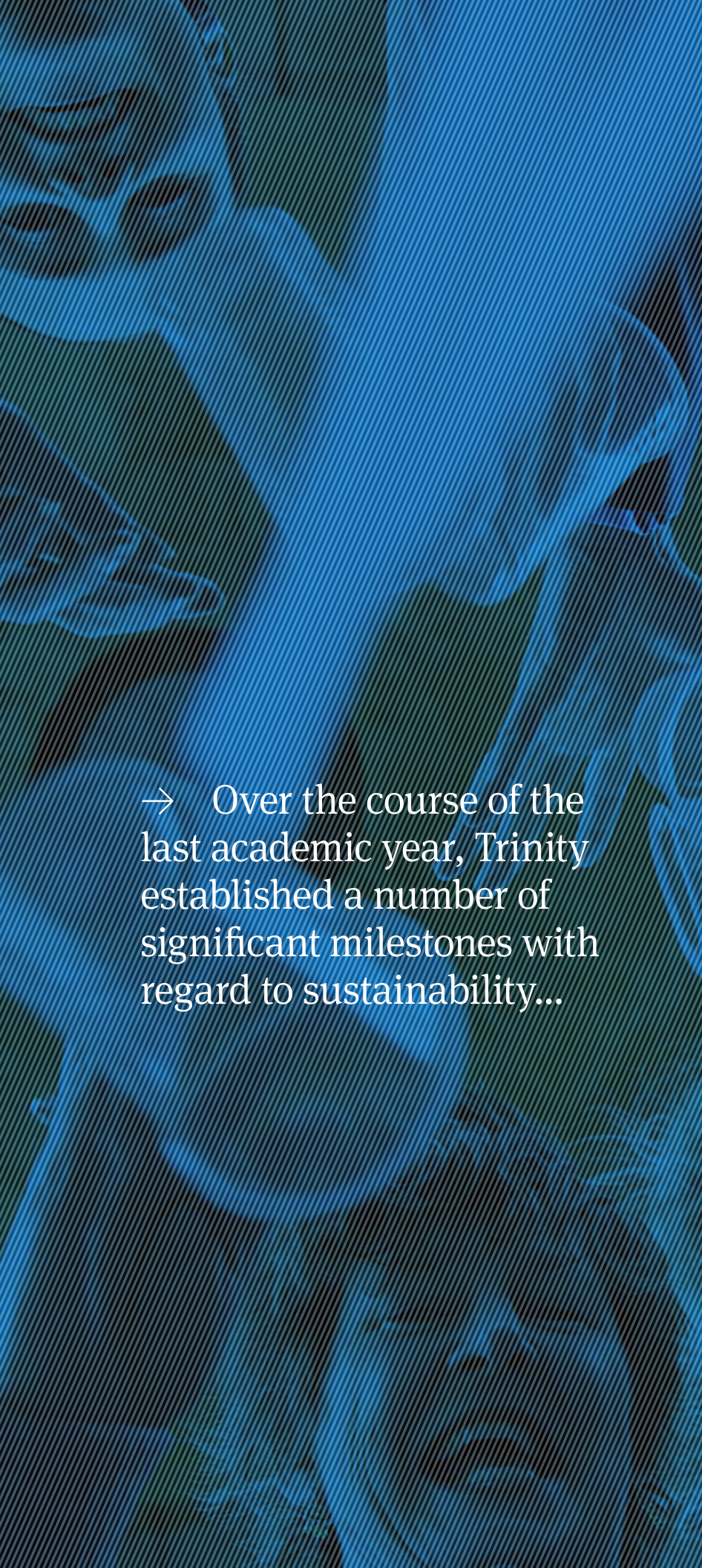
**Trinity is committed to developing a fully sustainable campus in line with best international practice.**

The third annual [Sustainability Report \(2017\)](#) highlights the significant gains made in recent years including a decrease in paper use by 50% since 2011, a reduction in water consumption of 41% since 2010 and a 26% improvement on energy efficiency since 2008. These benefits have resulted in cost savings for the university in addition to a substantial reduction in the environmental footprint of our operations.

The [Provost's Advisory Committee on Sustainability and Low Carbon Living](#) was established in February 2017, with staff and student representation. It is tasked with providing leadership in advancing the sustainability objectives in the College's current Strategic Plan, especially on environmental and carbon footprint topics. The Provost has appointed both a sustainability champion and sustainability advisor to encourage and link behaviours, projects and initiatives throughout the university.

**RIGHT** – The Trinity community agreed to replace or eliminate disposable plastics, and to phase out disposable plastic containers and utensils over the next two years





→ Over the course of the last academic year, Trinity established a number of significant milestones with regard to sustainability...



## 10



**Over the course of the last academic year, Trinity established a number of significant milestones with regard to sustainability, including:**

#### **Joining the International Sustainable Campus Network (ISCN)**

Trinity became the first university in Ireland to join the [International Sustainable Campus Network \(ISCN\)](#) in February 2018. The ISCN is a global forum of leading colleges, universities, and corporate campuses exchanging information, ideas, and best practices for achieving sustainable campus operations and integrating sustainability in research and teaching. The Provost attended and presented during a panel discussion entitled “Leadership for Sustainable Development” at the annual ISCN conference in June 2018, hosted by KTH Royal Institute of Technology, Stockholm.

#### **Establishing a plan for reducing disposable plastics on campus by 2020**

The student-led ‘Plastic Solutions’ group presented to the Provost’s Advisory Committee on Sustainability and Low Carbon Living (PACS) on the growing desire among the student population to eliminate disposable plastics across campus. The Committee supported the initiative and committed to creating a plan to reduce and eliminate where possible, disposable plastics across campus. Following a successful poll of staff

and students where 3,800 people voted on the measure, most catering outlets on campus have already replaced plastic straws with paper or biodegradable alternatives and moved to compostable disposable cups and take-away foodware. The plan will be further implemented in the coming year.

#### **Staff and student educational initiatives**

Trinity’s commitment to engaging staff and students in the creation of a campus designed to prioritise sustainability led the Provost to commission a number of educational endeavours in the past year, designed to inform and involve the campus community:

The ‘Green Pages’ website, which provides information about preferable sustainability behaviours to staff and students, <https://www.tcd.ie/provost/sustainability/> was officially launched during the annual campus ‘Green Week’ in February. More than 60 pages of sustainability-related topics serve to inform and invite participation in engendering environmentally preferable habits among Trinity staff and students.

As part of the staff induction programme, over 200 new staff were inducted into sustainability initiatives and behaviours on campus, with a view to driving good habits such as proper recycling, water and energy conservation, use of sustainable transport options and awareness of resource consumption.

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**LEFT** – Celebrating Trinity being awarded the 'Green Flag' for the quality of its environment again

**TOP RIGHT (L-R)** – Moira O'Brien, Catering Manager, Michele Hallahan, Sustainability Advisor, Provost Dr Patrick Prendergast, Joanna Mulkeen, OneStepCloser and student Caitríona De Búrca, TCD Plastic Solutions co-ordinator

**BELOW RIGHT** – Magnolia tree blossom

**BOTTOM RIGHT (L-R)** – Registrar Prof Paula Murphy, SU Environment Officer, Simon Benson, Provost, Dr Patrick Prendergast, and Senator David Norris

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A [Staff Sustainability Network](#) was established to encourage participation in shaping sustainability initiatives for Trinity. The first monthly meeting convened in December 2017 and has already created a number of opportunities to build connections between departments and offices for collaborating on sustainability initiatives.

Initiatives are also reaching out to and involving students. For the first time, every Fresher who joined Trinity in September 2017 received a [Student Sustainability Guide](#) (printed on 100% post-consumer recycled paper) and residents in Rooms and Trinity Hall also received a copy of the [Resident Sustainability Guide](#). In October 2017 an electronic copy of these guides (including a version designed specifically for staff), was issued to every student and staff member on campus.

Students continue to be actively involved in the Green Campus Committee, the Environmental Society and in proposing and developing sustainability initiatives. The Provost's Advisory Committee on Sustainability and Low Carbon Living provides a forum to link these valuable initiatives. For example a student movement led to the adoption of the Plastics Reduction Plan, and a successful student proposal led to the acquisition of Trinity "Keep Cups" this year.

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### Green Procurement

The Provost's Advisory Committee on Sustainability and Low Carbon Living established a Green Procurement Working Group, which is tasked with assessing the university's spend on purchases, this being a major contributor to Trinity's environmental footprint. The aim is to develop an understanding of Trinity's sustainable procurement activity, establish a Green Procurement Policy and determine appropriate goals.

A dedicated email address has also been established, to attend to suggestions, queries and communication regarding sustainability: [sustainability@tcd.ie](mailto:sustainability@tcd.ie)

**As part of the staff induction programme, over 200 new staff were inducted into sustainability initiatives and behaviours on campus, with a view to driving good habits such as proper recycling, water and energy conservation, use of sustainable transport options and awareness of resource consumption.**



# Raising our Game – Sport at Trinity

Trinity Sport continues to encourage participation of students in different sports and fitness activities, at all levels, and to provide support to student athletes on the field of play as they strive for greatness at both national and international level.

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## Sports Centre

The expansion of the Sports Centre allowed for an even wider selection of programmes and members voted with their feet – there was a 15% increase in usage from October 2017 to June 2018 compared to the same period the previous year.

This translates to:

- 2016-2017 – 249,504 attendance
- 2017-2018 – 286,361 attendance

In both cases the majority of users, circa 70%, were students.

**RIGHT** – Participating in  
the Christmas Campus 5k

→ Trinity Sport continues to encourage participation of students in different sports and fitness activities, at all levels, and to provide support to student athletes...



# 11



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**LEFT** – Sports scholars Michael Silvester (rugby), Conall Hayes (athletics), Aisling Maher (camogie), Rachel Burns (hockey), Isabelle Delamer (hockey), Aoife Hopkins (sailing), Cian O’Sullivan (hurling) and Jack Dunne (rugby)

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## → Trinity Sport is now a recognised identity amongst many stakeholders and continues to grow and develop.

