The rocky road of science communication in Ireland

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Irish public policy for science made an historic leap forward in the late 1990s. Since then, this small, peripheral country has set ambitious targets for its scientific research and major institutional efforts in public communication of science have accompanied this development and amplified it to various publics. As also seen elsewhere in "the global spread of science communication" (Trench et al 2014), Ireland has institutionalised science communication through programmes of government and government departments, state agencies, higher education and research institutions, professional societies and networks, cultural institutions, non-governmental organisations and many other bodies. In this chapter we show that the institutional efforts in public communication and specifically in public dialogue have not been commensurate with the political and promotional 'big talk' about science.[1] Progress in facilitating public access to research and researchers has been uneven and sometimes contradictory.

The ambitions for science are strongly stated: Ireland aims to be a global innovation leader, maintaining and improving the excellence of its research, according to Innovation 2020, the government policy statement released in December 2015. In his foreword to the statement, Taoiseach (premier) Enda Kenny stressed Ireland's achievements and potential in science, noting that since 2009 Ireland has been listed among the top 20 countries in global rankings for the quality of its scientific research, moving up to 16th place in the 2014 rankings for citations. The aspirations of Innovation 2020 are mirrored by those of the vision statement of Science Foundation Ireland (SFI), the primary agency for research funding, which sees Ireland becoming a "global leader in science and engineering research, discovery and innovation" and already situated "at the centre of global scientific and engineering research". SFI envisages that Ireland will by 2020 be "the best country in the world for both scientific excellence and impact" but it also lauds the historical and current achievements of Irish scientists in its modestly (ironically?) titled Little Book of Irish Science – 100 Things You Should Know.[2]

This is far removed from the expectations expressed by government and state leaders 50 years ago. It was widely assumed then that a small country like Ireland could not hope to do big science. Welcoming a US exhibition, Atoms in Action, to Dublin in 1966, President Eamon de Valera, who took a keen interest in scientific research throughout his political career, noted that nuclear science called for "very elaborate and expensive equipment [and] it was only the wealthiest of nations that could investigate it thoroughly".[3] At that time, Ireland was home to a Nobel Prize-winning physicist, Ernest Walton, known directly to President de Valera. He returned to Trinity College Dublin from Cambridge, where he had worked with John Cockroft on building the Nobel-winning particle accelerator in 1932, to a department with one technician, whose salary accounted for half of the £460 annual budget for equipment and running expenses (McBrierty 2003). When he received the Nobel Prize in 1951 Walton was barely active in physics research. For a decade, Ireland was also home to another Nobel Prize-winner in physics. But Erwin Schrödinger, who came in 1939 at de Valera's direct invitation, did physics that required little more equipment than pen and paper, or chalk and blackboard.

[1] I thank Padraig Murphy and Declan Fahy for their comments on earlier drafts of this chapter; discussion with them has helped shape the arguments.

[2] Posted at https://user-ont9f5h.cld.bz/Science-Foundation-Ireland-Little-Book-of-Irish-Science

[3] Irish Times, 29 September 1966

The accepted wisdom of that time was that Ireland needed to focus its modest resources on applied research, and when the first dedicated scientific research centre was established in the late 1940s with Marshall Plan support, it was in agriculture. Twenty years later, when the National Science Council was set up, Minister for Finance Charles Haughey set down an enduring keystone of policy discourse about science: "There is a close link between a country's science policy and its economic policy". In that context, Haughey asked "whether the costs involved in a national science policy are beyond the resources of smaller countries such as Ireland". And he answered the question, saying that "the smaller countries can least afford to neglect science, though this is not to suggest that they can afford the huge sums necessary for wide-scale research and development of a fundamental character".

Fast forward to January 2016, and the minister of state with responsibility for science, Damien English, states that Ireland is "ranked first in the world for its research in nanoscience, second in computer science and in immunology, third in animal and dairy science, and fifth in materials science". These far-reaching claims of Irish world success in science are based mainly on the average number of citations per published paper. In molecular genetics and genomics, for example, Ireland ranked first in the world in 2010 with 61.4 citations per paper. However, the total number of papers assigned to Ireland (601) was the lowest in the top 20 countries, including Ireland's similarly-sized neighbour Scotland, with 3,417 papers. In a smaller country this metric can be affected by exceptional impact of a handful of papers or authors.

From a communication perspective the metric's precise validity is less important than the symbolism of a small country aiming to do world-leading science across selected sectors. This ambition and the connections and comparisons sought with others doing likewise have found a resonance even among researchers previously sceptical about the approach of Science Foundation Ireland, which is leading this effort. Astrophysicist Peter Gallagher, who had earlier publicly questioned a research funding policy that he – like many other scientists – perceived to be excessively skewed towards applied and strategic research, declared 12 January 2016 the "highlight of my career to date". He was celebrating an award from SFI to support Irish participation in an internationally distributed telescope, Low Frequency Array for Radio Astronomy (LOFAR). "The dream [of] building a LOFAR telescope in Ireland will happen. We're over the moon. #DreamBig," Prof Gallagher tweeted.

