

The art of the engineer



Engineering is an art form, with creativity at its very heart – and its influence on society is profound, NUI President Dr James J Browne tells **Lorna Siggins**, Western Correspondent



'Almost everything is engineered': Dr James J Browne, President of NUI Galway

WE LIVE IN a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology...'. The speaker was the late astronomer, astrophysicist and science writer Carl Sagan, but it could easily have been NUI Galway (NUIG) president Dr James J Browne.

"No one ever says they know nothing about Shakespeare, and yet people are quite happy to say they haven't a clue about science or maths, or about how something works," says Browne. Mention "engineering" and most will associate it with the design of buildings, infrastructure and machines, he says. Yet engineers are now at the heart of a "range of life experiences", from designing medical components to wireless network development to information technology, he points out.

"Almost everything is engineered," says Browne, and by 2025 the Economic and Social Research Institute (ESRI) has forecast that engineering "services" will account for more than 70 per cent of Irish exports and almost 80 per cent of Gross National Product (GNP).

What perplexes Browne is the tendency for many members of the younger generation – praised constantly by their elders for their easy handling of technology – to show little or no curiosity about how such technology works. He believes there are several reasons

for this, including the fact that we live in a highly consumerist, disposable society, and the fact that "engineers aren't the best communicators about what they do".

"Everyone is capable of understanding the technology in a car engine, and I think one of the solutions would be to teach science and engineering studies at primary level," says Browne. "Our democracy is massively modified by the technological changes that we are living through, and it doesn't take a lot to teach the basic principles."

As he outlined in an address to Engineers Ireland, the professional body which he was president of several years ago, engineering is an art form, with creativity at its very heart. "You can see that in the way that young children will take to it so naturally. And the challenge is to retain that interest through primary and second level, rather than losing it – which is what is happening to so many of our young students."

The issues surrounding sufficiently qualified maths teachers have been well aired in the media, but he believes there is a fundamental lack of support for this branch of the profession.

"There is nothing in the ambient environment that supports physics, maths and chemistry teaching," he says. "It's a cultural thing – there should be a 'science-light' approach to everything to give people enough understanding to be good citizens, and there should be sabbatical leave for maths and science teachers to allow them to spend time working in companies specialising in practical applications of the subject."

"I do know a small number of engineers who have gone into teaching, bringing their life experiences to bear with great success," he says. "Unless the teacher is motivated, you can't expect the pupils to be."

IT WAS A schoolmaster-turned-engineer who shaped most of the landscape to compass points west, south and east of the NUIG campus. Scotsman Alexander Nimmo, who came to Ireland to join the Bogs Commission survey in 1811, designed harbours and piers in almost every maritime county.

As his biographer Prof Noel Wilkins of NUIG has recounted, he designed and build bridges and roads, he laid most of the Ring of Kerry road, and had a hand in Ireland's very first proposed railway line from Limerick to Waterford. A recently edited version by Wilkins of *Alexander Nimmo's Inverness Survey and Journal, 1806* sits on Browne's office desk.

Motivation, imagination and creativity were central to the design of the university's new engineering building, which Browne is extremely proud of, and which was opened by Taoiseach Enda Kenny in mid-July. The new "living laboratory" is the largest engineering

study centre of its type in Ireland, and it has more than three dozen "green credentials", including "low embodied" energy materials, a south-facing "climate wall", rainwater harvesting and grass roofing over its labs.

"It's not the first such design, but it is probably a first for an Irish university, and we have adopted best practice worldwide," he says. "When the planning group was initially set up for this, it had three aims on its wish list – a learning building, a green building, and integration of disciplines," he says.

"The profession is so diverse now, reflecting a changing economy and society," he says. "When I came here to do civil engineering in 1970, it was the only engineering course on offer, and it had been the only one since the university's foundation."

"It was in 1971 that the first industrial engineering course was offered, and it was several decades further on before the engineering school had expanded to embrace mechanical and electrical and electronic, computers/IT and biomedical."

"The university was responding to developments, if you like," he says. "When Boston Scientific came to Galway in 1994, there were discussions with it, and we offered the biomedical programme from 1996. Until last year, civil engineering was still the biggest course, reflecting the size of the construction sector, but now it is quite dispersed."

Energy systems will be one of the range of courses on offer to 1,100 students, along with, "sports and exercise", biomedical, environmental, civil, electronic and mechanical engineering. However, Browne is particularly keen on the fact that first years also have an "undenominated" option, allowing them time to choose which speciality.

"Almost half of this year's first-year intake has opted for the undenominated course, and I think it is great to postpone the specialisation until one has more information," he says. "They can enter any of the second-year programmes, and they will have had core training."

"The building will have a 'catalytic' effect, he says, in that casual interchanges among students will encourage innovation. Ocean energy is one very challenging area, where technology still has to be developed to withstand complex ocean and inshore tidal environments – with test beds located on the western seaboard. "The university's focus is on producing very high-quality graduates, and we have had campus companies – but I think it is unrealistic for a university to create companies," he adds. "We shouldn't predicate our research and development programmes on this."

"Our aim is to produce a stream of graduates, because it is people who do things – people who make things happen."