### Social sport & participation

The broadening out of the participation base continues to be a driving objective for Trinity Sport. There was a full programme of social sports and leagues on campus for students, including: 3 v 3 basketball, 5-a-side soccer, rookie hockey, social table tennis and learn to play Gaelic football.

These programmes had 612 participants playing weekly and a footfall over the academic year of just over 7,800. In addition a social sports programme was run off campus in Trinity Hall, where there were 167 participants.

The participation side of Trinity Sport activities also involved the Swim for a Mile training programme and event, a staff social programme, the Reindeer Run and Campus 5K as well as a new EU Active Campus Europe initiative, Move More – Feel Better, specifically aimed at targeting those who do not meet recommended activity levels.

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### Sports club performances

The Rifle club had a prominent year, with the club’s Siobhan Scarlett representing Trinity on the national and international stages, picking up a Pink and Performance of the Year at the annual Trinity Sports Awards. There were Colours wins for Fencing, Snow Sports, Trampoline and men’s Rugby. Other high-profile wins include the Association Football men’s team, who won freshers’ competition the Harding Cup for the first time in over 20 years thanks to a goal by sports scholar James Woods.

Elsewhere women’s Volleyball earned promotion to the premier national league, while our fresher hurlers won both the league and the championship for the second year in a row. Men’s rowing won the Wylie Cup (University Championships) and also came from behind to defeat UCD in this year’s Colours, bringing the Gannon Cup back to Trinity. Our senior women claimed the Corcoran Cup at the same event, which had to be hastily rearranged to take place at Islandbridge due to the snowy conditions.

Upcoming talent at Trinity Rugby was on display when the U20s men’s team won the All Ireland Fraser McMullen Cup for only the third time in the club’s history.

### Scholarships

October saw the unveiling of this year’s sports scholars, presented in conjunction with Bank of Ireland. Among the 63 awardees were: Aoife Hopkins (sailing), the current U21 European ladies radial champion; Lorcan Tucker (cricket), a previous Junior Player of the Year for Cricket Ireland; and four Ireland U20s (rugby) – Jack Kelly, Michael Silvester, Max Kearney and Jack Dunne, who is also a Naughton scholar.

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### Planning for the future

Two strategic partnerships were announced this year, which will further develop Trinity’s reputation as a sporting university. An agreement with Cricket Leinster will see the province use College Park as their new home ground for all Leinster youth and senior cricket. In turn, Trinity will have access to Cricket Leinster skills and capacity to upgrade and maintain the cricket square and outfield to the highest standard.

This was followed by the news that Trinity and basketball club Meteors are to field a joint women’s team to compete in the national league from the 2018-19 season with the Sports Centre as the new team’s home court.

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### Investment

Trinity Sport’s investment in capital projects and facilities was increased during the year with the purchase of the Iveagh Grounds sports facilities in Crumlin in November 2017. Further investment will be made in the site with planned redevelopment work to complement existing facilities at Santry. As Trinity continues to grow, sporting opportunities and facilities are being developed in tandem.

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### Strategy for Sport

Completed at the end of 2017-18, the strategy was delivered on track and achieved the overall objective to ‘Raise Our Game’ with an increase in performances, participation and much improved communications, infrastructure, resourcing and profile. Trinity Sport is now a recognised identity amongst many stakeholders and continues to grow and develop.

# New Professor Interviews

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**01** Jennifer McElwain

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**02** Mark Cunningham

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**03** Maeve Lowery

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**04** Michael Cronin

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## 12 Professor Jennifer McElwain

Professor of Botany (1711)

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→ “Botany is an old-fashioned word but a modern discipline. Maybe it’s time to redefine what we think botany is because it couldn’t be more important today - greening of cities, global food supplies, climate change – all this is botany.”

Jennifer McElwain, newly appointed to Trinity’s Chair of Botany (1711), makes the case for the importance of her discipline through her own research. She uses both fossils and historic plant specimen to demonstrate consequences of climate change. “I’ve been involved in climate change my whole career - each study I’ve done in the geological record has revealed more information about potential thresholds or boundaries at which you see major biological consequences.”

Her interest in botany started in her teens – “when all my friends had posters of Wham and Eurythmics on their walls, I had posters of mushrooms and the trees of Ireland!” – and it was while studying in Trinity as an undergraduate in the early 1990s that she developed her interest in paleo-botany [working with plant fossils]. “I was very lucky as a student. There were two members of the Department here - Fraser Mitchell who had expertise in paleo-ecology and Mike Jones, who had expertise in physiology - and they offered a dissertation project which involved looking at stomata on sub-fossil leaves to reconstruct the CO<sub>2</sub> concentration in the atmosphere around 9000 years ago in the Holocene. It was novel and kind of risky and very few others were doing research in this area at the time. I published from my undergraduate dissertation, which is quite rare, and went on to do a PhD in Royal Holloway University of London.”

Working with the archives of the Natural History museum in London and Kew as part of her PhD was inspiring

and her research could not have been more relevant: “The big question we’re always asking with climate change is: if you double CO<sub>2</sub>, how much does the temperature rise by? The range in estimates is huge between 1 and 4 degrees – but it turns out that paleo-botany allows for much more accurate modelling of how the CO<sub>2</sub> concentration in the atmosphere affects the global temperature.”

Her research came to international prominence through an article in *Science* in 1999. “After my PhD, I went to Sheffield as a post-doc. There I focussed on a mass extinction 200 million years ago. I wanted to know what happened in the plant world - did flora suffer the same levels of extinction as observed in the animal record? I used my method of estimating CO<sub>2</sub> and global temperature and it turned out that the peak CO<sub>2</sub> level coincided with the mass extinction. That was a big deal - that a major biological catastrophe in Earth history was forced by environmental change has huge implications for what might happen in the future.”

On the strength of her research, she landed “a dream job” as curator in the Field Museum in Chicago – “it’s one of the largest natural history museums in the world and I was curating its fossil plant collection, with an agenda to drive research. I also taught in the University of Chicago and Northwestern University.”

After seven years in Chicago, Ireland was calling. “I wanted to return for family reasons and I was lucky because



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there was significant funding in Ireland. I was able to avail of the Marie Curie Excellence Programme to bring scientists back to Europe. I got a job in UCD and applied for a Marie Curie grant and that brought multimillion euros in funding to undertake a large multidisciplinary research project.”

She spent just over a decade at UCD before her appointment to the chair in Trinity, which she took up a year ago. It felt, she says, “like coming home. This is where I started my career. Two of the lecturers I remember are still here – John Parnell and Fraser Mitchell, who started me on the path of paleo-botany all those years ago.”

She brought a large research project, together with a team of researchers, with her from UCD: “It’s an SFI-funded project with collaborators in the UK, Australia and Open University. We’re looking at a remarkable archive of leaves in the Smithsonian in Washington, gathered fifty years ago by a paleo-botanist. We’re asking how plants have responded to climate change in this really small timeframe - we’re seeing big changes and we’re working with climate modellers on the implications.”

Her goals now are to continue to drive research, education and public awareness.

As regards research, she is looking forward to publishing the SFI project, targeting funding for further research, and deepening interdisciplinarity: “I’ve always worked with other disciplines in the natural sciences and with atmospheric physicists and engineers and I look forward to doing more of this in Trinity. There’s a real drive here towards interdisciplinarity and finding connections, and E3 is going to be a huge opportunity.”

She is very impressed by students in Trinity: “There are plenty of individuals and eccentrics, which I think is brilliant

because we’re not doing factory learning; there’s acceptance of mad scientists at all levels. And just like in my time, undergrads have a sense of belonging, of being part of a discipline that they are central to. I think that’s because Trinity has held on to its traditions.”

One area she would like to develop is summer internships: “Things are so competitive for students today and relevant summer experience has become a differentiator. I’d like that opportunity for all our students and not just the ones who can afford to work for free. We have graduates working in bio-tech, academia and all over, and I’d really like to create a network of companies where our students could intern, perhaps coupled with small endowments to pay them to work for a few months in the summer.”

Aware of the importance of public advocacy, she is on the board of the Mary Robinson Foundation Climate Justice as well as the RIA Environment and Climate Committee. “I’m very much a natural scientist; I’ve huge amounts to learn in terms of working with policy experts.”

When not researching, teaching and advocating, she likes to upcycle old furniture, restoring the wood – “I like working with my hands, that helps me to switch off”. This seems a sustainable activity and, indeed, she is naturally more aware than most of the importance of sustainability and minimising the carbon footprint: “I take the train into work, which is no hardship – 40 minutes from where I live in Wicklow, door to door – and my house, which we built five years ago, is sustainable, very energy-efficient and geo-thermal. No gas or oil, and bills are minimal. It’s very comfortable – my final goal is for a green roof.”

## Professor Mark Cunningham

Ellen Mayston Bates Professor of Neurophysiology of Epilepsy (2016)

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→ “I do fundamental neuroscience that has impact at the level of patient treatment. My research is translational with implications for neurosurgeons, neurologists, pharmacologists - anyone treating patients with epilepsy, or indeed other brain disorders.”

Mark Cunningham, newly appointed Professor of Neurophysiology of Epilepsy (2016) in Trinity's School of Medicine, is talking about how his research brings together fundamental science with the clinical element.

He took up his Trinity appointment in the summer and has been occupied with moving his laboratory and equipment from the University of Newcastle, where he was previously based. “A lot of the equipment is quite sensitive and heavy. We use it to record from brain cells - that means large anti-vibration tables with stainless steel tops to keep things stable while we put tiny micro-electrodes into individual brain cells to record the electrical signal of these cells, and how networks of those cells behave.”

His research into epilepsy began formally with his PhD in the University of Bristol looking at how anti-epileptic drugs alter the release transmitter at the connection between brain cells - the synapse, but in fact his interest in synapses started much earlier.

“At school in Newry, I had an inspirational biology teacher and I have a clear recollection as part of the biology A Level that we covered synapses and I became really interested in these discrete structures. That's when I discovered that I have a passionate side to my personality with respect to research which I think you need to be an academic.”