It is just one of the many contradictions in the Irish science and science communication environment that, despite the proud and loud claims of international success in science, there was no direct successor to minister English in the government formed after the general election of February 2016. In the election campaign itself, issues of science policy barely featured, even the science-related issue of climate change getting little attention. Among more than 100 tweets by Damien English over three weeks of the general election campaign that referred to economy, jobs, public services, a single tweet referred to research and none to higher education.

Science Foundation Ireland's establishment in 2000 was a key marker of the country's 'turn to science' and SFI has expanded from being a channel of government funding for research in strategic areas to become almost the exclusive agency of government effort in research funding, research policy advice and promotion of public engagement with science. With the establishment of SFI came a major increase and consolidation in government funding of scientific research. The model for SFI was the United States' National Science Foundation (NSF) and its first director, William Harris, came from a background with NSF and its second director, Frank Gannon, from another major global scientific organisation, European Molecular Biology Laboratory. With leaders of this background, SFI has encouraged Irish researchers to think big.

The 'turn to science' was an integral part of the Irish model for late industrialisation, based largely on foreign direct investment in export-led high-technology manufacturing and high-knowledge services and concentrated on the bio-pharmaceutical and information technology sectors.

(Indeed, these two sectors were designated as the sole areas of activity for SFI, in its original version.) But while that model and the economy as a whole took a hammering after the global financial and economic crash of 2008, the commitment to support scientific research was more or less maintained. In a period of stringent spending cuts across many sectors, SFI's annual budget for 2017 is just 9 per cent lower than at its peak in 2009 of €180 million.

Total government allocation to research and development has fallen over 20 per cent from 2008 but, with the overall decline in the economy, the percentage of Gross Domestic Product spent on research and development continued to rise, reaching 1.52 per cent in 2014, according to OECD statistics. The historical and comparative pictures diverge here: at this historical high point in 2014, Ireland was below the average (1.94 per cent) for the 28 member states of the European Union and well below the average (2.37 per cent) for OECD members. Despite this, SFI can claim significant credit for putting Ireland on the world map of science and its ambition is undimmed. The agency's quick response to the British vote in June 2016 to leave the European Union was to appeal to disenchanted British-based researchers to consider the opportunities a short distance away in Ireland. This appeal may appear audacious but daring to think big has brought results.

For decades, the movement of scientific talent was in one direction, out of the country. Professor Garret A. Fitzgerald, an Irish-educated but US-based biomedical researcher, decried in The Irish Times (28 December 1994) the "national neglect of science". Following a frequently used two-cultures line of argument he claimed that "the place of the arts in Irish culture contrasts remarkably with that of science. There is little perception of the importance of science to our society by the public and certainly by their public representatives". Reflecting the concerns of Irish scientists and then widely quoted by them in public debates, a news report in Nature (19 August 1993) had stated starkly in its headline, 'Irish funding disappears'.

The lobbying efforts of the newly formed Irish Research Scientists' Association and of highly visible scientific exiles contributed to the commissioning of several reports on the state of Irish science and in November 1996 to the publication of a White Paper on Science, Technology and Innovation. In line with the claims of neglect outlined above, The Irish Times greeted its publication with a report headlined, 'Decades of neglect end for Irish science'[4]. This first formal statement of government policy on science addressed the need for more and better co-ordinated funding and management of research. But it also linked this with wider socio-cultural factors when it argued that Ireland needed to "develop an ability to feel as comfortable discussing issues which have a scientific or technological angle as we do about popular culture, literature and the performing arts" (Government of Ireland 1996). The strength of the White Paper's emphasis on cultural contexts has not been matched in any subsequent government policy documents on science.

Taking his lead from the White Paper, historian Joe Lee wrote on the "centrality of science and technology in our changing culture"[5] but argued for "a mission statement on investment in research in Ireland that would envisage a balanced relationship between science, technology, the social sciences, and the humanities". As a member of the Irish upper house of parliament, the Seanad, Prof Lee had earlier picked up science minister Pat Rabbitte's reference to a "technical culture" and insisted that "if such culture is to be properly appreciated it ought to become an integral part of general culture". In a similar spirit, Senator Fergal Quinn argued in that 1995 Seanad debate on the report of the Science, Technology and Innovation Advisory Council, that "we do not have a tradition of science and technology in Ireland … our culture is mainly focused in other directions".[6]

[4] Irish Times, 25 November 1996
[5] Sunday Tribune, 11 May 1997
[6] Report of Seanad Debates, vol. 143, No. 2, 27 April 1995

Little political and public discussion

These debates found weak echo in wider society and the political discussion was very largely confined to the Seanad, with its sprinkling of university representatives. The Seanad and lower house, Dáil, maintain committees on a wide range of topics but neither in the 1990s nor since has the parliament had one focused on science. Debates on science or science policy are very rare in the political arena, and speeches by politicians on these topics are very largely confined to holders of the ministerial office with responsibility for science.

