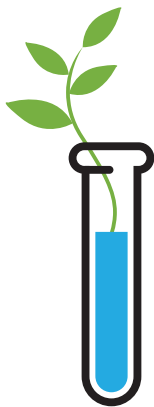


# Little Book

*OF*

# IRISH SCIENCE

100 Things You Should Know





Science  
Foundation  
Ireland

sfi

For what's next

# Contents

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Acknowledgements

# 1 Remote Care

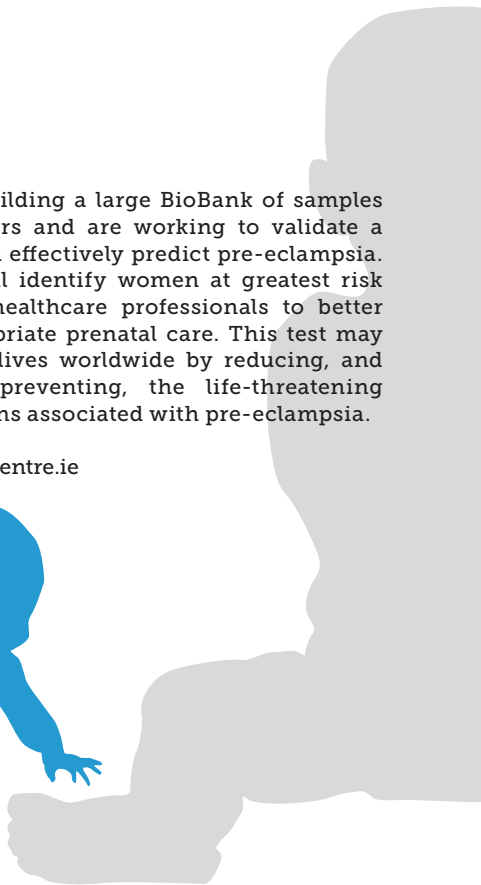
## For Mother And Baby

Pregnancy can be a dangerous time for millions of women worldwide: pre-eclampsia alone claims the lives of more than 70,000 women and over 500,000 infants every year. Researchers led by Prof Louise Kenny, co-director of the world renowned Science Foundation Ireland funded Centre for Fetal and Neonatal Translational Research (INFANT) are working to develop screening tests to predict and prevent pre-eclampsia, a major complication of late pregnancy.



They are building a large BioBank of samples from mothers and are working to validate a test that will effectively predict pre-eclampsia. The test will identify women at greatest risk and allow healthcare professionals to better align appropriate prenatal care. This test may save many lives worldwide by reducing, and eventually preventing, the life-threatening complications associated with pre-eclampsia.

[www.infantcentre.ie](http://www.infantcentre.ie)



## 2 BeeHave

Scientists from University College Cork, supported by the Irish Research Council, are working to safeguard the sweeter things in life. The team have developed a carbon neutral system to remotely monitor the status of beehives, alerting beekeepers to disturbances in the hive environment which could negatively affect the health of the swarm.

[www.ucc.ie](http://www.ucc.ie)





## 3 Marine Sponges

A potential new source of bioactive molecules and antibiotics is being mined from the humble Irish sea sponge by researchers at the Marine Institute, NUI Galway, University College Cork and Queens University Belfast. Filtering up to 24 litres of water per kilo of sponge a day, they contain a wealth of interesting compounds and bacteria that have a huge potential to lead to amazing new medicinal compounds.

[www.marine.ie](http://www.marine.ie)





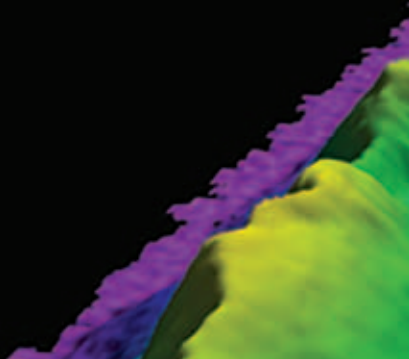


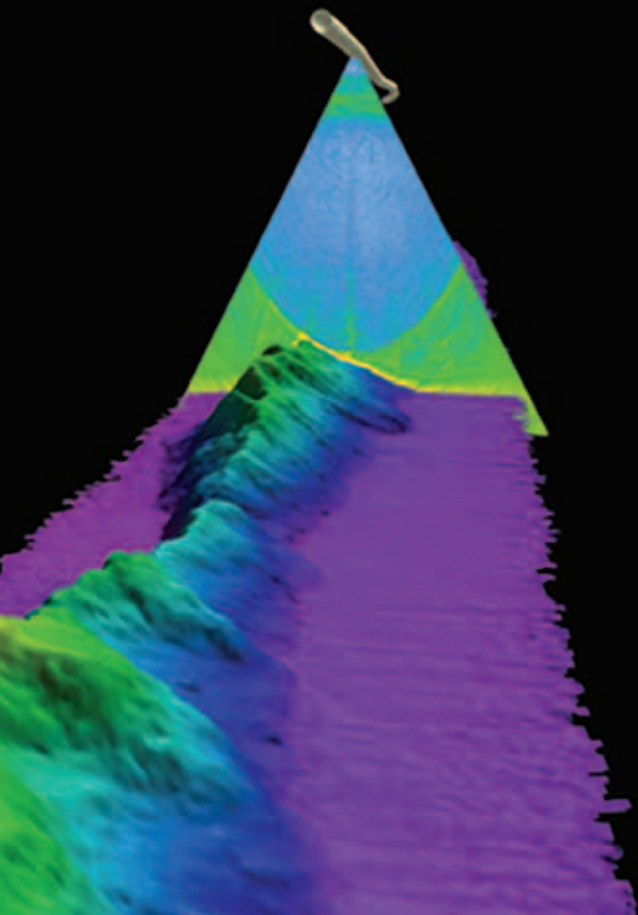
## 4 Under The Sea

The Irish national research vessel the RV Celtic Explorer has been playing host to a cohort of Irish, Canadian, American, and Portuguese scientists, intent on mapping the Atlantic seabed. Using the latest multibeam echo sounder technology, an extensive 140km long seabed mountain ridge has been imaged along a major fracture zone associated with the opening of the Atlantic Ocean.

Valleys through this fracture zone now form the only North Atlantic passage for deep water species to migrate between the west and east Atlantic.

<http://www.infomar.ie/StoryMaps/Atlantic/index.html>





## Behind the Perfect Pint

As a freshly drawn pint of Guinness settles in a pint glass, small bubbles in the stout sink, rather than rising like the larger bubbles do in lagers. Researchers at the Science Foundation Ireland-funded Mathematics Applications Consortium for Science and Industry at the University of Limerick used computational fluid dynamics, a technique used in designing aircraft and Formula One cars, to figure out why. They found the narrow-ended shape of the traditional pint glass is a key factor in the downward pull of those nitrogen bubbles as the Guinness settles.

[www.macs.ul.ie](http://www.macs.ul.ie)





## 6 3150 BC

The roof box at Newgrange keeps time using the winter solstice sun.

## 7 1845 AD

Birr, Co. Offaly, was home to the world's largest telescope, the Leviathan.





**8** 1938

Westmeath born Kenneth Edgeworth proposes Pluto is not a planet but rather a large piece of space rubble.