He studied Physiology at Queen's University Belfast and proceeded to Bristol University to do his PhD under Professor Roland Jones, staying on for a time after to work with Pfizer on developing new anti-epileptic drugs.

He then moved as a post-doctoral fellow in 2001 to the University of Leeds where they were doing “really interesting work around brainwaves”. He explains: “Typically, we use EEGs to look at abnormal electrical activity in the brain but an EEG is attached to the scalp so you're not recording directly from the brain tissue itself. In Leeds we were able to use slices of brain tissue from laboratory animals. Kept alive, these slices contain important structures of the brain and generate organised electrical activity enabling us to study the brain oscillations that are disrupted in epilepsy and schizophrenia.”

After four years in Leeds with a brief visiting scientist post at Heidelberg University, he moved to the University of Newcastle to take up a five-year fellowship, created by the UK Research Council as a tenure track position. The medical school in Newcastle is physically attached to the hospital, and after meeting with neurosurgeons, he was able to start working on human tissue.

“At that time, pharma was becoming increasingly challenged in their attempts to develop new drugs for diseases of the brain and there had been a number of high-profile failures.

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Part of the problem is that working with animal models involves a massive assumption that this would work for the human brain. I was very keen to understand more through using human tissue.”

For about a third of patients with epilepsy, he explains, surgery is a valued option. With the consent of patients, he was able to obtain microscopic slices of tissue removed during surgery and bring them back to the lab and record from human neurons.

“This was a bit of a game-changer and it rekindled my connection with pharma. I worked with them looking at treatments for epilepsy and brain tumours.”

He and his wife, who is from Donegal and works as a dietician with the NHS, had it “in the backs of our minds that we wanted to come home, and Brexit really brought that into focus”. He was excited when the Trinity job was advertised – “Trinity has an excellent reputation and its connection to hospitals makes it ideal for the kind of translational research that I do.”

The Professorship in Neurophysiology of Epilepsy is a newly created chair, founded thanks to an endowment from Ellen Mayston Bates, who also endowed a clinical chair in epilepsy that will be filled shortly.

This is Professor Cunningham’s first time living and working in the Republic of Ireland. “My mother is from Wexford and we used to drive down every summer from Newry and this was before the M50 so we’d go through Dublin city centre. We’d drive right up to Trinity’s Front Gate and then around the side to get to the N11. I’ve a very clear memory of looking at Front Gate and thinking ‘what goes on in there?’ So it’s a nice circle of life to be working here now.”

Thus far he’s delighted with Dublin – “it’s a very vibrant, multicultural dynamic city” – and with Trinity – “I’m impressed by the way that Trinity has held on to its traditions while also looking outward and staying nimble and adaptive in a fast-paced world.”

As an example of great Trinity traditions, he cites the Senior Common Room, which he says is something that

many British universities got rid of over the past decade but “is so important for giving you headspace and allowing you meet colleagues informally.” As examples of Trinity’s adaptability and modernity, he talks about its interdisciplinarity, translational research, innovation and partnering with industry.

“I’ve had meetings with neurosurgeons from Beaumont and I’m hopeful that I’ll be able to get access to human brain tissue as I had at Newcastle.”

And he’s already put feelers out to industry. “I had two guests over from the pharma company, Eli-Lilly looking to apply for SFI funding and organise a partnership around ageing and epilepsy.”

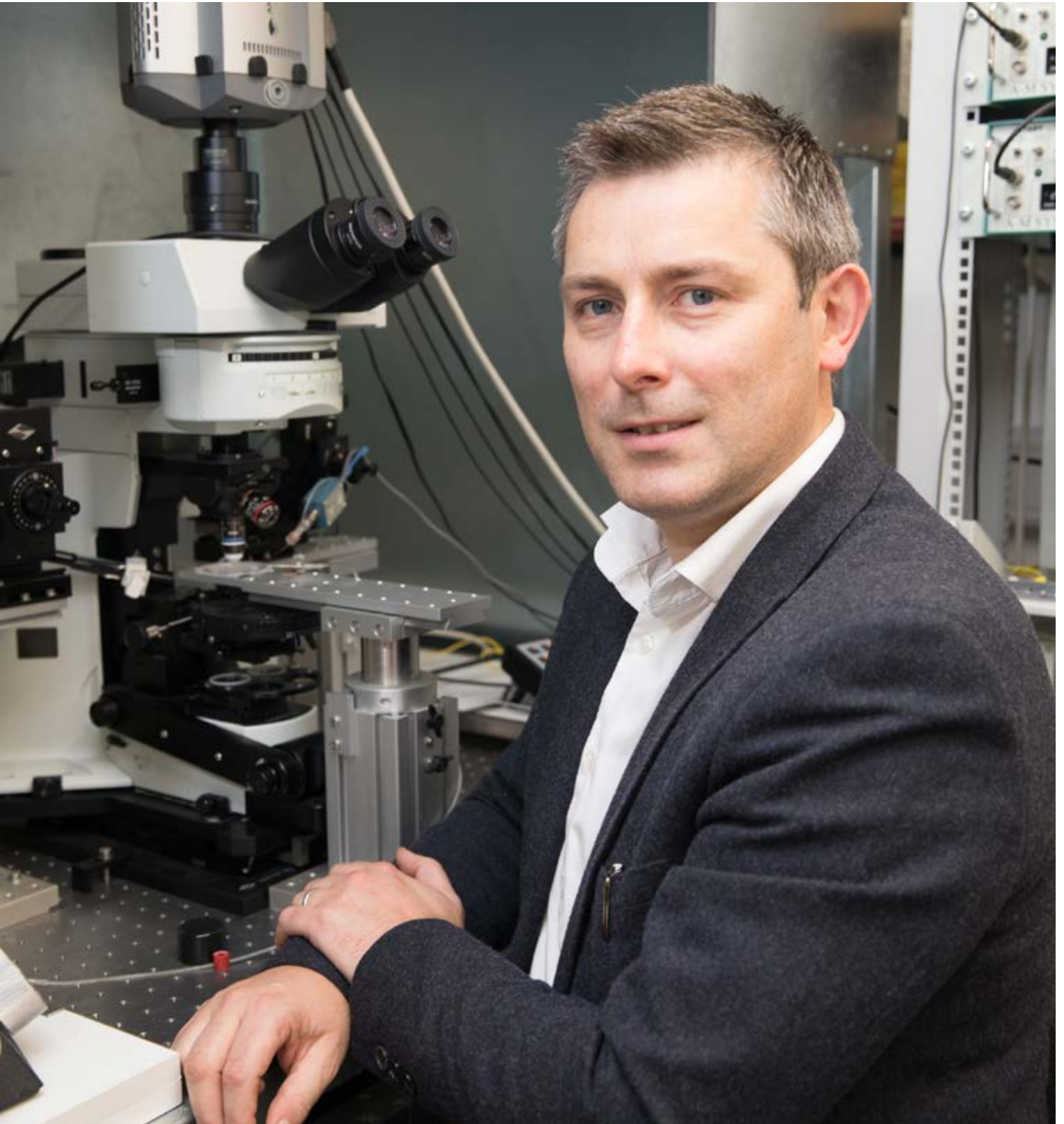
Epilepsy, he explains, can be early, or late-life, onset. The reasons for late onset overlap with ageing itself, meaning that research has potential to address both conditions. “I’ve had discussions with Rose-Anne Kenny, who heads up TILDA [the longitudinal study for ageing]. I think Trinity is potentially a very collaborative space. It’s about getting out and meeting people which is something I like to do.”

He is looking forward to settling his family into Ireland and taking advantage of the outdoors as well as the theatres and exhibitions on his doorstep in Trinity.

On campus, his priorities are to get his lab up and running with access to brain tissue; target funding where industry and research meet; and get stuck into teaching.

“Neuroscience education is a fast-developing area. I’m hoping to get products from a US company, Backyard Brains, which has created small portable labs on circuit board. You can hook these up to electrodes and then connect to your smartphone to see individual muscle fibres firing. That really brings the science home to students.

“Education is essential to research. It’s important to expose students to cutting-edge research and it’s an opportunity to talent spot people for a masters or PhD. I look forward to building up a vibrant team doing translational research here in Trinity in epilepsy, with implications for other diseases of the brain.”



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## 12 Professor Maeve Lowery

Professor of Translational Cancer Medicine (2015)

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→ “Being part of a centre of excellence established for a hundred years, that’s great, of course. But having the opportunity to come back and help create something new - that’s transformative and something that in thirty years’ time you could be very proud of.”

Maeve Lowery, newly appointed Professor of Translational Cancer Medicine (2015) in Trinity, is explaining why she left a dream job in the Sloan Kettering Center in New York to come back to Dublin to help establish the Trinity St James’s Cancer Institute. This Institute is linking together two established structures – Trinity and St James’s Hospital – into a national cancer centre delivering world-class care to patients in Ireland, while contributing to the global search for cancer cures.

The Institute will “be an umbrella joining together medics, oncology researchers in disciplines like immunology and biology, and PIs – nurses, dieticians, physiotherapists - working in patient-centred research and care” explains Professor Lowery.

The Institute already exists virtually insofar as these practitioners and researchers are already working across Trinity and St James’s. The goal now is to establish the essential pathways and linkages across the various roles to facilitate discovery and speed up the transition of treatments to patients.

Professor Lowery has a dual role: as well as holding the professorship of Translational Cancer Medicine - a newly created post - she works as a medical consultant oncologist in St James’s: “My lab focuses on the development of targeted drug therapies for pancreatic cancer, but I also develop clinical trials and care for patients with gastrointestinal cancers. In the optimal situation, I can smooth the path for our immunologists and cancer biologists, bringing their discoveries to our patients in a much quicker timeframe.”