In this context, a speech in October 2015 by President Higgins stood out. Speaking in Seattle, USA, in the run-up to the COP 21 climate change conference in Paris, the president raised questions of the ethics of research in the contexts of sustainable development and climate change. Although not intervening directly in political or lobbying discussions about research strategy, he observed that "the greatest long-term, paradigm-changing advances have come … from investment in fundamental scientific research freed from the narrow confines of applied and instrumental research in the service of industry, or of a limited lifespan structured solely around market exploitation. State-funded fundamental research in science is the founding source of what has changed our world for the better in so many ways".[7] The difference of emphasis from former president Eamon de Valera, cited earlier, is very clear.

Even with encouragement from the highest office-holder in the country, the mass media have paid little or no attention to such issues. As explored by Declan Fahy later in this book, only The Irish Times has maintained consistent coverage of Irish scientific research and of science policy questions. However, the developments that have placed scientific research at the centre of economic and educational policy have also helped put public communication of science on the agenda of government, state agencies, companies, cultural institutions and other social actors and despite relatively low level of attention to science among the population as a whole[8], there are significant pockets of more intense public activity around science, as we shall illustrate below and elsewhere in this book.

Policy-makers think big about public engagement with science as they do about scientific research. Announcing €2.8 million in grants for science-in-society projects in January 2016, SFI declared "this investment further supports our national aim to have the most scientifically engaged public". While Innovation 2020 had very little to say about public awareness or public communication, it did set a high target for work in this area, declaring that public engagement funding will raise the number of Irish people who feel informed on STEM research and development from 49% to 60% of the population.[9]

The international context has been crucial to creating opportunities for advances in scientific research and for assessing what has been done. This is true also, perhaps to a lesser degree, in public communication of science. International experience provides examples of what can be done and international surveys provide a valuable context for assessing what has been done. The EU-funded project, MASIS (Measurement and Assessment of Science in Society), sought to paint a picture of how science sits in public policy and public culture across 38 EU member and accession states. The study was based on reports from national correspondents who used a shared template to collect information on governance of science, science in policy-making, science-in-society research as well as on science communication. In this last area, in particular, the project co-ordinators proposed in the synthesis report (Mejlgaard et al 2012) a model that has value for examination of the Irish case, and, indeed, other cases. They examined the national reports according to six parameters and then, based on the reports' identification of strengths and weaknesses in respect of these parameters, characterised

[7] Speech posted at www.president.ie/en/media-library/speeches/re-defining-development-taking-responsibility-for-climate-change-the-challenge

[8] We explore this topic more fully in a later chapter, Science in culture, culture of science

[9] Again, more on this in the later chapter, Science in culture, culture of science

("tentatively") the science communication culture of each country as fragile, developing or consolidated. Ireland's science communication culture was assessed on this basis as developing (as also were those of Austria and Slovenia, for example), rather than consolidated (as for Germany and UK), or fragile (as for Bulgaria and Czech Republic).

Extending the application of this model, we can see it as a tool not just to assess a country's relative position but also to compare various elements of science communication within a country as they have emerged and evolved alongside one another. The MASIS model could also be usefully extended to assess changes over time within an individual country but the model would be misused if it was taken to suggest that science communication in individual countries moves inevitably along an evolutionary path from fragile to developing to consolidated. Neither a country's culture as a whole nor discrete parts of it are organised so systematically that they grow on one path only. Providing detail on an individual country, as we do in this book, indicates that a country's culture may change in various ways in response to political, economic and other developments. Indeed, Denmark, from where the MASIS project was co-ordinated, provides a strong illustration of this: it was once taken as an exemplar in the application of dialogical and participative science communication, as illustrated in citizen consensus conferences pioneered in that country. But it has been observed more recently to give preference to more hierarchical approaches (see e.g. Horst 2012). A similar caution applies in assessing elements of a country's science communication culture or infrastructure; these too may change in various directions, revealing inconsistencies and contradictions in a given national environment.

We can say of Ireland, in general, that through the efforts of individuals, businesses, institutions, government departments and agencies, and others, science communication has gradually become embedded in higher education and research sectors and become more visible beyond those sectors. But we present through this book initiatives and experiences in public communication of science that together add up to a more variegated picture of the Irish scene, in which there are elements that contrast with each other. Science communication's development includes hopeful starts, abrupt endings and significant absences. More than that, there is little, if any, evidence that these efforts have delivered tangible results, in the form of notably greater interest or attention at the level of the public as a whole.

In the following sections we offer summary accounts of selected cases of public communication of science in some of which mini-publics showing above-average attention to science have emerged and in others of which opportunities for inclusive engagement with science have appeared but not been realised.