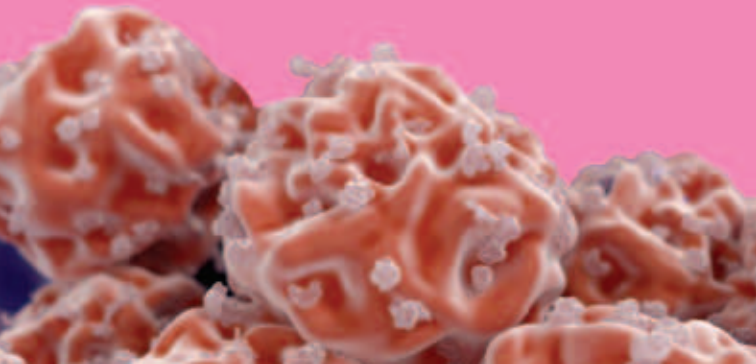
**9** 1943

Jocelyn Bell Burnell is born in County Armagh and will later go on to discover pulsating radio stars, or pulsars.

## 10 Stem Cells for Diabetes?

Could stem cell therapy help to tackle diabetes? The NUI Galway is leading REDDSTAR, an EU-funded study that aims to develop adult stem cells with the potential to both control blood glucose levels in patients and to address the complications caused by diabetes mellitus. The study will work with adult stem cells developed by Irish company Orbsen Therapeutics, and test them at various centres around Europe, resulting in a clinical trial in Denmark.

[www.reddstar.eu](http://www.reddstar.eu)





# Bananas taking a stand 11 against viral infection

Giving superfoods a run for their money, the banana is now making waves in the world of anti-viral medicine. A multinational team of researchers, including Prof Paul Murphy's team in the NUI Galway, have shown that a specific protein known as a lectin can be isolated from the banana and with slight modification has shown promise as an anti-viral drug. The protein called BanLec binds to sugars on the surface of the virus thus preventing them from entering the host's cells and causing disease.

<http://www.nuigalway.ie/>



## 12 Chomping at the bit of technology

Irish company SelfSense has bruxism grinding to a halt. The condition of habitual teeth grinding, particularly prevalent at night, can now be managed using a smart technology mouthguard. This device monitors and measures nightly teeth grinding and sends the recorded information to the patient and dentist every morning allowing for more targeted intervention.

[www.selfsense.ie](http://www.selfsense.ie)



# The emergence

13

## of a new alloy

A new alloy combining manganese, ruthenium and gallium, aptly named MRG, has been developed by Prof Michael Coey and team at the Science Foundation Ireland funded AMBER (Advanced Materials and Bioengineering Research) centre in Trinity College Dublin. MRG, a 'zero moment half metal', is a world first material that is extremely magnetic on the inside, but seen from the outside, it appears only weakly magnetic if at all. Magnetism lies at the heart of our capacity to store and retrieve data, making MRG an exciting new player in the field of superfast memory and big data storage.

[www.ambercentre.ie](http://www.ambercentre.ie)

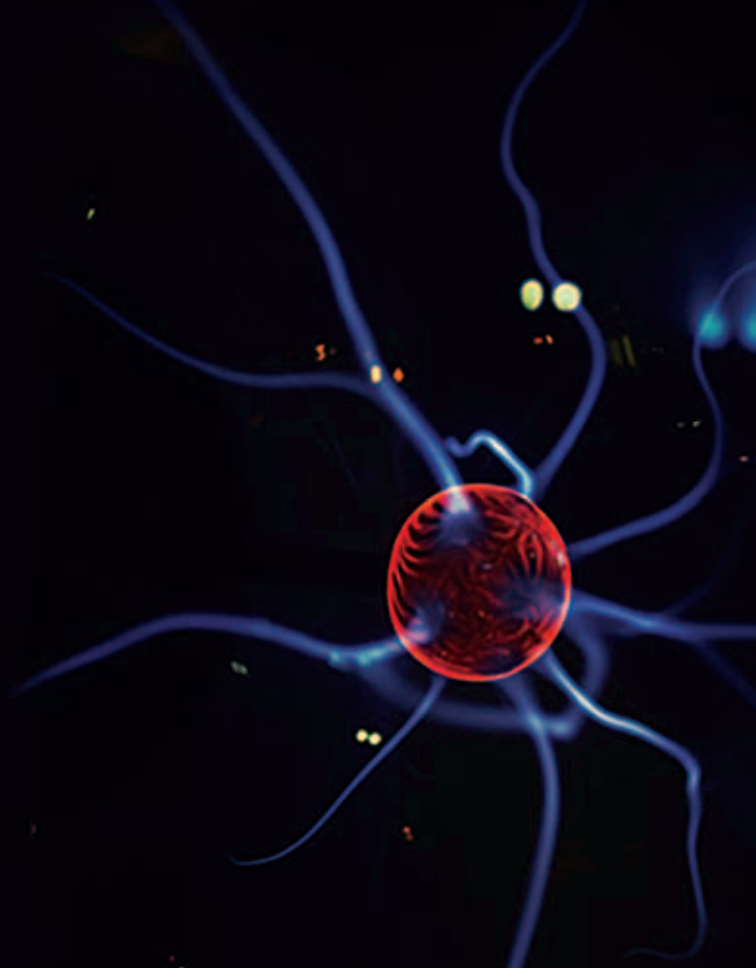


## 14 Magnetism Switch

Further work by the same group at AMBER revealed how magnetism can be suddenly switched on by adding an extra layer just one atom thick to a thin film of a specific oxide material. When thin layers of this material were grown, it was discovered that the magnetism was sensitive to the slightest change in layer thickness. Below 5 layers of these atoms, the material is non-magnetic, but magnetism is switched on abruptly when the number of layers changes from 5 to 6 (or more).

[www.ambercentre.ie](http://www.ambercentre.ie)





## 15 1848

Belfast's William Thomson, 1st Baron Kelvin develops the Kelvin scale and postulates a temperature for absolute zero of  $-273.15^{\circ}\text{C}$ .

## 16 1861

County Carlow-born physicist John Tyndall answers the age old question, "Why is the sky blue?". He also observed that moist air absorbs more heat than dry air, contributing to the understanding of the "greenhouse effect" phenomenon.



**17** 1891

George Johnstone Stoney of Birr, Co.Offaly, coins the term 'electron' to describe the "fundamental unit quantity of electricity".



**18** 1932

The atom was "split", thanks in part to the work of Waterford native and Nobel prize winner, Ernest Walton.

## 19 The Perfect Foam

In 1880 Belfast-born scientist Lord Kelvin (1824-1907) pondered some pretty deep problems. One such problem was what the lowest energy structure of a liquid foam of equal size bubbles might be. In the 1990s, scientists Denis Weaire and Robert Phelan at Trinity College Dublin came up with a structure that improved upon Kelvin's solution.

This complex Weaire-Phelan structure was the inspiration for the Water Cube aquatic centre at the Beijing Olympics. In 2011, Italian scientist Ruggero Gabbrielli, working with a team at Trinity, announced he had designed a container that could accommodate the Weaire-Phelan bubbles, and this allowed the creation of the perfect foam in the laboratory.