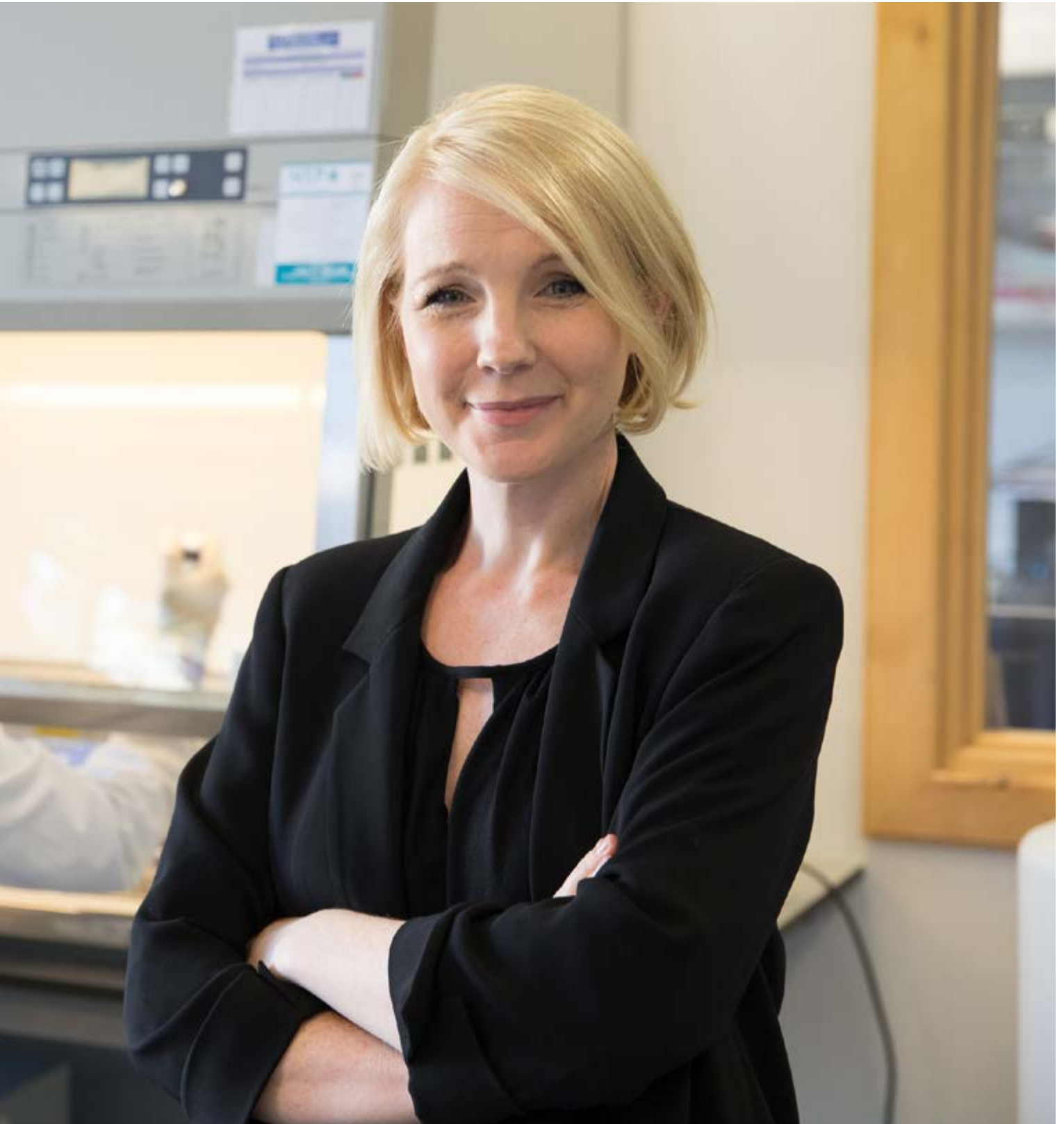
As part of her contract, she is also on the executive committee of the National Cancer Control Programme (NCCP), chairing the committee on cancer molecular diagnostics, which means she is “helping with strategic planning on a national level.”

Her lab is located within the St James’s campus: “It’s a real joy to have a lab within walking distance of the hospital, and it’s quite unusual. It means I can move quickly from one aspect to another – I can see patients on ward rounds and then come back to the lab and focus on drug development and clinical trials.”

She specialises in gastrointestinal cancers – of the pancreas, liver, oesophagus and stomach - and has responsibility for clinical research in that field: “I run clinical trials for patients with upper gastrointestinal cancers. In addition to that, I work on translational studies, working with patient biopsies and blood samples to identify predictors of response to treatment, and with mouse models of cancer to develop new cancer treatment strategies.”

She has a very clear idea of what the Trinity St James’s Cancer Institute should be because she is coming from a model centre of excellence. After graduating from UCD in medicine in 2003, she spent a further six years in Dublin, three of them doing sub-speciality oncology training in the Mater and St James’s, before moving to New York to take up a fellowship position in Sloan Kettering, where she subsequently remained as a researcher and medical oncology consultant. “They have





a record of excellence in translational medicine. They've been doing it for years - translating key discoveries in the lab into innovative clinical trials and using patient samples to refine their treatment in a continuous cycle of improvement. That's the gold standard of how cancer drug development should function."

She combined her consultancy and research role with teaching. "I had a joint appointment in Cornell University, where I tutored medical students. And while Sloan Kettering had a strong medical oncology fellowship training programme for clinicians, I also enjoyed supervising post-docs in the lab, including pure scientists, from a non-clinical background. I would act as a clinical and translational research mentor to them, providing guidance on their research project from a clinical perspective."

The "sharing of cultures" is, she says, "hugely important for innovation. When that happens you get a spark. Medical trainees should spend time in labs to better understand basic scientific research, and scientists should spend time in hospitals. It's important to ensure that we identify key challenges facing patients in the clinic and focus translational research efforts on these areas that will really impact on patients care. The culture has to be cross-disciplinary, not silo-ed."

The gastrointestinal cancers that she works with tend to be challenging – "often they're aggressive cancers which don't respond well to chemotherapy or radiotherapy. That can be challenging and humbling, but it is a privilege to spend time with these patients and their families. What balances it out personally is the ability to focus on research in addition to clinical care. The drive to make a real impact comes from our patients – they are a constant motivation to do better and

really change outcomes for future patients."

It was "the gift of protected research" in the Trinity-St James's post that persuaded her to move from New York, where she was happily settled with her husband, a surgeon, and their son. "This was the first post of its kind in Ireland and it's very innovative in terms of how it was created."

She knew St James's from her time as a trainee: "It has a long history of patient-centred high-quality care, and I knew about Trinity's excellent research record. So I knew the fundamentals were there. With the foundations in place, the potential for success with the Trinity St James's Cancer Institute is high."

Her goals for the next few years are first, to invest in expanding availability of cancer clinical trials. "We want to take this up a level. Eventually we want 10 percent of our patients to go on clinical trials. That's an ambitious figure but it's what patients want, and deserve."

Secondly, the Institute is looking for accreditation from the OECl, the European body that regulates cancer institutes. "We're already a member of the OECl, we're working towards accreditation as a comprehensive cancer centre and eventually becoming a fully integrated cancer centre combining clinical care, research and education in one purpose built facility."

To deliver on its high ambition, the Trinity St James's Cancer Institute will need investment. It has been chosen as one of the flagship projects in the college's philanthropic campaign, which is launching in 2019.

"The treatment of cancer is changing week by week. We have to be flexible and adaptive, leverage what we already have, and aim high. I believe the Institute can make a big impact on care of Irish cancer patients within five years."



## 12 Professor Michael Cronin

Professor of French (1776) and Director  
of the Trinity Centre for Literary and Cultural Translation

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→ “We want the Centre to be a cultural hub in Dublin, linking Ireland to the world and the world to Ireland. We want to spread the good news about Irish writing; equally we want to showcase the literature and culture of all the people who come to live and settle and work in Ireland. We can’t expect the rest of world to take an interest in our culture if we don’t take an interest in theirs.”

Michael Cronin, recently appointed Director of the Trinity Centre for Literary and Cultural Translation (TCLCT) is talking about the mission of the new Centre, which was formally opened in a beautifully renovated Georgian house in Fenian Street in April.

The only centre of its kind in Ireland - the nearest equivalents are in the University of East Anglia and the University of California, Santa Barbara - TCLCT was years in the planning. The brainchild of Professor Sarah Smyth of the Department of Russian and Slavonic Studies, the idea was first launched at a special event in the college chapel in 2012, entitled ‘Translating Seamus Heaney’, attended by Heaney and five of his translators.

Professor Cronin, who took up his new role in April, explains what he calls TCLCT’s three “component parts”:

“There’s the educational programme – the Centre runs the college’s MPhil in Literary Translation, working with the 17 languages taught at Trinity, and we have a translator-in-residence who, this year, is from China.