Young Scientist Exhibition

The Young Scientist Exhibition has been a remarkable success since it started in 1965. It has become one of the largest such events in Europe in proportion to the country's population and it has frequently produced winners of international competitions and been a springboard for participants into careers as scientists. This annual event represents a very significant mobilisation of resources within the scientific and business communities and among school students, their teachers and their families. It has been a platform for public communication of science over the decades, as enthusiastic teenagers engage in and explain scientific inquiry before large audiences attending the event, and following it on radio, television and through print and online media. Taking place in early January, when 'hard news' tends to be in short supply, the exhibition has been a source of science-related stories for radio, television and newspapers sustained over a week. Opening the 2016 exhibition, President Higgins observed that the event had become "synonymous" with the month of January; this is a singular achievement for a science-based event. President Higgins mentioned the encouragement that past participants had from the exhibition to pursue careers in science but he also sketched a broader purpose for taking part and implicitly for public engagement with science, describing the exhibition as

"a celebration of curiosity and independent thinking … [showing] students drawing their inspiration not only from within but also from outside the school curriculum, from the world around them and from the connections between different subjects – the interstices between different areas of science and between the physical sciences and other areas of study"[10].

Government awareness programme

In the early 1990s, government advisory bodies and scientists' representative bodies advocated simultaneously for significantly increased resources to support scientific research and to promote public awareness of science. Indeed, one was seen as the necessary corollary of the other and even before other elements of the 1996 White Paper were implemented, the government established a Science Technology and Innovation Awareness Programme. This later became Discover Science and Engineering, then Discover Science, housed within Science Foundation Ireland. Through its several manifestations this programme has remained a flagship of official endeavours in this area. The programme's budget has increased in recent years, against trends elsewhere, and the scope of its activities has broadened. As well as directly organising a national science week and other regular events such as Maths Week and Engineers Week and established institutions, the programme gives financial support to projects proposed through an open call.

Science Week Ireland defines its main purpose as being "to inspire young people to take up studies and careers in the disciplines of science, technology, engineering and mathematics"; this was how science minister Damien English introduced Science Week Ireland in 2014. At the start of Science Week Ireland 2015 RTE Radio 1 reported that "the organisers believe the more popular science and technology become, the greater the chances of Ireland's prosperity". In 2016, the same station presented Science Week Ireland as "highlighting the exciting science around us". The emphasis remains constant on inspiration, excitement, success and celebration but there have been wider effects of the two decades of science weeks: the 2016 programme included more partnerships than before with sectoral and regional organisations, including new local science festivals in the midlands, to add to those that have emerged in the west and south-east, helping to embed public science into local communities.

National Science Centre

Despite strong advice from government advisory councils and others over more than two decades, that Ireland should have a national science centre similar to the many hundreds of contemporary science centres around the world, Ireland remains one of the very few OECD countries without such a centre. Among the bodies to press the case were the Irish Council for Science Technology and Innovation and the Task Force on Physical Sciences, who both made similar recommendations to government in 2000. The building of such a centre was adopted in the following years as government policy and it was announced in 2006 as Exploration Station, a project to be undertaken in partnership between public and private interests. This fell victim to the economic crash but was revived in 2013 when the state assigned a well-located property but no significant capital funds to this purpose. Exploration Station remains on the agenda, championed notably by Danny O'Hare, who has had long-term interest in this project, including as long-time president of Dublin City University and as chair of the Task Force on Physical Sciences 15 years ago. Dr O'Hare is leading the efforts to raise €13 million from private and sources to equip the supplied space, and to secure government commitment for annual funding. The proposal for the centre shows it as similar to the now hundreds of centres that have been built across the world over the past 40 years, targeted mainly at school-children and linked strongly to their curriculum. Exploration Station appointed a chief executive officer in late 2016, giving the ambitious target date for opening the centre as end of 2018. In the meantime, more locally oriented

[10] Speech posted at www.president.ie/en/media-library/speeches/remarks-at-the-young-scientist-of-the-year-exhibition

centres like the Blackrock Castle Observatory in Cork have been building their audiences and a more thematically focused centre, Cool Planet Experience, opens in Co. Wicklow in 2017.

Science Gallery Dublin

A central contradiction in the science communication infrastructure of Ireland is that absence of a national science centre alongside the presence of an innovative science centre that has set international trends. Since it opened in 2008 Science Gallery Dublin has become not only a very significant national cultural institution and visitor attraction but also an international leader in presenting ways of making "science and art collide".[11] SGD operates in some respects more like a contemporary art gallery than a science centre, having no permanent exhibits, and filling its modest but flexible spaces with shows that are curated by small interdisciplinary groups and largely assembled through open calls. Catchily-titled exhibitions on focused topics running usually for three months each have drawn strong audiences and extensive international and national media attention. The gallery's young team of managers are at the core of networks of advisers, supporting scientists, contributing artists, leaders of the home institution, Trinity College Dublin, media-savvy staff and enthusiastic student volunteers. Science Gallery has the remarkable achievement of making a science-based institution culturally 'cool' for young people but also attractive to corporate and state support. Along with continuous sponsorship from other leading high-technology companies, a grant from Google has enabled the establishment of a programme to spread science galleries elsewhere. Science Gallery London opened in 2016 and similar centres are due to open soon in Melbourne and Bengaluru, and later elsewhere.