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





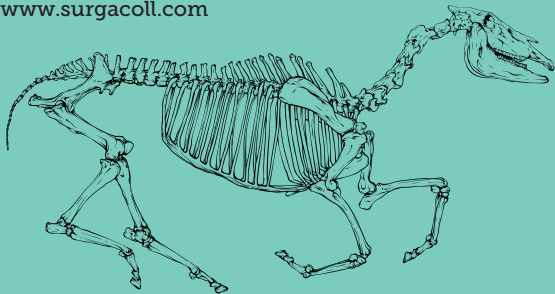


## 20 SurgaColl

is at the races

Irish racehorse Annagh Haven was given a new lease on life after ground breaking surgery removed a cyst in her jaw, replacing the bone with a new scaffold technology called HyroxyColl. This novel bone graft scaffold developed in the Royal College of Surgeons Ireland and commercialised by Irish company SurgaColl Technologies, is comprised of the two principle components of bone, collagen and hydroxyapatite, brought together in a highly porous, biodegradable and biocompatible matrix. After incorporation of HyroxyColl into the jawbone of Annagh Haven, new bone growth was promoted and normal jaw bone shape and function was restored. The filly has since returned to racing and has even seen success in a number of races.

[www.surgacoll.com](http://www.surgacoll.com)



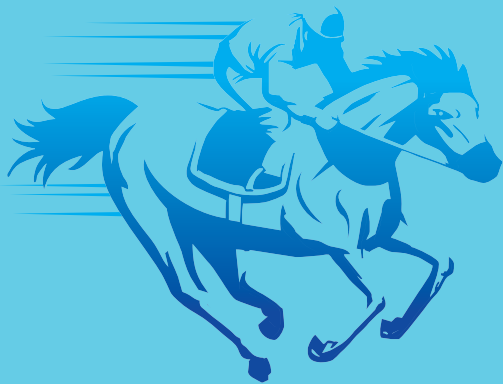
# Testing for the Speed

21

## Gene in Horses

While analysing genes in thoroughbred racehorses, Dr Emmeline Hill at University College Dublin identified important genetic information relating to racing performance. Her discovery led to the development of a 'speed gene' test to help match horses with courses and to inform breeding and training decisions. Irish company Plusvital Ltd (inc. Equinome Ltd) now uses the test to provide services to the global bloodstock industry.

[www.equinome.com](http://www.equinome.com)



## 22 CONNECT

Ireland is home to a new testbed initiative called “Pervasive Nation”, an island-wide infrastructure dedicated to Internet of Things. The Science Foundation Ireland funded CONNECT Centre for Future Networks and Communications led by Prof Linda Doyle is championing Pervasive Nation which will span urban, suburban and rural Ireland, supporting research and commercial Internet of Things activities and will be the first of its kind anywhere in the world.

[www.connectcentre.ie](http://www.connectcentre.ie)

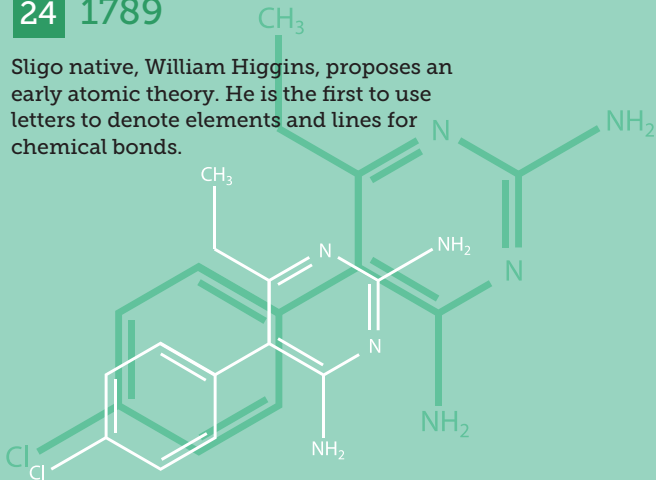


Prof Dermot Diamond from Dublin City University along with the Environmental Protection Agency and researchers from the Insight Centre for Data Analytics have developed in-situ sensors for measuring water quality, in particular nitrates and phosphates. These pollutants trigger the growth of algal blooms which results in oxygen depletion from the water resulting in fish kills; ultimately the water becomes undrinkable. The team has been collaborating closely with TE Laboratories (Tullow, Co. Carlow) through several EU projects and a targeted project with the Science Foundation Ireland Insight Centre to develop innovative technologies that will dramatically improve the quality and performance of in-situ remote sensing of pollutants in water bodies. Prototype devices developed by the joint Insight-TE Laboratories team has been selected for the final stage in a global competition organised by the US-based Alliance for Coastal Technologies to assess the best approaches to delivering robust solutions for in-situ sensing of nutrient levels.

[www.insight-centre.org](http://www.insight-centre.org)

24 1789

Sligo native, William Higgins, proposes an early atomic theory. He is the first to use letters to denote elements and lines for chemical bonds.



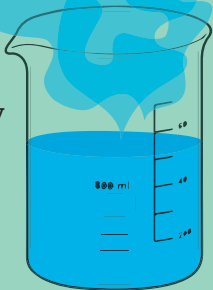
25 1662

It is said that Waterford born Robert Boyle was the "Father of Modern Chemistry", he went on to establish Boyle's Law, a law that relates the pressure and volume of an ideal gas.

$$P_1 V_1 = P_2 V_2$$

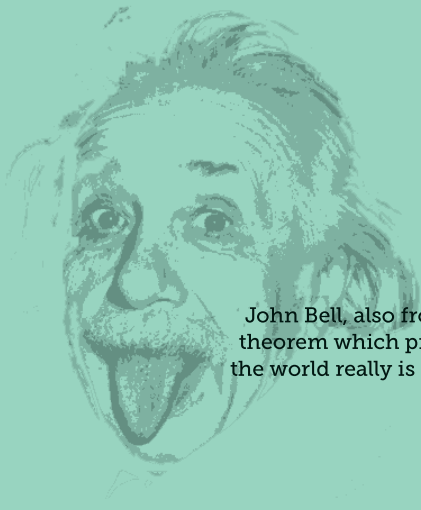
26 1869

Thomas Andrews, at Queen's University Belfast, is the first to make liquid gas, now vital in refrigeration, medicine and industry.



27 1964

John Bell, also from Belfast, publishes a theorem which proves Einstein wrong - the world really is quantum and 'spooky'.



## 28 Happy Gut Bugs

Your gut is naturally home to trillions of bacteria, and their effects could be far reaching: they may even have an impact on mood. Researchers at the Science Foundation Ireland, APC Microbiome Institute in University College Cork discovered that if mice lacked gut bacteria in early life, they had altered levels in adulthood of a chemical called serotonin in the brain. Serotonin is thought to be involved in regulating mood. Moreover, these mice also displayed autistic-like behavioural traits. Separately, the researchers also found that feeding mice with a specific strains of probiotic gut bacteria (so called psychobiotics) meant the animals displayed less anxious behaviour.





## bacteria?

Gut bacteria can also have an effect on stress levels. A small study of healthy men taking the probiotic, *Bifidobacterium longum* 1714 or a placebo control over a 4 week period showed a reduction in the stress hormone cortisol and reduced anxiety.