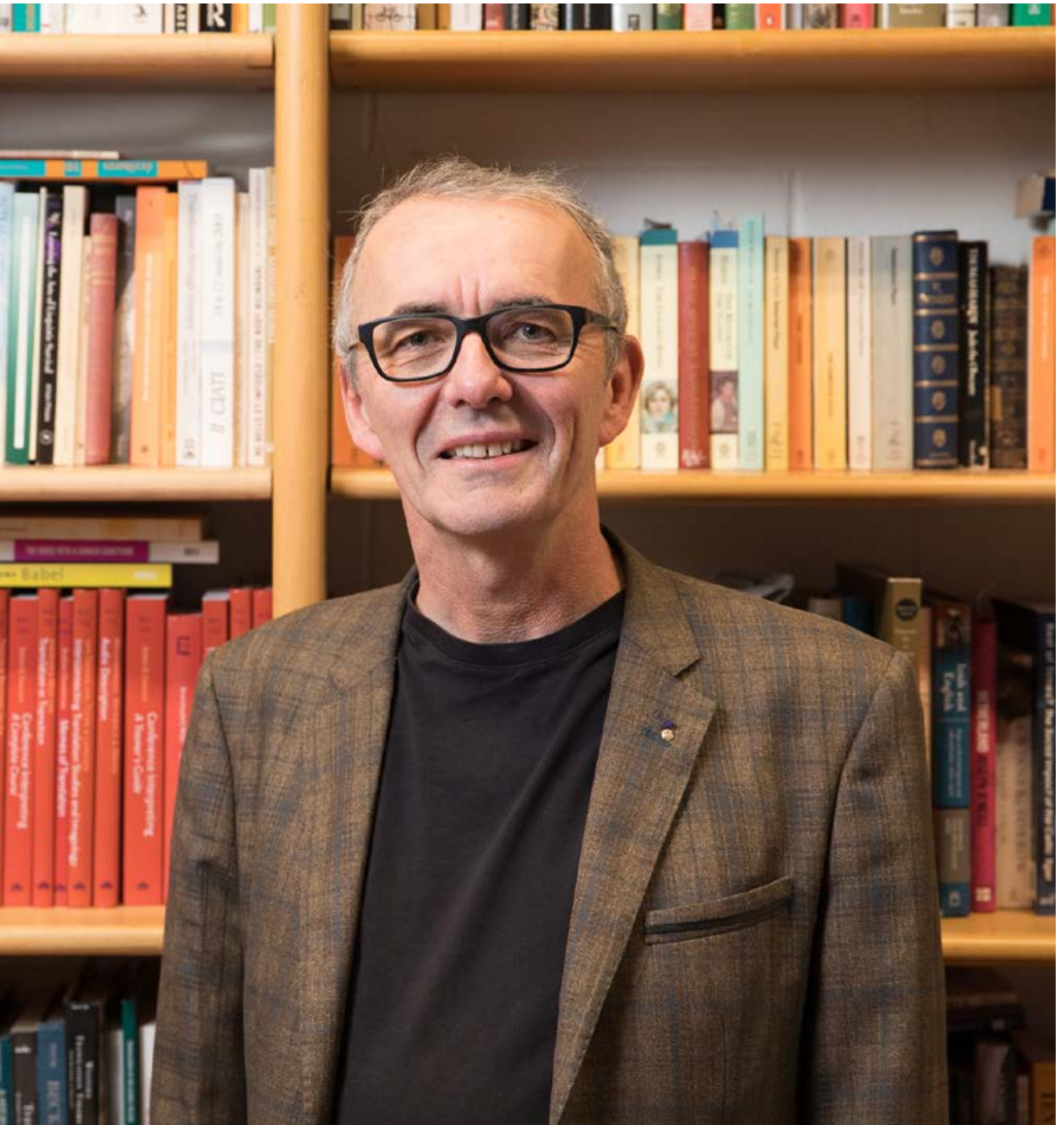
“The Centre also houses Literature Ireland, which is the national organisation for the international promotion of Irish

literature in English and Irish. Literature Ireland commissions translations of Irish works into world languages.

“And, finally, the Centre houses Dalkey Archive Press, which is the most important English-language publisher of translations in the world. It’s a US company – they base their European operations in the Centre.”

Through its three component parts, the Centre cultivates partnerships with relevant cultural institutions around the city – such as the Goethe Institute, Alliance Française and Dublin City Library - and it hosts numerous events, including translation workshops and slams, book clubs and public interviews with writers and their translators, as well as podcasts and live streaming. The day-to-day running of the Centre is done by the newly appointed operations manager, Eithne Bowen, with Cronin providing overall direction.

A few months before taking up the directorship of TCLCT, he received another major appointment within the university: the Professor of French (1776), which is the oldest chair of French in the world.



## 12

“I have a dual role in the Centre and Department of French but central to both is the active promotion of language learning and teaching.”

As it happens, this has now become a national imperative. For the first time in the history of the state, the Irish government has produced a language policy which sets ambitious targets. This is in reaction to Brexit and the realisation that Ireland will have to orient itself more towards Europe and other markets.

“The Celtic Tiger years – with their focus on FDI from US multinationals and financial services in London and New York – were characterised by a strong move away from foreign languages,” says Cronin “and a significant drop-off in students.”

As a result there is now a crisis in the provision of high-quality language teachers. “Addressing this is the immediate practical challenge, but more widely, how do you situate Ireland in a post-Brexit Europe? There’s been a lot of debate, nationally, about the economic dimension for Ireland after Brexit, but almost none on the cultural dimension. We need to be thinking about this.”

Cronin was brought up in Dublin in a family with some connections to France. “My grandmother taught in Dijon during the First World War. I never knew her but my mother would re-tell some of the stories she was told and ours was quite a Francophile household. Then, in my teens, I discovered the joys of existentialism. Reading *The Mandarins* by de Beauvoir, I was enthralled by the sense of curiosity and freedom which contrasted with the dreadful homogeneity of 1970s Ireland.”

He came to Trinity to study French, spending his holidays “grape-picking in the south of France or working on building sites. That was invaluable experience. I remember staying in a squat near Orleans with anarchists and Trotskyites – it was political education in all of three weeks.”

After a Masters in UCD, he did his PhD in Trinity on French Canadian novelists. As a junior lecturer in DCU, his first academic posting, he became interested in Translation Studies – a new interdiscipline dealing with the theory, application, sociology and politics of translation.

“My first book, *Translating Ireland*, looks at how cultural political changes in Irish history have coincided with big translation drives. This happened in the medieval, Elizabethan

and French revolutionary periods. Often this gets left out of the story because it’s happening outside the national territory. I was trying to re-write the transnational element back into Irish history”.

This has now developed into his current research area of Eco-Translation. “We are now into a post-humanities world and the end of human exceptionalism. With climate change and biodiversity loss, we have to reconsider the human role and where we stand in relation not only to other species but to the inorganic world of rocks, hills, rivers. Translation is a relationship across difference – not just across different languages but across different ways of being. I’m interested in exploring how Translation Studies might help us negotiate our relationship to the natural world.”

He has just published a book on this – *Eco-Translation: translation and ecology in the Age of the Anthropocene* (2017) – and is currently developing a global research network of researchers interested in the paradigm that he’s developing. This is a key aim for the next few years, and he will also be developing networks within the college: “I hope to build a real sense of interdisciplinary connectivity around this. For instance, I know there’s great work being done in Zoology on animal communication systems – bringing a translation perspective to bear on that body of research has huge potential.”

In terms of his dual role within the Centre and the Department of French, he has two key goals for the next few years:

First, he wants to make the contribution of modern languages to society more public. “If I turn on the radio, I hear historians, political scientists, sociologists, English Lit academics being consulted on national issues. When was the last time I heard a professor of French or German or Spanish commenting? I think there’s a terrible mismatch between the knowledge base we have and the public square, and I want to address that.”

Relatedly, his primary focus is “to increase the local, national and international visibility of the Centre for Literary and Cultural Translation. We want to work with the faculty and School, our internal partners and our alumni to ensure that the Centre becomes a landmark for the city and for the whole Trinity community.”



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# Philanthropy and Alumni Engagement

**Philanthropy and alumni engagement have played a crucial role in the university since Trinity's foundation, empowering lasting global impact in research and education.**

This year Trinity celebrated two crucial capital development projects made possible through philanthropy: the completion of the Trinity Business School and a new Engineering, Environment and Emerging Technologies development known as the E3 Initiative. With both these projects, exceptionally generous philanthropy enabled the leveraging of significant state investment and loans.

In 2019 Trinity will publicly launch its first ever comprehensive philanthropic campaign which will be the most ambitious fundraising campaign ever undertaken on the island of Ireland. The focus of the Campaign will be on the two 'umbrella' areas for which philanthropy is essential: investment in staff and students through a series of transformative professorships and scholarships; and investment in major capital development and research infrastructure projects, including the Trinity St James's Cancer Institute, E3 Institute, the Trinity Business School, and the Library and its unique collections.

**RIGHT** – Dr Martin Naughton, Trinity STEM student Aedin McAdams (Zoology) and Provost Patrick Prendergast at the announcement of the new E3 initiative





→ The Naughton Foundation announced the single largest private philanthropic donation in the history of the state to Trinity, a gift of €25 million, paving the way for Trinity's ambitious new E3 Initiative...



## 13



### The Naughton Foundation and E3

In 2018 we continued to witness the transformative contribution of the Naughton family to Trinity. In May, the Naughton Foundation announced the single largest private philanthropic donation in the history of the state to Trinity, a gift of €25 million, paving the way for Trinity's ambitious new E3 Initiative. E3 will bring together engineers alongside natural scientists and computer scientists to strive for solutions to some of the greatest challenges facing our planet today. Martin and Carmel Naughton and their family invest in excellence in many fields including education, science, technology, engineering and the arts. Their support to Trinity includes the development of the Naughton Institute incorporating Trinity's nanoscience institute, CRANN, and the Science Gallery, the Seamus Heaney Professorship in Irish Writing, the Naughtons Scholarships programme and now the development of the E3 Initiative at Trinity.

### Other philanthropic highlights

Other philanthropic highlights this year included a contribution by Nobel laureate and Trinity alumnus, Professor William Campbell, who donated to the Department of Zoology from his Nobel Prize fund. Trinity used this donation to establish the W. C. Campbell Moderatorship Prize, Undergraduate Research Prize, and Postgraduate Teaching Inspiration Award. Trinity also received a significant legacy from Professor John Byrne to

support Computer Science and Engineering students through the Student Hardship Fund.

The Irish Longitudinal Study in Ageing (TILDA) was awarded continued funding from the Department of Health, The Atlantic Philanthropies and Irish Life. This new round of funding enables TILDA to continue its valuable work as Ireland and the world face the challenge of an ageing population.

The Samuel H. Kress Foundation Conservation Fellowship was awarded to Trinity to fund a ten-month placement in the Conservation Department of the Library. This enabled the appointment of Lauren Buttle to conserve and rehouse papyri, including Books of the Dead, Mythologies and legal documents from the collection donated in 1838 by Edward King, viscount of Kingsborough.

The Ryanair Foundation announced €1.5 million funding of a Professorship of Entrepreneurship. The new professorship will drive and direct entrepreneurship and innovation at the Trinity Business School and across the university.

### Alumni engagement

With over 140,000 alumni in 150 countries worldwide, Trinity is committed to staying in touch with all graduates in order to provide opportunities for them to engage with, and support, their alma mater.