Professional education in science communication

In 1996 Dublin City University joined the small number of universities in western Europe and Australia providing professional education in science communication. The seeds had been sown for this with a conference at DCU in 1993 that included pioneering science communication academic John Durant, then based at the Science Museum and Imperial College in London, among its speakers. The Masters in Science Communication, delivered jointly with Queen's University Belfast for its first decade, quickly took its place in the international networks of education and research in this fast-growing field. The story of the students and eventual graduates of this Masters programme reflects the story of science communication in Ireland but also beyond. Recruits to the Masters have frequently reported that they did not know 'science communication' existed until they found information about the programme. But as graduates they were frequently the first occupants of designated science communication posts in their employments, working in research and higher education institutions in Ireland and beyond, in Science Gallery Dublin and international science centres, in public media and communications consultancies in many countries, and in research and education in the broadening science communication field.

The DCU programme has continually attracted international students and those joining in autumn 2016, 20 years after the first intake, include students from eight countries. Responses to a 2011 survey of graduates came from Ireland, Northern Ireland, England, Scotland, Wales, Belgium, Netherlands, Australia, Canada, United States and West Indies. The respondents recorded personal and professional impacts of undertaking the programme typically in these ways[12]: "The MSc Science Communication enabled me to change careers and pursue a job that interests me and is constantly challenging"; "The MSc allowed me to bridge the gap between the hard sciences and the humanities thus allowing me access to other job areas and encouraging my interest in science communication

[11] For more on Science Gallery Dublin see Ian Brunswick's later chapter on its genesis

[12] Quotes from the survey report online at www4.dcu.ie/communications/resources/pdf/Results-of-survey_of_graduates_of_MSc_in_Science_Communication.pdf

activities"; "Completing the dissertation on this course gave me a basis for my knowledge of research which I use every day in my current position".

Research in science communication

Formal research in science communication and closely related topics (science policy, science ethics, etc.) has been conducted in several higher education institutions in Ireland, though mainly in DCU, where the research effort grew out of the Masters programme. As the European Commission increased its funding for actions and research around this topic, it created opportunities for international collaboration and for research assistants to be employed short-term; this in turn made it possible for early-career researchers in the field to pursue PhD studies. DCU researchers took part in EC-funded projects under research and co-ordination programmes, covering such topics as science communication training, science on television and public participation in science through science shops. National funding was also secured for work on biosciences in society, public participation in controversial science and several aspects of environmental communication. Annual science and society seminars running in DCU since 2006 have been a platform for leading international researchers in the field to engage with Irish colleagues, and for exchange between researchers in various Irish institutions. Doctoral research in science communication, as in any emerging academic field, can be taken as a sign of maturation and stabilisation, and the numbers of PhDs in science communication and closely related topic areas are comparable with those of any European country on a per-capita basis. Theses undertaken in DCU have covered such topics as young people's understandings of genetic technologies, celebrity scientists and stakeholder perspectives on sustainable development[13].

Science communicators in institutions

From the early 2000s, a new infrastructure of specialised research institutes grew with targeted support from Science Foundation Ireland, and in partnership with leading high-technology companies. From the start, these institutes were charged with undertaking public activities, generally titled 'education and outreach'. At the same time, EU funding of scientific research projects, for which Irish researchers proved able competitors, also came with requirements for 'dissemination', or similar. Over 15 years, a community of science communicators attached to research institutes and projects has grown, though unevenly, due to the vagaries of funding cycles and reviews. However, the growth has been sufficient to allow movement between institutions, also between Irish and international institutions. Many of the public activities these individuals and teams have initiated have been targeted at schools, as 'education and outreach' implies. The schools-based competition, Debating Science Issues, which ran in the 2000s, was one of the more notable and visible of these, operating on a national level. Other activities have been more local, leading in some cases to strong relations between individual institutes and particular schools. But education in this context has also extended to postgraduate programmes and short courses in which science communication training for early-career research scientists has been included.

Science communicator networking

The growth to maturity of the science communication community was reflected in the first national conference on science communication in 2015. The one-day Sci:Com event drew over 250 participants that year and again in 2016, most of them active – part-time or full-time, voluntarily or professionally – in public communication of science. This was undertaken as a commercial venture but with support from over 20 state bodies, companies and higher education and research institutions.

[13] See theses available at DCU Library, e.g. P. Murphy: Choosing identities: the politics and practices of classroom discourse on reproductive and genetic technologies; D. Fahy: The celebrity scientists: a collective case study; C-P. Hong: Stakeholder perspectives around sustainable development: a Q methodology study on 'green pioneers' in Ireland

It was thus different from national science communication conferences in, for example, Britain, Netherlands and Portugal, which have been running for several years and are based on national associations. No such association exists in Ireland, at the time of writing. However, Sci:Com's emergence is a statement of science communication having achieved critical mass or, as the welcome to the 2015 conference from its hosts put it, "We have seen an extraordinary growth in the number of science communication events and initiatives taking place across the island … Now feels like the right time to bring this vibrant community to share experiences, learn new skills, spark new ideas and meet new faces".