[apc.ucc.ie](http://apc.ucc.ie)



## 30 Software to Make

### Sense of DNA

Irish scientist Prof Des Higgins wrote one of the most-widely used pieces of computer software in bioinformatics. In the 1980s, he developed CLUSTAL, a programme to align DNA and protein sequences, and this became a standard tool in the field around the world, allowing researchers to draw meaningful information out of genomic data. The latest web-based version of this programme is being used over a half a million times a month.

Academic papers explaining the software tool were widely referenced by other researchers. As a result, Prof Higgins has held rankings among the most cited authors in computer science, although interestingly, he is a biologist. Today, Prof Higgins continues to develop and use bioinformatics software to analyse biological data at University College Dublin, and help find new molecules of interest for diagnosing and treating cancer.

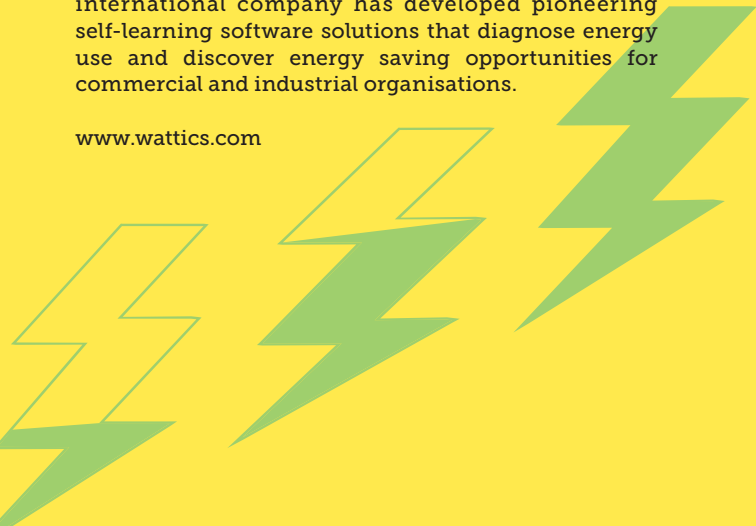
[www.ucd.ie](http://www.ucd.ie)



## 31 Wattics

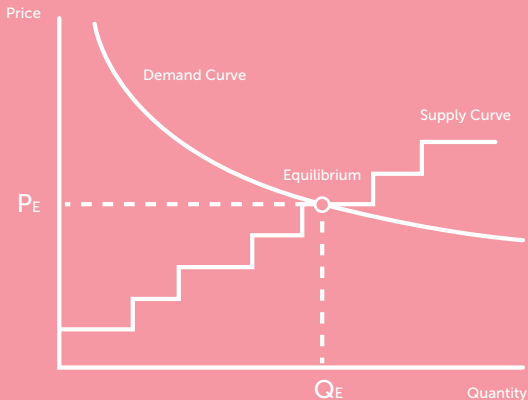
Energy conservation and awareness has become an important part of modern day business with huge emphasis being put on lowering emissions and reducing energy consumption. In light of this ever increasing trend it is not surprising that University College Dublin spinout Wattics, has received accolades such as being named Best Emerging Company in the Isle of Ireland. This now leading international company has developed pioneering self-learning software solutions that diagnose energy use and discover energy saving opportunities for commercial and industrial organisations.

[www.wattics.com](http://www.wattics.com)



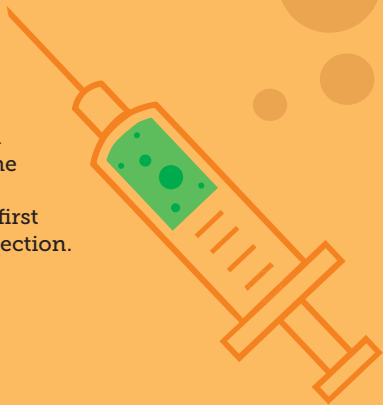
With new global targets set for a reduction in energy emissions by 2030, the Sustainable Energy Research Group in University College Cork has teamed up with academic partners in University College Dublin and Teagasc to further develop modelling of Ireland's energy use and need. Using The Integrated Markal-Efom System (TIMES) of modelling, Ireland can align our results with over 100 institutions across 50 countries.

[www.ucc.ie/en/serg/](http://www.ucc.ie/en/serg/)



33 1844

Francis Rynd invented the hollow needle of the hypodermic syringe, delivering the world's first ever pain-relieving injection.



34 1857

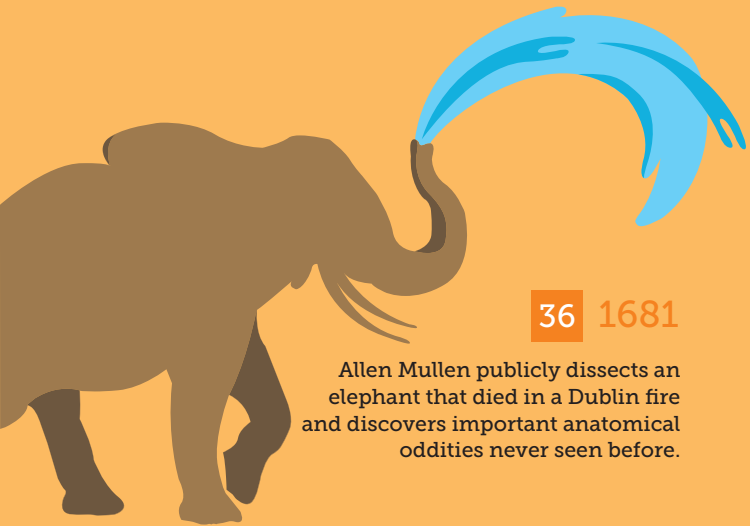
Offaly born John Joly gave us the photometer, meldometer, a differential steam calorimeter, colour printing on glass, an explanation for sap rising in tall trees and most significantly the first effective radiotherapy for treating cancer, the 'Dublin Method'.





35 1916

Born in County Down, Frank Partridge introduced the modern version of CPR and developed the first portable defibrillator.



36 1681

Allen Mullen publicly dissects an elephant that died in a Dublin fire and discovers important anatomical oddities never seen before.

## 37 Finally, a battery

### with staying power

Fantastic news for mobile phone users across the globe! Dr. Ryan and his research team in the Materials and Surface Science Institute (MSSI) at the University of Limerick (UL) have developed a technology that more than doubles the capacity of lithium-ion battery anodes and retains this high capacity even after being charged and discharged over a thousand times. The team used germanium, an alternative element to carbon but with a higher capacity, to restructure nanowires into a stable porous material using nanotechnology. The new germanium nanowire-based anode has the ability to greatly increase the capacity and lifetime of lithium-ion batteries.

<http://www.ulsites.ul.ie/mssi/materials-surface-science-institute>







Secondary School students, Ciara Judge, Émer Hickey and Sophie Healy-Thow joined the elite group of BT Young Scientist Exhibition winners with their project on diazotroph bacteria as a cereal crop germination and growth aid. The trio went on the claim first prize at the European Union Contest for Young Scientists (EUCYS) and international acclaim at Google Science Fair. Our Scifest winners are also flying the flag for Irish science having gone on to win awards at the Intel International Science and Engineering Fair and the International Environment and Sustainability Project Olympiad.