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**LEFT** – Provost Patrick Prendergast with Neil Sorahan, Ryanair CFO and Alannah Higgins, Trinity Business School student at the announcement of the Ryanair Professor of Entrepreneurship

**BELOW** – Professor Campbell chats with James Orr, winner of the W.C. Campbell Moderatorship Prize in the Zoological Museum



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This year two new services were launched to engage alumni worldwide. Trinity Alumni Online is an interactive platform for alumni to connect with each other and mentor students. To date over 3,000 alumni have registered on the platform. Trinity Talks is a new online service providing access to educational lectures and talks from across the university in a centralised location. These benefits add to Trinity's recently launched Alumni Room, a dedicated space in Front Square for alumni to enjoy when visiting Trinity.

On campus, a variety of engaging events for alumni are offered which includes the Trinity Business Alumni series of events and a new focus on alumni events in Innovation & Entrepreneurship. Internationally, there are 76 alumni branches around the world, supporting the local network of alumni through a variety of events and engagements with visiting Trinity staff.

Alumni have been very generous with their support of Trinity during the year. Two hundred and twenty two alumni mentors connected with 720 student mentees during a series of alumni to student mentoring events on campus. In addition, many alumni abroad have supported international student recruitment as well as being host to many Trinity students studying abroad. Over 1,000 alumni volunteered during the year and more than 2,500 alumni donated to the university in support of Trinity's research and education mission.

→ Over 1,000 alumni volunteered during the year and more than 2,500 alumni donated to the University in support of Trinity's research and education mission.

# Trinity's Visitors

**The President of Ireland, the Duke and Duchess of Sussex, Prince Harry and Meghan Markle, the head of the IMF, Christine Lagarde, the prime ministers of the Netherlands and Korea, and actors Rupert Everett, Mel Gibson and Amy Poehler were some of the people who visited Trinity this year, while the Book of Kells received a record number of visitors - 1,062,860 - coming from all over the world.**


Over two million people visit the university each year and it consistently features strongly on lists of Ireland's Top 10 visitor attractions. This year almost 6,500 people visited the Zoological Museum to view its unique 200-year-old collection of approximately 25,000 specimens as well as 'live animal' displays.

2018 saw Science Gallery Dublin celebrating its 10th birthday with RÉALTA, a performance exploring the stars by the first artist in residence at the European Space Agency, Aoife von Linden Tol. Performers danced and played with fire, setting off a chain reaction of pyrotechnic events in Front Square.

A team of student Welcome Ambassadors worked on campus during the peak tourist season, June to October, promoting the venues and facilities open to the public. This summer, for the fourth year running, they were a real point of difference to visitors who love hearing insider knowledge on Trinity student life.

Trinity hosted 74 visits by international universities including the University of Sydney, Hubei Provincial delegation, China, Taiwan Medical University, China Education Association for International Exchange (CEAIE), Kyoto University and Thapar University.

**RIGHT (L-R)** – The Duke and Duchess of Sussex, Prince Harry and Meghan Markle admire the Long Room with Trinity Librarian, Helen Shenton



→ The Book of Kells received a record number of visitors - 1,062,860 - coming from all over the world.

# 14



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**TOP LEFT** – Science Gallery Dublin 10th birthday celebrations

**BOTTOM LEFT** – The President of Ireland, Michael D Higgins meets African ambassadors and the Provost at a special event celebrating Africa Day in Trinity

**BELOW RIGHT** – Head of the IMF, Christine Lagarde meets Law student Ciara Hennessy and BESS student, Nathan Misischi, participants of Launchbox and Prof Gail McElroy, Head of the School of Social Sciences and Philosophy

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→ Over two million people visit the university each year and it consistently features strongly on lists of Ireland's Top 10 visitor attractions.

### Welcoming Dignitaries

The President of Ireland, Michael D. Higgins gave a keynote address on 'Africa-Ireland Relations: Current and Future' at a special event celebrating Africa Day in Trinity. The university, through the Trinity International Development Initiative (TIDI), partnered with African Ambassadors in Ireland to host the celebration of the official day of the African Union, and the continent's unity and diversity. The Provost also spoke at the event, along with the South African Ambassador, Ahlangene Cyprian Sigcau, Dean of the African Heads of Mission in Ireland.

The Duke and Duchess of Sussex, Prince Harry and Meghan Markle visited Trinity in July on their first official visit outside of the UK as a married couple. Members of the public, college staff and students in Front Square gave them a warm welcome. They visited the Long Room of the Old Library and viewed the Book of Kells. During the Royal couple's visit, the Provost emphasised the importance of Irish-UK relations for the university sector.

In June the head of the International Monetary Fund (IMF), Christine Lagarde, was guest of honour at a lunch celebrating women in leadership hosted by the School of Social Sciences and Philosophy. Before the event Mme Lagarde met with students involved in Launchbox's summer accelerator programme.

The Italian President, Sergio Mattarella visited Trinity in February and met with Italian students and academic staff. He viewed the Library's collection of Italian books and manuscripts, including 15th and 16th century first editions of Dante's *La Divina Commedia*, 18th century maps of Italy and Sicily from the Dutch Fagel collection, and Samuel Beckett's notebook from 1926 when he was preparing for his final Trinity examination in Italian.

Colombia's Ambassador to the UK and Ireland, His Excellency Nestor Osorio addressed a capacity audience in October 2017 when he spoke on 'The Colombian Peace Process: Opportunities and Challenges', organised by the Irish School of Ecumenics and the Centre for Post-Conflict Justice, in conjunction with the Trinity Long Room Hub.

Other dignitary visits through the year included Mr Lee Nak-yon, Prime Minister of the Republic of Korea; Mr Mark Rutte, Prime Minister of the Netherlands; Mr Carwyn Jones, Welsh First Minister; Mr Michael Russell, Member of the Scottish Parliament; Mr Wissanu Krea-ngam, Deputy Prime Minister of Thailand; and Mr Pavlo Klimkin, Foreign Affairs Minister of the Ukraine.

Among the visitors to the Book of Kells and to student societies were actors Evanna Lynch, Kristin Chenoweth, Helen McCrory, and Marisa Tomei and musicians Alanis Morissette, Charlie Watts of The Rolling Stones, and The Waterboys.

At Trinity's winter commencements, Irish rugby player, Brian O'Driscoll, journalist and broadcaster Olivia O'Leary, former senior archivist of the National Archives of Ireland, Catriona Crowe, Waynflete Professor of Physiology and Director of the Centre for Neural Circuits and Behaviour at the University of Oxford, Gero Miesenböck, and Emeritus Professor of Astronomy at Leiden University, George Miley were awarded honorary doctorates.

At the summer commencements in June 2018, the former US Secretary of State Hillary Rodham Clinton, prominent US philanthropist and mathematician, Dr James Simons, president of the Confederation of British Industry, Paul Drechsler, archivist at the Irish Architectural Archive, Ann Martha Rowan, and co-founder of the Young Scientist Exhibition, Dr Tony Scott received honorary degrees.

# Trinity's Trees

**This year Trinity lost three iconic trees – the two venerable Oregon maples that had stood in Library Square for almost 180 years, and a third smaller, probably younger Oregon maple in New Square.**

The Oregon maples in Library Square, possibly the oldest trees on campus, were amongst the largest known specimens in Ireland and the UK, and in Europe. It is reputed that they arose from the first consignment of seed brought back to Ireland by David Douglas in 1827.

The first to go, the Oregon maple on the GMB side of Library Square, collapsed unexpectedly and dramatically in the early hours of Saturday 2nd June. This produced an outpouring on social media, including a tweet from the Taoiseach, Leo Varadkar, TD, who, like generations of Trinity graduates mourned the tree he had loved.

**RIGHT (L–R)** – One of the Oregon maples in Library Square in its full glory before its demise



→ These mainly deciduous trees range from all over the world and include 12 species of maple, seven species of oak, magnolia, rowan, ash, mulberry, arbutus, alder, birch, wild cherry, holly and hawthorn.



# 15



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**TOP LEFT** – Prof John Parnell, Professor of Systematic Botany and Chair of the Grounds and Gardens Advisory Committee examines the tree trunk of the Oregon maple

**BELOW LEFT** – The remains of the Oregon maple in Library Square being cleared after its collapse

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## → Not all trees on campus are outside: an indoor arboretum in the Hamilton Building is home to tropical plants, including a banana tree which is 30 feet tall...

Trinity's trees are regularly surveyed by leading tree experts, Bartlett Consultants, to assess their condition using a variety of techniques, including state-of-the-art tomography (similar to an ultrasound scan providing coloured images of sections through the trunk or branches of a tree). The April 2018 survey indicated concerns about the condition of all three Oregon maples, particularly the one in New Square, but it was not believed they were in immediate danger of collapse and it was hoped that the life of the Library Square maples might be prolonged through remedial works.

It is not known, and probably never will be, why the maple in Library Square collapsed at the time it did. The very hot weather may have played a part, causing exceptional physiological and physical stress to a tree that was not in tip-top condition.

Following the dramatic collapse of this tree, the decision was taken to proceed with felling the smaller Oregon maple in New Square. The April survey had revealed a large amount of dead or damaged wood on its trunk as well as two different wood-decaying fungi (*Ganoderma applanatum / australe* and *Bjerkandera adjusta*) infecting the trunk and roots. The tree was already known to be in poor condition and in anticipation of its likely felling, the Grounds and Gardens Advisory Committee had planted replacement trees close by a number of years ago - an Irish Sessile Oak (*Quercus petraea*) from Killarney and a Beech (*Fagus sylvatica*). These will soon occlude the gap, rapidly remaking the landscape of that part of the university.

It was initially hoped to save the remaining maple in Library Square through remedial works - lightening the canopy, and treating the roots and some of the limbs with a mixture of fungicide and nutrient solution. However, as work began removing a major limb (and another smaller limb to balance the weight of the crown), it became evident that the tree was more infected with wood decay fungus (*Polyporus squamosus*) than foreseen and its structure was so highly compromised that any further work would likely lead to immediate collapse. This necessitated the felling of the tree.

The Provost and the Grounds and Gardens Advisory Committee have agreed not to rush into immediate replanting. Instead this unique opportunity will be used to comprehensively consult and plan for the future of Library Square. Since the university requires an integrated plan covering the next 150 years, this process will take at least a year.