ESOF and Dublin City of Science

In 2012, a massive mobilisation of financial, personnel and institutional resources was co-ordinated by the office of the Chief Scientific Adviser to enable the Euroscience Open Forum (ESOF) to take place in Dublin. An ambitious proposal was prepared and implemented with very significant support from government and from active committees representing a wide range of interests. Ireland's strength in science diplomacy was reflected in the very broad interdisciplinary and inter-continental support for the proposal. The central part of ESOF is a large-scale conference, with high-profile keynote speakers and many parallel sessions, presenting and debating current science in broadly accessible terms. This part is geared to professional scientists and others with high levels of interest in science but for the 2012 event, Dublin was self-designated a City of Science, with buy-in from Dublin City Council, and this was the platform for a programme open to the wider citizenry.

In 2005, Dublin had hosted the British Association Science Festival with a linked Science in the City programme co-ordinated from Dublin City University. But both equivalent parts of the 2012 event were on a vastly larger scale and involved much more diverse interests. Public events were presented in a 10-day festival by arts groups, national cultural institutions, maker groups, science buskers, and many others. Exhibitions, theatre pieces and concerts in the major venues were science-themed for the event. Twelve poets wrote poems of 12 lines each on science (McGovern 2012). A central concern of the organising committees had been to ensure the programme had a legacy. The stated values for Dublin City of Science – "openness, curiosity, community, inspiration and fun" – have been echoed in the Festival of Curiosity which was developed from 2012 and has run each summer from 2013, further enlarging and consolidating the mini-public that emerged around Dublin City of Science. It has offered a counterpoint in the summer holiday season to the more schools-oriented Science Week Ireland in November.

Government adviser and Irish Council for Bioethics

As Chief Scientific Adviser (CSA) to the government, retired animal genetics professor Patrick Cunningham was the main driving force for ESOF and Dublin City of Science in 2012. The post of CSA was established in 2004 and Prof Cunningham was the third person to hold this office, from 2007. He worked with a small team from the premises of the state agency, Forfás, but operated independently in commissioning reports of the best-available science as advice to government on selected issues. The role of adviser was in this way placed between government departments, state agencies, scientific institutions and the public and hosting ESOF 2012 and organising Dublin City of Science was done through the Chief Scientific Adviser's office at arm's length from government, though with crucial government funding. In 2012, however, on Prof Cunningham's retirement, the role of adviser was incorporated into the functions of Science Foundation Ireland. SFI's director Prof Mark Ferguson also carries the title of Chief Scientific Adviser, though this role is not nearly as visible as it was previously. Prof Ferguson has dismissed the claim that there is a conflict of interest, though he may be asked to advise on the organisation of the research infrastructure, of which SFI is a key part.

A similar fate befell the Irish Council for Bioethics, which was established in 2002 with administrative support from the Royal Irish Academy to advise the government on the many difficult issues arising from developments in biological sciences. The council membership represented a range of scientific and non-scientific interests; the appointment of journalist Mary Mulvihill was intended to ensure a link to the wider public. The council published reports on sensitive topics such as stem cell research, held public events on topics such as the ethical issues in preparing for a pandemic in 2006, and staged public debates on bioethical controversies in 2007 which were also aired as a series of radio programmes. In 2010, the council was disbanded and the staff members were redeployed to the Department of Health, working on bioethical matters, but with much less public visibility or interaction.

False starts in public dialogue

The Technology Foresight reports of 1999 that were the basis of Science Foundation Ireland's establishment included one on biotechnology that contained a proposal for a National Conversation on Biotechnology. This was in response to the tempestuous controversy of the late 1990s around genetically modified organisms (GMOs), specifically in relation to foods and crops. The intention appeared to be to avoid confrontational exchanges by facilitating an exchange of information and views. Some mechanisms were put in place to support this conversation but when the heat went out of the GMO controversy, and several major actors withdrew from the scene, the barely-started conversation was aborted. An industry and academy consultation on nanotechnology in the mid-2000s drew up plans for a major programme of investment in research and development in this new area of research and business. In association with this, and also in response to the GMO controversy, preparatory work was done on a public dialogue around nanotechnology. When the economic and financial crash came in 2008, advocacy of the nanotechnology programme ceased and the dialogue never started.

With the growing international awareness of and advocacy around global climate change, this issue has become the focus of public mobilisation in many countries; scientific information and scientists' arguments have been at the centre of public discussions. Despite the presence in Ireland of a Green Party that has been in government, of high-profile campaigners and active and dedicated campaign groups around climate change, the subject has had muted public resonance and was a barely tangible concern in the 2016 general election.