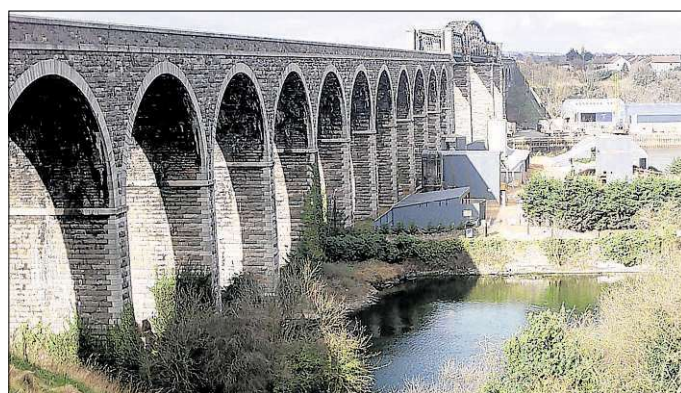
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Galway's illustrious alumni A who's who of pioneers and adventurers

THE FEE WAS 11 pounds and 10 shillings when the first engineer course, lasting two years, was opened up to students of what was then Queen's College Galway in October 1849.

Its first professor stayed just a year, but his successor, **William Bindon Blood** (1849-1860), was an expert on stresses in continuous girders and beams. His work was to have an impact on the 19th-century Boyne Viaduct which, when built, was the longest spanned bridge in the world.

The Clifden-Galway railway, the Shannon hydro-electric scheme and expansion of Ardnacrusha were among projects which subsequent engineering professors and lecturers from University College



Galway (UCG) played a central role in, and late professor **JE Nash** gained an international reputation for the college in applied hydrology.

Its first female engineering graduate, **Alice Perry**, became the State's only female county surveyor. Perry subsequently

The Boyne Viaduct, at one time the longest spanned bridge in the world

pursued a career in industrial safety until her retirement in 1922.

One of the more far-flung connections involved Galway engineering graduate **Joseph Fitzgerald**, who graduated in 1937 and was in Malaya when the second World War broke out. As Paul Duffy recounts in *From Queen's College to National University* (1999), Fitzgerald was commissioned in the Indian Army, taken prisoner at the fall of Singapore in 1942, and spent the next three-and-a-half years working as a slave labourer on the Burma-Siam railway for the Japanese.

PROFILE LAOISE McNAMARA

'We're taking an engineer's approach to the body'

Dr Laoise McNamara, Department of Mechanical and Biomedical Engineering

"I am a Science Foundation Ireland (SFI) Stokes Lecturer in the Department of Mechanical and Biomedical Engineering at NUI Galway. I hold a PhD in Biomedical Engineering from Trinity College Dublin and completed a postdoctoral fellowship in bone cell biology at the Department of Orthopaedic Research at Mount Sinai School of Medicine, New York. I have held lectureships in Biomedical Engineering at the National University of Ireland and in Mechanobiology and Musculoskeletal Biomechanics at the University of Southampton in the United Kingdom before taking up my current position at NUI Galway."

"My current research group consists of eight PhD students and three postdoctoral fellows. I have been awarded funding by the European Research Council, under the Starting Independent Research Grant Programme 2010, the Health Research Board Ireland and SFI. The research group is focused on studying bone diseases to develop new treatment approaches. Tissue engineering offers great potential for treatment of diseases, but approaches for recreating bone as clinical treatments for bone diseases and injuries are not yet successful. We seek to break through existing barriers by combining engineering mechanics with biology through a number of innovative approaches to understand the complex mechanical environment in which bone cells live, and to characterise the response of bone cells to



mechanical loading in healthy bones and during diseases such as osteoporosis. With this information, we're seeking a way to regenerate bone tissue as clinical treatments for bone diseases.

"While our research is relevant to any bone disease, we're particularly interested in trying to understand how osteoporosis comes about. So we look at the mechanobiology of the cells, which requires expertise in a combination of understanding the

biology of disease as well as the mechanics of our bones.

"That's what's different about our work: the interdisciplinary approach. We're engineers not biologists, and are taking an engineer's approach to the human body, which is quite novel."

"In addition to these studies, I have research collaborations with the medical device companies Stryker Instruments and Medtronic Vascular."

"Studies with Stryker Instruments aim to advance

understanding of the mechanical and thermal properties of bone and cutting tool materials during surgical cutting procedures. Stryker are in fact closely linked to our bone research. When you cut bone you create heat around the bone. So we are helping them understand how to optimise the cutting process – how long should it take, how much heat can be tolerated – to optimise regeneration and the healing process.

"Studies with Medtronic Vascular aim to advance understanding of transcatheter bioprostheses using experimental approaches and computational modelling."

"The opening of the new building is really exciting. We now have all disciplines in the one building, which leads to cross-fertilisation in different areas. I've already been in here two months and have already seen lots of overlaps with colleagues in different fields. The students seem to be very impressed too, but it's not surprising as these are the best biomedical engineering teaching facilities in the country."

"We're lucky to have so many medical device manufacturers in the locality too. There are 33 in the NUI Galway area, which leads to convenient collaborations. The links are very important for creating employment too."

"Biomedical engineering has become very strong in NUI Galway. Here on our doorstep we can find placements for our students in companies and students do projects with industries. Hopefully, we'll see some exciting new research over the next few years."

John Holden

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