[www.btyoungscientist.com](http://www.btyoungscientist.com)

[www.scifest.ie](http://www.scifest.ie)

Championing youth involvement in technology is Clare McInerney, the Education and Outreach Manager in Lero, the Science Foundation Ireland funded, Software Research Centre. Backed by a team of world class researchers focusing on Evolving Critical Systems, Claire and the team at Lero hosted summer camps for 40 female students from local secondary schools. The camps granted students the opportunity to learn about problem solving and computational thinking using various tools and technologies. Her work was recognised internationally by the Google RISE award. Lero was commissioned by the National Council for Curriculum and Assessment (NCCA) to develop the first official 100-hour Junior Cycle Short Course in Coding. Lero is also actively involved in a pilot CPD (continuing professional development) initiative training teachers to deliver this course.

[www.lero.ie](http://www.lero.ie)



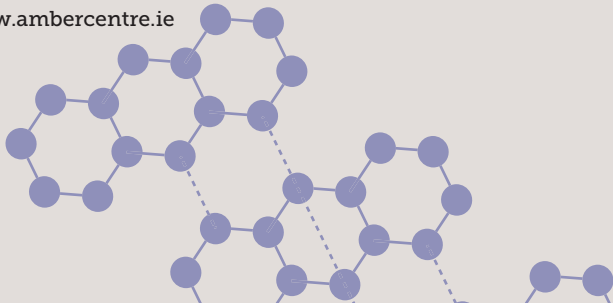
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## 40 Layers for Better

### Plastics and Computers

Smaller, faster computers, more efficient batteries and greener plastics could be on the way if we can use tiny flakes or nanolayers of certain materials. Prof Jonathan Coleman and his team at the Science Foundation Ireland funded AMBER centre in Trinity College Dublin, have developed a method to split these materials into billions of such layers. One example is graphene, atom-thick sheets of carbon with immense strength and the ability to conduct electricity. Prof Coleman figured out how to use a soapy solution to turn cheap lumps of graphite into billions of precious graphene layers. These flakes could be added to plastics to make them stronger while keeping them light. However, they have many other applications in areas such as electronics and sensing and energy storage.

[www.ambercentre.ie](http://www.ambercentre.ie)



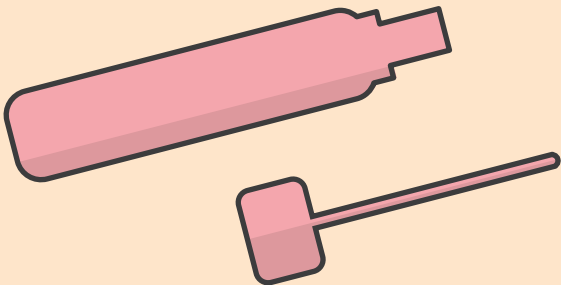


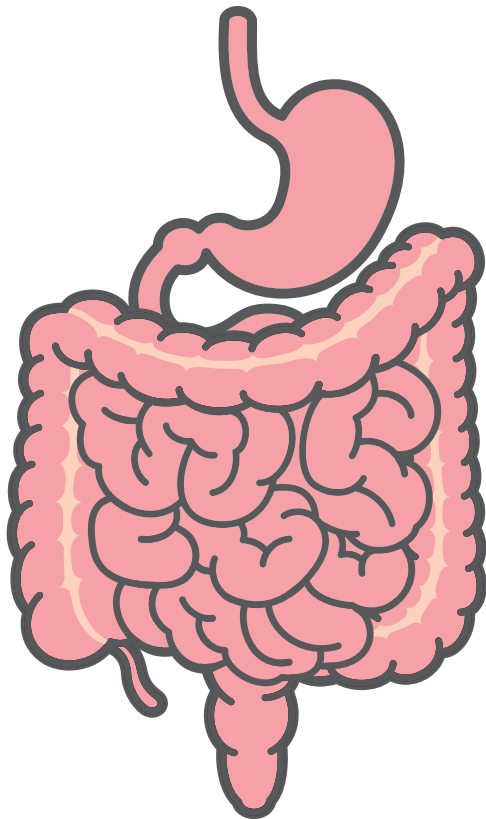
## 41 Bowel Cancer Screen

Each year 1,000 Irish people die from bowel cancer and 2,500 are diagnosed with the disease making it the second most common type of cancer in Ireland. Unfortunately the screening test for bowel cancer, the 'Faecal Occult Blood Test', which tests for blood in the patients stool is not very sensitive, often missing early stages of the disease.

A team from the Biomedical Diagnostics Institute at Dublin City University has been working with Irish biotech firm Randox to develop a €25 bowel cancer screen that detects antibodies produced in response to cancer onset and aims to do away with the outdated, expensive, and inaccurate FOBT test.

[www.bdi.ie](http://www.bdi.ie)





42 1898

Annie Maunder born in County Tyrone extensively studied sunspots and coronal masses, having famously photographed the longest coronal extension at that time, reaching 10km into space.



43 1889

Dublin-born physicist George Francis Fitzgerald laid the foundations for Einstein's special theory of relativity. The Fitzgerald crater on the far side of the Moon is named after him.



$$x^3 + 2x^2 = x^2(x+2)$$

#### 44 1843

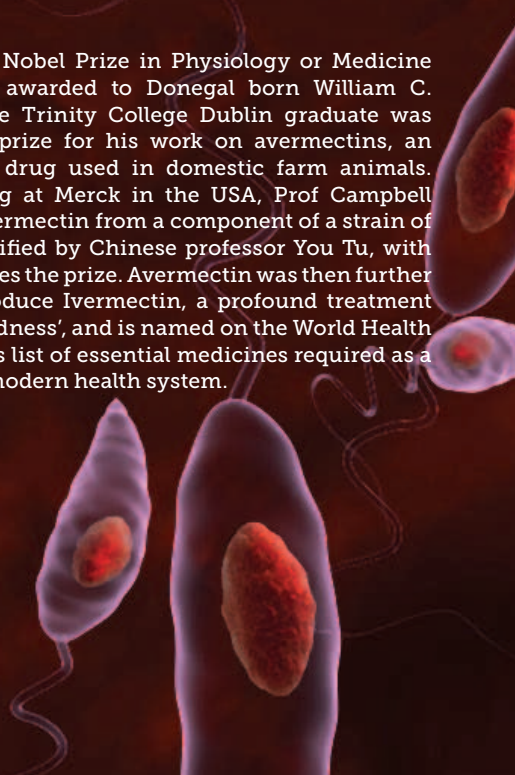
Dublin native, Sir William Rowan Hamilton's 'quaternions', herald the birth of modern algebra and are also used in space flight navigation equations.

#### 45 1848

Also born in Dublin, Margaret Lindsay Huggins along with her husband William Huggins were the first to apply the dry gelatine photographic plate to astronomical spectroscopy, an important tool in modern observation astronomy.

## 46 William C. Campbell

2015 saw the Nobel Prize in Physiology or Medicine being jointly awarded to Donegal born William C. Campbell. The Trinity College Dublin graduate was awarded the prize for his work on avermectins, an anti-parasitic drug used in domestic farm animals. While working at Merck in the USA, Prof Campbell developed Avermectin from a component of a strain of bacteria identified by Chinese professor You Tu, with whom he shares the prize. Avermectin was then further refined to produce Ivermectin, a profound treatment for 'River Blindness', and is named on the World Health Organisation's list of essential medicines required as a staple of the modern health system.