In 2003, Tánaiste Mary Harney, Minister for Enterprise, Trade and Employment, and responsible for science policy, delivered a speech to the Royal Irish Academy which the academy subsequently published (Harney 2003), asking if "science will assume a central place in our culture". Ms Harney made the case for a civic science, "a science engaged with and invited into the national dialogue … responsive to the public and worthy of the public trust … embraced and valued by students, parents, educators, industry and communities, and yes, the government". The minister's challenge was not taken up by any of the relevant professional bodies or policy agencies. The proposition of a civic science garnered little attention in media or other public discourse.

Science on air

In its assessment of science communication cultures in European countries, the MASIS study looked to "the science journalism situation in the country in question" but also, under the heading of the national science communication infrastructure to "the number and regularity" of science sections in newspapers and "the number and quality" of science programmes on television and radio (Mejlgaard 2012). Later chapters in this book analyse the "science journalism situation" in relation mainly to print media and there are reflections by practitioners on their experiences of working as science writers and on science programmes for television and radio. Here, however, we draw attention to two aspects of broadcast science that are somewhat contradictory. The national broadcaster, RTE, which

had annual series of science radio programmes in the 1990s and early 2000s, had by the start of the new millennium no home-produced television programmes on science and no correspondent for science and technology in their newsroom. Under pressure from government, a specialist was appointed, though initially only as a part of the responsibilities of the Education Correspondent. On the basis of sponsorship from Discover Science and Engineering, then from SFI, short TV science series were introduced, including Scope (2007-11), Science Squad (2012-14), 10 Things to Know About… (2015 onwards) and, most recently, a science-based comedy quiz show, Eureka: the Big Bang Query, from 2016. The last-named reflects an international trend in combining science and comedy, but also in mainstreaming science in unexpected media contexts; it is a departure from the previous concentration on experts talking formally about their or others' research. However, there is a cautionary finding in the 2013 Eurobarometer survey of public attitudes to science and technology: in the midst of this sponsorship-driven enterprise in TV science, Irish respondents were the least likely of all in Europe to identify television as a source of information on developments in science and technology; the 44% of Irish respondents naming TV as a source were the only cohort fewer than 50% in Europe; the equivalent figure for Sweden was 84%.

The weekly science programme, FutureProof, on Newstalk radio is also sponsored by SFI and is a vehicle for enthusiastic engagement with current science within the mainstream of radio programming. However, it is reasonable to infer from these cases of broadcast science that without external sponsorship such programme-making would be much less or non-existent. On the other hand, there is also an increasing amount of science coverage on radio that is offered independently of such supports. Again, on Newstalk, the afternoon magazine programme frequently includes extended interviews with scientists and other researchers, generally in their capacity as book authors, and the evening and morning current affairs programmes have regular science slots; on the morning programme immunology researcher Prof Luke O'Neill – one of the few highly visible public scientists in Ireland – ranges widely across topics of scientific interest.

Cultivating scientific heritage

A common feature of speeches on science by politicians and leading figures in the scientific community is a reference to Ireland's heritage in science. Recalling historically important research has been a way to legitimise current public spending in this area, to address issues of more recent neglect, and to encourage wider public attention to science and scientists. Over the past two decades, a scientific heritage movement has emerged, that is represented by the publication of books on people and places of historical scientific interest, notably those written or edited by Mary Mulvihill (1997, 2002)[14], by the establishment of summer schools and similar events dedicated to the memory of Irish scientists, and the erection of scores of commemorative plaques at places associated with notable personalities. The National Committee for Science and Engineering Commemorative Plaques has since 1996 erected plaques to preserve the memory of, for example, George Johnston Stoney, who coined the term, electron, Richard Lovell Edgeworth, an 18th century engineer, and Agnes Mary Clerke, a 19th century astronomer. The involvement of Women in Science and Technology in this endeavour has ensured that women's contribution to Irish scientific heritage has not been neglected. The Robert Boyle Summer School held in Boyle's birthplace, Lismore, Co. Waterford[15], also recalls the involvement in his pioneering scientific work of his sister, Lady Ranelagh. Raising awareness of the heritage Boyle and others represent has undoubted value for promoting public attention to science but it also carries the risk that strong emphasis of the historical record, including references to a 'golden age', may imply that past achievement cannot be matched. The recently established History

[14] See also later chapter in this book by Cormac Sheridan on Mary Mulvihill (1959-2015)

[15] See www.robertboyle.ie

of Science, Technology and Medicine Network encourages formal research in this field, including on the history of public communication of science.

Public science chat

Informal public communication about science was not one of the criteria for the MASIS assessment, not least because it is by its nature difficult to measure. More recently, tools have become available to capture such informal communication in social media but only detailed narrative can represent the experience of one of the globally-spread formats of science communication, that of science café, which is found with variations across all continents and in many very different cultural contexts. The Alchemist Café has since 2004 hosted open, unscripted, slide-free presentations and discussions of science topics in Dublin pubs. The model has been adopted and adapted elsewhere, including Blackrock Castle Observatory in Cork. Similar ventures have started in recent years, including PubhD, which began in Dublin, but has a presence in England and Portugal, and involves PhD researchers talking freely about their work in everyday settings. Other combinations of chat, jokes and science that are represented in Ireland include Pint of Science, started in 2013, and Bright Club, which originated in England, and features researchers as stand-up comedians, sometimes alongside professional stand-ups.