In the short term, the remaining stumps have been cleaned and sanded so that the tree-rings can be counted and viewed. A number of slices or sections of the stumps have been taken away for further investigation: eventually the stumps will be ground out.

The many other trees - 466 in total - on Trinity's campus are enjoyed by staff, students and visitors alike. These mainly deciduous trees range from all over the world and include 12 species of maple, seven species of oak, magnolia, rowan, ash, mulberry, arbutus, alder, birch, wild cherry, holly and hawthorn. The wych elm which was the last survivor from the epidemic of Dutch elm disease that killed 60 elms in Trinity in the 1970s was removed in July as the main stem has split in high winds and it became unsafe.

Interestingly, one of the birch trees in Parliament Square on the lawns just inside Front Gate is considerably larger than the other, despite both being of the same genetic strain and planted at the same time, more than six decades ago. Trinity was built on the site of All Hallows Priory and the archaeological remains lie beneath Front Square. It is likely that the smaller tree is located just above some of the masonry remains and this has restricted its growth.

Not all trees on campus are outside: an indoor arboretum in the Hamilton Building is home to tropical plants, including a banana tree which is 30 feet tall. Planted directly in the ground, these plants are watered by an automatic system delivering each plant a set volume of water at night.

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# 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](http://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.

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## **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.

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## **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/](http://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.

# 16

→ The total number of Board meetings held during the year was 11.

## 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, scheduled meetings and membership can be found on the Board website (<https://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, scheduled meetings and membership can be found on the Council website (<https://www.tcd.ie/committeepapers/council/papers/>).

## Major decisions of Board in 2017/18:

### Research and Education:

- Trinity Education Project (TEP) now in its fourth phase, the implementation phase, with all proposals to be mainstreamed by 2020;
- Changes to the criteria for the allocation of Entrance Exhibitions agreed;
- Review of Two-Subject Moderatorship completed.

### Campus development:

- The construction of the Trinity Business School is progressing well and the building is on schedule to be completed in early 2019;
- The excavation of the site for the Printing House Square Student Accommodation is complete and the project is progressing well;
- Approval of the E3 Learning Foundry business case;
- Update noted on the plans for Trinity @ Grand Canal Quay;
- Approval of the Dartry Accommodation Project business case;
- Draft Estates Strategy presented by the Bursar to the Board.

### Governance:

- Establishment of a working group which would include some external members to consider some of the topics raised in the self-evaluation including Board size, composition and the frequency of meetings and that exit interviews for those Board members stepping down from Board should be introduced;
- Recruitment of a Chief Risk Officer and a Data Protection Officer;
- Introduction of the Sick Leave Absence Management Policy;
- Introduction of the Sustainability Policy and Trinity is now a member of the International Sustainable Campus Network (ISCN);
- Approval of a revised Campus Tours Policy;
- On-going oversight of the activity of Trinity's subsidiaries.

## Board meetings

The total number of Board meetings held during the year was 11.

## BOARD MEMBER

## ATTENDANCE

EX OFFICIO		ELIGIBLE TO ATTEND	NO. TO ATTEND
P.J. PRENDERGAST	PROVOST	11	11
C. MORASH	VICE-PROVOST/CHIEF ACADEMIC OFFICER	11	10
G.S. MARTIN	SENIOR LECTURER/DEAN OF UNDERGRADUATE STUDIES	11	10
P. MURPHY	REGISTRAR	11	10
V.A. CAMPBELL	BURSAR/DIRECTOR OF STRATEGIC INNOVATION	11	11
ELECTED/NOMINATED			
D. AHERN	FELLOWS AND FELLOW PROFESSORS	11	11
S. ALYN STACEY	FELLOWS AND FELLOW PROFESSORS	11	8
O. BRAIDEN	EXTERNAL MEMBER	11	9
S. COLLINS	STUDENT REPRESENTATIVE (PRESIDENT OF GRADUATE STUDENTS' UNION)	11	11
S.M. DRAPER	FELLOWS AND FELLOW PROFESSORS	11	8
S. DUNPHY	TECHNICAL, ADMINISTRATIVE AND SUPPORT STAFF	6	3
S. FARRELL	TECHNICAL, ADMINISTRATIVE AND SUPPORT STAFF	11	9
D. FAYNE	NON-FELLOW ACADEMIC STAFF	11	10
M. FOODY	TECHNICAL, ADMINISTRATIVE AND SUPPORT STAFF	4	3
R. GILLIGAN	FELLOWS AND FELLOW PROFESSORS	11	9
K. KEANE	STUDENT REPRESENTATIVE (PRESIDENT OF THE STUDENTS' UNION)	11	11
J. KEOGH	TECHNICAL, ADMINISTRATIVE AND SUPPORT STAFF	11	9
T. KEOHANE	EXTERNAL MEMBER	5	1
C. LAUDET	NON-FELLOW ACADEMIC STAFF	11	11
B. M. LUCEY	FELLOWS AND FELLOW PROFESSORS	11	6
A. MACPHERSON	STUDENT REPRESENTATIVE (EDUCATION OFFICER OF THE STUDENTS' UNION)	11	10
C. MCCABE	NON-FELLOW ACADEMIC STAFF	11	10
D. MCCLEAN	STUDENT REPRESENTATIVE (WELFARE OFFICER OF THE STUDENTS' UNION)	11	10
R. MOSS	NON-FELLOW ACADEMIC STAFF	11	10
E. O'HALPIN	FELLOWS AND FELLOW PROFESSORS	11	8
D. R. PHELAN	FELLOWS AND FELLOW PROFESSORS	11	9
A. SEERY	NON-FELLOW ACADEMIC STAFF	11	10
R. TIMONEY	FELLOWS AND FELLOW PROFESSORS	11	10
IN ATTENDANCE			
I. MATHEWS	TREASURER/CHIEF FINANCIAL OFFICER (IN ATTENDANCE <i>EX OFFICIO</i> )	11	10
J. COMAN	SECRETARY TO THE COLLEGE (IN ATTENDANCE <i>EX OFFICIO</i> )	11	11
G. RUANE	CHIEF OPERATING OFFICER (IN ATTENDANCE, BY INVITATION)	11	9
J. HUSSEY	VICE-PRESIDENT FOR GLOBAL RELATIONS (IN ATTENDANCE, BY INVITATION)	11	8
V. BUTLER	ASSISTANT SECRETARY TO THE COLLEGE (IN ATTENDANCE)	11	11

# Financial Elements 2017–18



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There is an encouraging trajectory in terms of the University's continued improvement in financial performance in the past year and, although Trinity continues to report a consolidated financial deficit, a return to surplus in the medium term is projected in the most recent five-year forecasts. The University remains committed to addressing its financial position as a matter of priority and continues to focus on its key non-Exchequer income strategies in order to generate significant cash surpluses from its operations to enable investment in both capital infrastructure and other strategic priorities.

The University recognises that returning to a surplus in the short term will be a significant challenge in the current financial and regulatory environment, when many of the recommendations of the Cassells report (which are fully endorsed by the University) have yet to be implemented and when the provision for infrastructure renewal is taken into account. It remains the University's view that significant additional funding is required from the State as a key stakeholder in higher education both in recurrent and capital terms to meet anticipated forecasted growth in demographic and participation rates and to maintain the quality of the student experience, particularly given "Ireland's ambition to be the best education and training service in Europe by 2026". In this context, Trinity continues to engage with the HEA, which has been complimentary of the University's resilience in the prolonged period of austerity.

Achievement of our objective of financial sustainability is the responsibility of the whole University and the significant level of work and huge effort undertaken to date by the Executive, Schools, Faculties and Administrative areas in developing an integrated approach to strategic financial planning is fully acknowledged and appreciated. This will enable the University to take a holistic view of its activities to inform its decision making in relation to the future shape of the University in terms of the composition of the future student body.

# 17 Summary Financial Position 2013-17

The Consolidated Financial Statements for the year ended 30 September 2017 were approved by the Board in March 2018 and the summary financial position is set out below.

	2017 €m	2016 €m	2015 €m	2014 €m	2013 €m
State grants	44.5	44.0	44.5	47.3	54.5
Academic fees	136.9	133.7	128.9	122.2	116.1
— EU UG	70.9	71.3	71.3	70.6	68.7
— EU PG	22.7	23.5	23.1	22.1	23.1
— Non EU UG	24.8	25.0	22.7	21.0	17.1
— Non EU PG	13.5	9.2	7.4	6.7	6.1
— Other	5	4.7	4.4	1.8	1.1
Research grants and contracts	100.1	92.2	85.2	78.0	74.7
CRU Income	42.1	40.6	34.4	29.8	27.9
Other income	11.3	10.0	10.1	21.4	22.6
Investment income	6	6.8	7.0	7.0	6.5
Donations and endowments	14.9	11.7	12.9	–	–
Income (excluding grant amortisation)	355.8	339.0	323.0	305.7	302.3
Staff costs	245.9	234.7	231.1	225.7	221.8
Other operating expenses	99.4	95.9	94.5	89.4	85.0
Total operating expenses	345.3	330.6	325.6	315.1	306.8
Operating (deficit)/surplus before interest costs and net depreciation	10.5	8.4	(2.6)	(9.4)	(4.5)
<b>Less:</b>					
Depreciation (net of grant amortisation)	(20.1)	(34.4)	(19.8)	(17.0)	(14.0)
Net Interest payable	(4.9)	(4.6)	(3.6)	(3.4)	(1.4)
Deficit before other gains and losses	(14.5)	(30.6)	(26.0)	(29.8)	(19.9)
<b>Plus:</b>					
Gain/(loss) on revaluation of investment property	4.5	11.6	9.9	7.9	(2.6)
Gain on investments	5.1	9.6	2.1	–	–
Deficit for the year	(4.9)	(9.4)	(14.0)	(21.9)	(22.5)

## 2016-17 Financial Year

BELOW – Growth in Trinity  
Endowment Fund 1996-2017

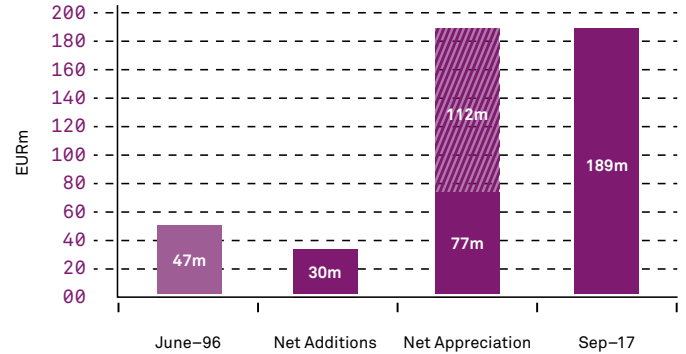
Earnings before interest, tax, depreciation and amortisation (EBITDA) increased €2.1m (25%) to €10.5m in FY2016/17, which represents a strong performance in the year. However, including net interest payable of €4.9m, the provision for depreciation (net of amortisation) of €16.2m and a one-off impairment charge of €3.9m relating to the Biochemistry building (due for demolition), the University reported a deficit (after other gains and losses) of €4.9m (2015/16: €9.4m).