# Mutebutton

47

(neuromod)

Researchers at the National University of Ireland Maynooth have developed a technology that aims to alleviate the symptoms of tinnitus, a condition where the person 'hears' noises such as ringing or hissing even though there is no external source of the sound. The device, called MuteButton, simultaneously stimulates the sense of hearing and touch by playing sounds to the ear and stimulating touch using sensors on the tongue. The approach targets centres in the spinal cord and brain that integrate sound and touch, with the aim of suppressing the perceived but imaginary sounds of tinnitus.

[www.mutebutton.ie](http://www.mutebutton.ie)

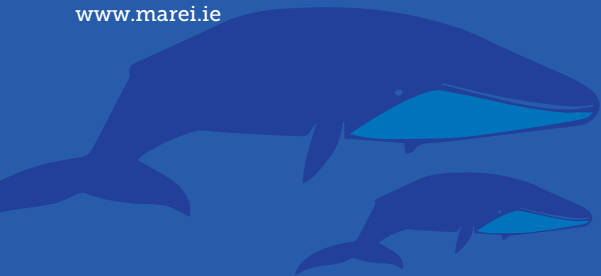


## 48 Protecting Ireland's

### Marine Wildlife

A major data collation exercise is underway in the Science Foundation funded MaREI Centre for Marine and Renewable Energy, involving Dr Mark Jessopp in collaboration with Kosmos Energy and others. The three year DCENR ObSERVE programme will take all existing marine datasets, and identify data gaps specific to protected seabirds and cetaceans (whales and dolphins) in Irish territorial waters. The aim is to improve our knowledge of seabird and mammal occurrence, habitat and population ecology in the seas, ocean and continental trenches off Ireland. Given that Irish waters are 10 times larger than its land mass, filling in the gaps has proved challenging, necessitating the use of specialist aircraft and sophisticated ship based surveys.

[www.marei.ie](http://www.marei.ie)

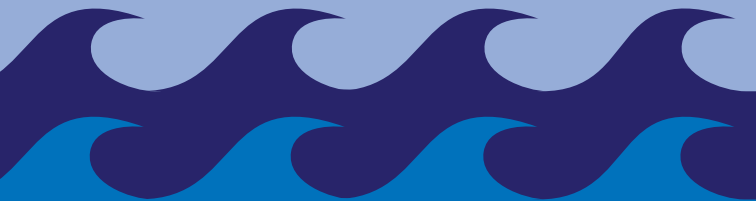




## 49 The Indoor Ocean

Lir National Ocean Test Facility is a world class test facility within the Science Foundation funded MaREI Centre at University College Cork, with state of the art wave tanks and electrical rigs that allow for scaled testing of ocean energy and marine systems in a controlled environment. The facility can simulate a multitude of wave and current conditions, allowing for accurate testing of the operational performance and durability of aquatic devices destined for the Atlantic Ocean.

[www.marei.ie](http://www.marei.ie)



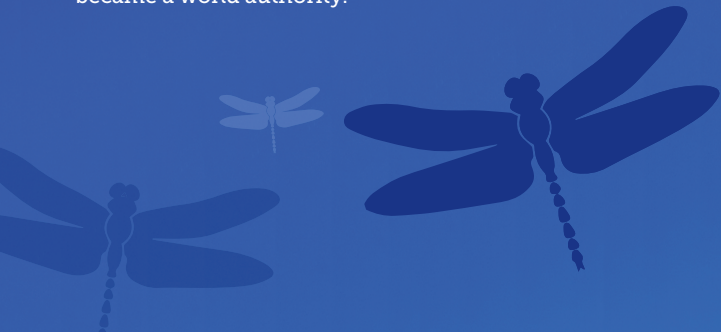


50 1785

Ellen Hutchins, born in County Cork, was Ireland's first female botanist, whose name is still carried by many of the plants she studied.

51 1896-1991

County Cork-born Cynthia Evelyn Longfield, became known as 'Madame Dragonfly' due to her extensive study of the insects, in which she became a world authority.





## 52 1896-1993

Maude Jane Delap, from County Donegal was the first person to breed jellyfish in captivity, allowing her to observe their complete life cycle.

## 53 1896-1992

Matilda Cullen Knowles, from County Dublin was renowned for her study of Irish lichens and shared curatorship of the National Museum of Ireland herbarium.



## 54 Healthy weight,

## healthy immune system

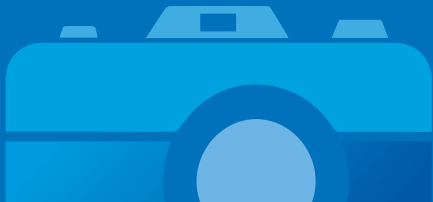
Obesity is a worldwide epidemic. Ireland is predicted by the World Health Organization to become the fattest country in Europe by 2030. The current strategy for weight loss is simplified to, fewer calories in, more calories out. The Obesity Immunology Research Group in University College Dublin however, is investigating the role the immune system may play in controlling body weight, with the latest research indicating that the immune system could actually be “protecting” us against weight loss. The team have found that in the absence of certain parts of the immune system we gain weight and even with new weight loss therapies, we fail to lose weight until the immune system is restored.

[www.stvincents.ie/E.R.C/Obesity\\_and\\_Endocrinology\\_Group.html](http://www.stvincents.ie/E.R.C/Obesity_and_Endocrinology_Group.html)



Dr Cathal Gurrin has been lifelogging for longer than anyone else in the world. He has taken a photograph of events in front of him every 20 seconds for a decade. These images are analysed by a team of data researchers at the Science Foundation Ireland funded Insight Centre for Data Analytics at Dublin City University and are providing critical insights into a range of areas including memory, image processing, machine learning and behavioural science. The work has both societal and commercial potential. Dr Gurrin and his team have created analysis tools with implications for the development of therapies and supports for dementia patients. Their work also holds promise for the progress of artificial intelligence, as well as teaching devices to recognise and categorise objects and faces more accurately.

[www.insight-centre.org](http://www.insight-centre.org)



## 56 Brain Freeze



Prof Mike McCork and Dr Sorcha Knowles are the stars of the very popular RTE and CBBC children's television show *Brain Freeze*, they are also puppets. Along with the channel boss Mrs Hucklebuck and the floor manager Colin they bring science to the nation through their fact-filled TV show, even scooping up first prize at the Kid's Choice Award for Best Animated Series. *Brain Freeze* is funded under the Science Foundation Ireland Discover Programme.



## 57 Shedding Light

### on Research

The science of light is a focal point for Science Foundation Ireland funded IPIC, the Irish Photonic Integration Centre. Photonics involves the generation, manipulation and utilisation of light, with implications in medical devices, bio-imaging, bio-diagnostics, digital networks and communications industries. Collaborating with some of the top multinational technology companies, SMEs and start-ups, IPIC is positioning itself as a world leader in photonics research.

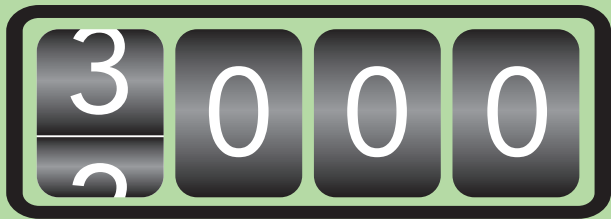
[www.ipic.ie](http://www.ipic.ie)



# Ranked Highly

58

Over the past decade, Science Foundation Ireland has built a community of approximately 3,000 researchers in Ireland. Through this investment, Ireland has speedily ascended the international rankings of scientific research capability, from 36th place in 2003 to a consolidated position inside the top 20 in recent times. Particular strengths have emerged with Irish research ranked highly in various fields for scientific citations: 2nd in the world for nanotechnology, 3rd in the world for immunology, materials science and animal and dairy (Thomson Reuters).