Domination of STEM approach

The proliferation of these formats and their presence in Ireland reminds us that formal, hierarchical models of science communication can and do co-exist with informal, participatory models in the same national-cultural context. But it is fair to observe that the dominant rationale for promoting public awareness of science remains, as it was 20 years ago, focused on economic needs. The explicit concern with placing science in culture is, if anything, weaker now than it was 20 years ago. The economistic emphasis has been expressed over the years in arguments for improving public awareness as a means to encourage uptake of science studies and science-based careers and thereby to ensure a 'successful Ireland'. The precise terms of the argument have changed but the emphasis remains largely the same, as seen, for example, in the publicity for Science Week Ireland. This orientation supports, or even assumes, a largely one-directional mode of public communication – young people and their parents need to be persuaded of the wonder and value of science and of the employment and other opportunities it brings. Science (also, more frequently in recent times, research or innovation) is presented as a key force in economic development and greater public awareness of science is assumed to lead to greater public support for it, and thus for the efforts to build a knowledge-based economy.

The recent widespread adoption of the STEM acronym for science, technology, engineering and mathematics fits with that emphasis. STEM studies, STEM careers, STEM awareness are phrases generally used in contexts that strongly link research and economy. The contemporary successor to the Task Force on Physical Sciences, which examined science education over 15 years ago, is the Review Group on STEM Education appointed in November 2013, and anticipated at that time to report in six months. Thirty months later, the Programme for Partnership Government committed to publishing and implementing the STEM Review report, and it was eventually made available in November 2016. The report of the STEM Education Review Group (2016) drew attention to shortcomings in the educational provision, calling for a "step-change in STEM performance and outcomes" but that did not inhibit the minister, Richard Bruton, from declaring that Ireland should aim to be a world leader in STEM education.[16]

Science education to meet skills needs accounted for the single reference to science in the 130 pages of the government programme of April 2016. This narrow focus strips away not only the context of scientific research and the higher education infrastructure but also the wider context of

[16] See Department press release at http://www.education.ie/en/Press-Events/Press-Releases/2016-Press-Releases/PR2016-11-24.html

public awareness of and interest in science. Even from the limited, economistic perspective on STEM studies and careers, this appears short-sighted: public attitudes to science and technology, as mediated by parents to their children, are at least as strong an influence on young people's life-choices as are teaching methods in school. Despite strong cultural connections with Britain and institutional connections with the European Commission, policy discussions in those places around science communication have been weakly reflected in Ireland. In Britain the emphasis of two and three decades ago on scientific literacy and public understanding of science was critiqued as supporting an inappropriate and ineffective 'deficit model' of science communication; the deficit in question was, variously, public ignorance and public distrust. From 2000 onwards it became a commonplace of British debate on these issues to say this approach had given way to encouragement of public dialogue. Meanwhile, the EU multi-annual programmes in this area changed names in step with the shifting consensus among researchers, policy-makers and science communication practitioners. Thus, Raising Public Awareness of Science and Technology gave way to Science and Society, leading to Science In and For Society. Fuller discussion of the implications of these shifts can be found elsewhere (see, e.g. Trench 2008) but the MASIS report observed that countries with a consolidated science communication culture had greater "emphasis on ethical and critical debates concerning science in society" and "a tendency towards more interactive activities" (Mejlgaard et al 2012, p69). The report summed up, "Dialogical, rather than one-way, science communication is, in other words, more outspoken (sic) in countries belonging to this category".

Summing up our own outline of the Irish situation, we might say that dialogical communication is weakly present in institutional practices but increasingly evident in the diverse activities promoted by interest groups and communities. Science communication has become more deeply embedded within the institutions but the range of actors involved, to borrow again from the MASIS study, has broadened steadily beyond the institutional sphere. There are aspects of the science communication culture that are fragile, e.g. political attention, public participation in science issues, science journalism and public attitudes towards science; there are aspects that are developing, e.g. the national infrastructure, the academic tradition, science communication research and public science chat; and there are aspects that are consolidated, e.g. education and training in science communication, the spread of participants and innovation in science centres and science events.

The dominant model of institutional communication of science has changed little over two decades. It is illustrated in the autumn 2016 advertisement of the Tyndall National Institute and CONNECT research centre for a public engagement and outreach officer. The linked centres, both focused on information and communication technologies and based in University College Cork, sought this person "to deliver our objective of achieving a scientifically engaged public"; the two centres aim "to inspire and encourage the next generation to study STEM subjects and to consider a career in these fields". The approach privileges dissemination and promotion models of public communication, stressing the transfer of information and argument from scientists and scientific institutions *to* various publics, but mainly younger people, rather than inclusive communication *with* these and other publics as active participants in the process.

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