Given the financial challenges that the University has encountered over the last number of years, it was encouraging to see that the non-Exchequer income generating strategies are continuing to deliver with the University's Exchequer/Non-Exchequer income ratio reported as 41:59 compared to 48:52 in 2012/13 and 70:30 in 2007/08.

The University has a strong Statement of Financial Position (Balance Sheet) with consolidated net assets amounting to €800.3m at 30 September 2017 (2016: €805.1m). Fixed asset capital additions during the year, reflecting the continued investment in the University's estate, amounted to €34.3m (2015/16: €25.6m). The scale of investment in capital expenditure demonstrates a firm commitment to build a world leading campus for our students and staff and future development plans are well advanced for targeted growth in specific areas including the E3 Learning Foundry and further student accommodation.

The total funds held by the Endowment Fund amounted to €189m at 30 September 2017, exceeding the €180m target value set out in the University's Strategic Plan 2014-2019. During the year, the University, in consultation with Students' Union representatives and Fossil Fuel TCD, divested from companies whose primary function is extraction of fossil fuels. In addition, following a detailed review, the portfolio was significantly restructured to reduce our fixed income holding and reinvested in global equity funds (ex-Fossil Fuel). The University is planning further divestment from fixed income as well as moving to international infrastructure and property assets in 2017/18. The Fund achieved a net return of 5.8% in FY16/17, resulting in a gross income contribution to the University of €6.0m. In 2016/17, thanks to the continued support of alumni and friends, Trinity Development & Alumni (TDA) successfully secured new gifts/pledges in excess of €29m.

The level of research activity for 2016/17 recorded in the Consolidated Financial Statements amounted to €100.1m, which exceeded €100m for the first time, an increase of 8.6% on the prior year (2015/16: €92.2m). This is the fourth consecutive year that the University has recorded an increase in research income with the current year 34% ahead of 2012/13 results. New Awards in 2016/17 include a €10m grant from the



Department of Health to support The Irish Longitudinal Study on Ageing (TILDA) and an €8m award from Enterprise Ireland to fund the Learnovate Technology Centre. Trinity's success in attracting EU funding has continued in 2016/17 with the value of awards funded under the Horizon 2020 programme amounting to €23.4m (2015/16: €24.8m) securing 27% of all Horizon 2020 funding awarded to the Higher Education sector. Trinity is now ranked 36th in Europe out of over 1,300 HEIs for Horizon 2020 funding. The University has also secured 48% of all European Research Council (ERC) awards to Ireland since 2014. In 2016/17 the Exchequer: non-Exchequer ratio of research income was 65:35 (2015/16: 64:36).

While the research environment remains competitive, the University continues to benefit from the success of its Research Diversification and Industry Engagement Strategies, which focuses on EU, Industry and other non-Exchequer funding. The relative low recovery rate of indirect costs when compared to the Full Economic Cost (FEC) rate of 66.7% remains a cause for concern with the indirect cost rate recovered on direct expenditure decreasing to 17.4% (2015/16: 18.1%). Progress to narrow this funding gap is being addressed at a sectoral level.

### Conclusion

The financial affairs of the University continue to need careful management and, as mentioned above, Trinity remains committed to addressing its financial position and to returning to a sustainable surplus. Concurrently, the University will be enabling investment in both its capital infrastructure and other strategic priorities to promote the student experience through the generation of further revenues from non-Exchequer sources over and above that delivered to date.

DR. PATRICK PRENDERGAST  
PROVOST

IAN MATHEWS  
CHIEF FINANCIAL OFFICER

# 17 Mid-term review of the Strategic Plan 2017

The mid-term review of the University's Strategic Plan was reported to the Board in September 2017 including progress against agreed Key Performance Indicators (KPIs) as set out below.

KPI's	FRS102		Irish GAAP				
	2019 Target	RAG Status	2017	2016 Restated	2015 Restated	2014	2013
EBITDA <sup>1</sup> as % of income	6%	A	3.0%	2.5%	-0.8%	-3.1%	-1.5%
Total Deficit % of income <sup>2</sup>	3%	A	-1.4%	-2.8%	-4.3%	-7.1%	-7.4%
Exchequer / Non-Exchequer Income <sup>3</sup>	40:60	A	41:59	43:57	44:56	45:55	48:52
Pay / Non Pay Ratio <sup>4</sup>	65:35	A	71:29	72:28	71:28	72:28	72:28
Pay as % of Operating Income	65%	A	69%	69%	72%	74%	73%
Net Assets	€800m	G	€800m	€805m	€815m	€909m	€916m
Endowment Fund Value	€180m	G	€189m	€181m	€169m	€165m	€147m

<sup>1</sup> Earnings before interest, tax, depreciation, once off impairments and amortisation

<sup>2</sup> Income before unrealised gains/losses and amortisation

<sup>3</sup> Excludes State funding for pensions, SUSI payments and amortisation of capital grants (sector agreed)

<sup>4</sup> Excludes depreciation, once off impairments and interest costs



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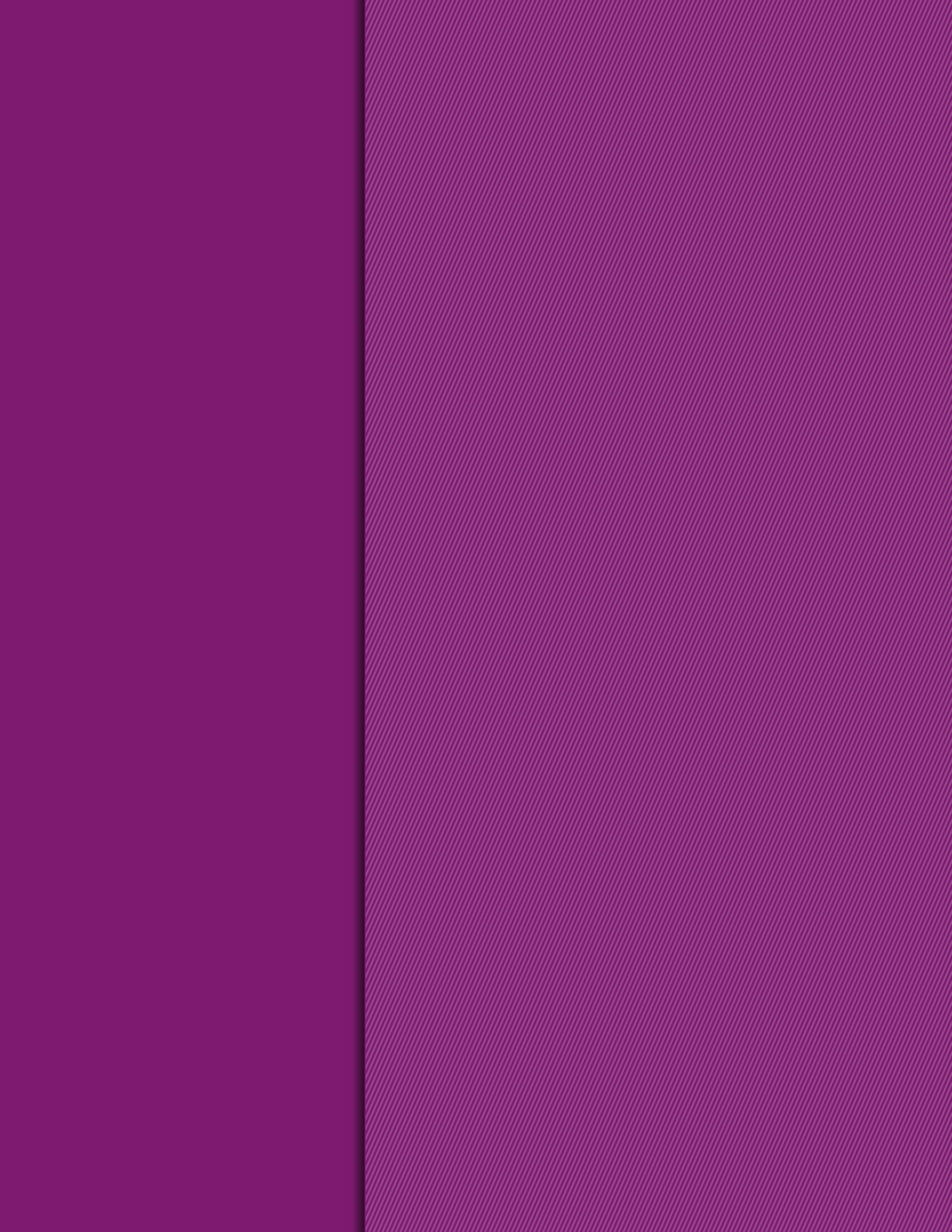
House 1, Trinity College Dublin  
Dublin 2, Ireland

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**T** + 353 1 896 4362

**E** [provost@tcd.ie](mailto:provost@tcd.ie)

**W** [www.tcd.ie](http://www.tcd.ie)



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