## 59 1788 - 1871

Londonderry's James Murray finds a way to make minerals soluble, producing the first artificial fertilisers and inventing 'Milk of Magnesia'.



## 60 1884-1960

Harry Ferguson began his career as a mechanic and raced motorcycles but became fascinated by aviation, becoming the first Irishman to fly. He also solved the weak link between tractors and ploughs by inventing a single powerful vehicle.





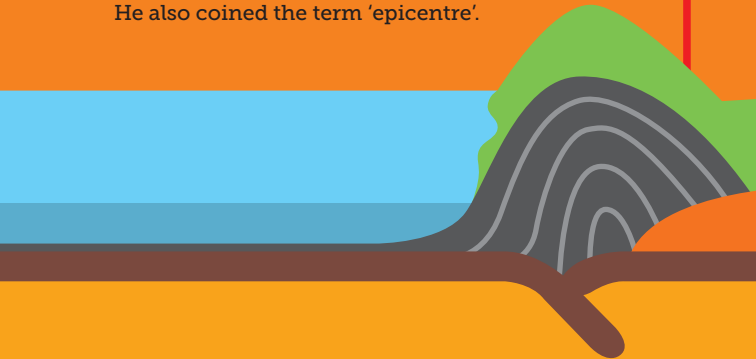
## 61 1774-1857

Navan born Francis Beaufort designed the Beaufort Scale for indicating wind force.



## 62 1810-1881

Irish scientist and engineer Robert Mallet was a pioneer of modern seismology, studying the buckling of the earth's crust. He also coined the term 'epicentre'.



## 63 Genetics hits the

### Bulls-Eye for Cattle Breeding

Back in 2009 Ireland became only the second country in the world to incorporate DNA information directly into dairy cow breeding to increase yield. Scientists led by Dr Donagh Berry at Teagasc in Cork, have since shown that by analysing the genome of dairy cows before breeding, genetic gain has increased by over 50%. These increases are also predicted to apply to milk, meat and wool production helping to increase sustainability without increasing herd size.

[www.teagasc.ie](http://www.teagasc.ie)



# The Prehistoric Cow

64

Back up the road at University College Dublin, scientists from the School of Agriculture and Food Science are also studying cattle genomes, only their focus is on ancient Irish and British livestock. Prof David MacHugh and a cohort of national and international collaborators have determined that thousands of years ago, a now-extinct species of giant wild cattle, the aurochs, crossbred with the ancestors of modern cattle in Britain and Ireland. Studying the genomes of the aurochs and the descendants of these great beasts will have a profound impact on breeding programmes in dairy and beef cattle.

[www.ucd.ie](http://www.ucd.ie)

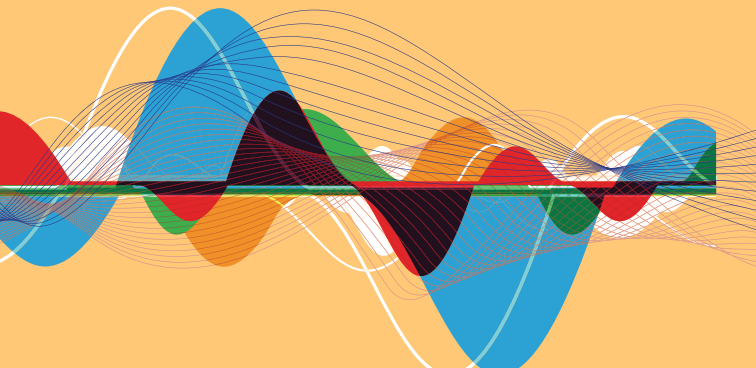


## 65 Good (Stereo)

### Vibrations

Good Vibrations by the Beach Boys is one of the classics of pop. The 1966 track has given a new lease of life by Dublin Institute of Technology researcher Dr Derry Fitzgerald. He developed software that could model individual instruments and vocals on the original mono recording so that they could be split out and remixed. The result is the first stereo version of Good Vibrations, which was included in a recent re-issue of Beach Boys albums. The technology has potential applications in music education, where a user could enhance or remove instruments from a recording in order to learn a piece.

[www.dit.ie](http://www.dit.ie)



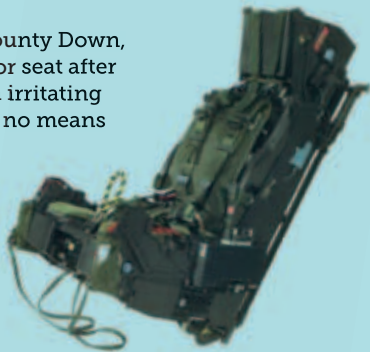
Researchers at the Science Foundation Ireland funded Microbiome Institute in University College Cork and Teagasc Moorepark have found a new antimicrobial agent, Thuricin CD, that can kill the antibiotic-resistant bacterium *Clostridium difficile*, which poses a major problem in clinical and healthcare settings. The new antibiotic may also reduce the risk of disease recurrence, compared with that of broad-spectrum antibiotic treatment, because it spares the normal gut bacteria that help to limit *C. difficile* growth. Thuricin CD was discovered by screening over 30,000 bacteria isolated from the human gut and the technology has been licenced to a recently formed spin-out company, Artugen Therapeutics.

[apc.ucc.ie](http://apc.ucc.ie)



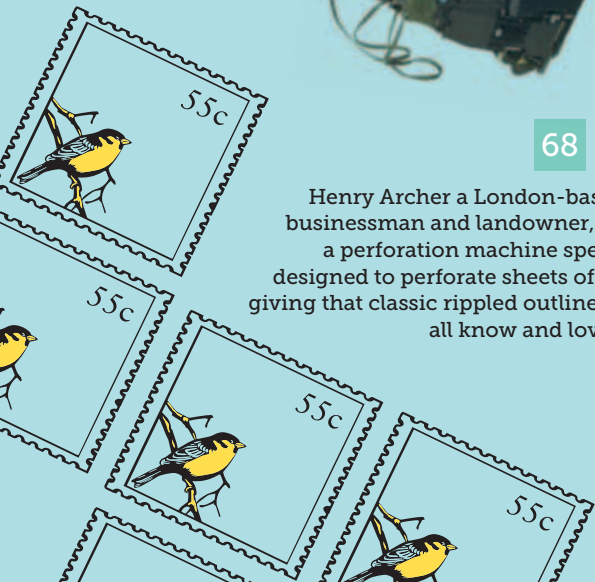
## 67 1893 - 1981

Sir James Martin, of County Down, invented the first ejector seat after being seated next to an irritating person on a flight with no means of escape.



## 68 1847

Henry Archer a London-based Irish businessman and landowner, devised a perforation machine specifically designed to perforate sheets of stamps, giving that classic rippled outline that we all know and love today.

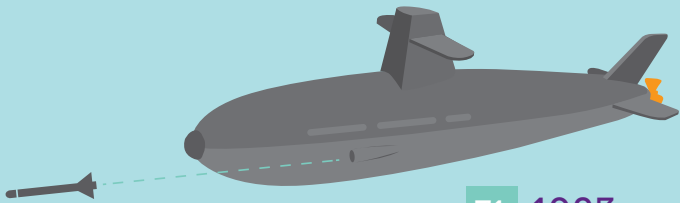


69 1889

Scottish born John Boyd Dunlop relocated to Belfast to work as a vet. When his son complained of discomfort from the solid tyre on his bike, Dunlop designed him an air filled tyre. It was so successful that within a year he went into business with an entrepreneur, Havrey du Cros and opened the first Dunlop factory in Dublin.

70 1897

Clare native John Philip Holland was an engineer who designed the first submarine to be commissioned by the US Navy, as well as the first Royal Navy submarine.



71 1903

Louis Brennan, originally of Castlebar, Co Mayo trained as a watchmaker but later patented the first steerable torpedo, which was trialled in Cork Harbour. He also invented a type of monorail.

## 72 A Virtual Sawmill

Imagine you could plan to fell a forest without leaving your chair? Technology developed by Irish company Treemetrics and by Science Foundation Ireland researchers at University College Cork lets users non-invasively measure and virtually optimise the management of forest resources. The laser technology physically measures trees in a forest then converts and represents the data in a way that allows better use of forest resources and less wastage. The company, which now offers measurement and 'virtual sawmill' technology to analyse forest resources quickly and accurately, is working with partners and clients around the world.

[www.treemetrics.com](http://www.treemetrics.com)



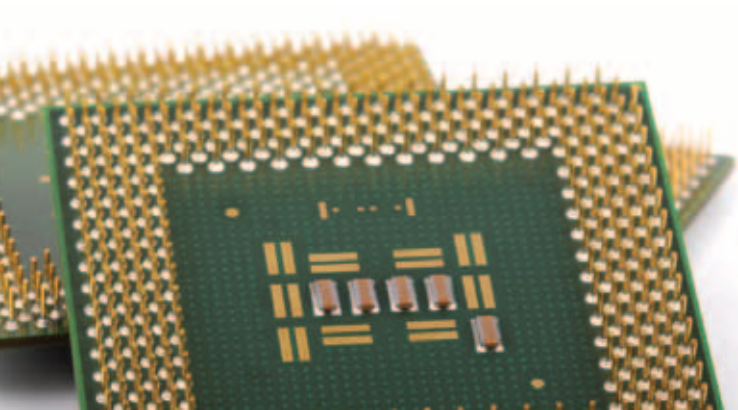




## 73 The Intel Quark 1000

In 2013 Intel announced the release of the Intel® Quark™ SoC X1000, a new product designed at Intel in Leixlip, County Kildare. A few weeks later the chip, designed for its low energy consumption and small size, was incorporated into Intel's Galileo development board. Galileo is a low cost platform ideally suited to academics, inventors and hobbyists looking to explore Internet of Things applications.

[www.intel.ie](http://www.intel.ie)



# Pulling on your

## heart strings

74

The chordae tendineae or 'heart strings' are fibrous strings that attach to the flap-like openings between the upper and lower chambers of the heart. They stop these flaps from buckling as the blood flow changes pressure inside the respective chambers. Prof Bruce Murphy and team at the Science Foundation Ireland funded AMBER Centre in Trinity College have measured the fatigue strength of the chords in an effort to design predictive models of their life span, particularly in relation to diseases of the heart.

[www.ambercentre.ie](http://www.ambercentre.ie)



## Seizures in Babies

Researchers in the Science Foundation Ireland funded INFANT Centre are helping to improve health outcomes for newborns. Seizures or 'fits' are the most common neurological emergency encountered in the neonatal intensive care unit (NICU). Seizures can be caused by problems such as lack of oxygen around the time of birth, haemorrhage and meningitis, if left untreated, seizures can cause major problems for the babies.



But here's the problem: seizures can be very difficult to detect in newborns as there may be no obvious outward signs that the baby is experiencing one and this makes intervention and treatment very difficult. The only accurate tool for diagnosis is EEG monitoring, a measure of electrical brain activity, but newborn EEG interpretation is a highly specialised skill and few experts are available. Prof Geraldine Boylan, co-director of the centre, has been carrying out research with collaborators into automating EEG interpretation so that seizures can be detected reliably by non-specialists in the NICU.

[www.infantcentre.ie](http://www.infantcentre.ie)



## 76 COMBINE

Childcare doesn't stop there! The Science Foundation Ireland Research Centres INFANT and APC are also pioneering the Cork Nutrition and MicroBiome Maternal-Infant Cohort study (COMBINE). The study will monitor the nutrition and development of infants over the first 24 months of life. The study will allow scientists to determine the effects of diet on early growth, development and body composition, with an eye towards monitoring early obesity and neurological health outcomes. They are also focused on the gut microbiome and the affect of antibiotic use in early life.

[apc.ucc.ie](http://apc.ucc.ie)



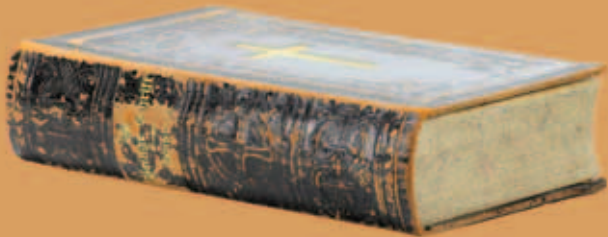


**77** 1899

Cork native, Humphrey O'Sullivan is responsible for rubber-soled shoes, designed to aid his sore feet from standing at a printing press all day at work.

**78** 560AD

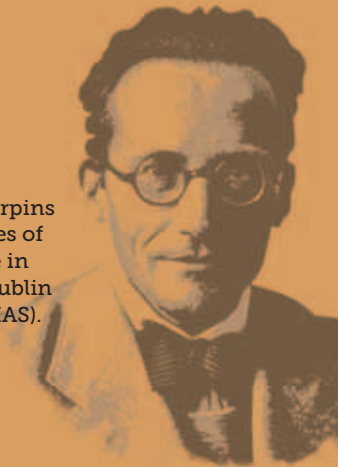
In a dispute over who rightfully owned the copy of a book of psalms, King Diarmait Mac Cerbhaill, king of Tara, gives the first legal ruling on copyright: 'To every cow her calf, to every book its copy'.





**79** 1943

Erwin Schrödinger looked at the physics and chemistry that underpins living organisms based on a series of public lectures Schrödinger gave in 1943 under the auspices of the Dublin Institute of Advanced Studies (DIAS).



**80** 1891

Tattoo artist and Irish-American immigrant, Samuel O'Reilly patented the first rotary tattoo machine for his parlour in Chinatown.



*Tattoo*

## 81 Flying High

Ireland has been a member of European Space Agency since ESA's foundation in 1975. Today, more than 40 Irish companies are working with ESA on a range of projects with benefits for both space exploration and life on terra firma. They include TechWorks Marine, which uses realtime ocean sensors and satellite data to assess marine and coastal pollution, Radisens Diagnostics, which is developing rapid and convenient blood-testing technologies for use in space and on Earth and ÉireComposites, which is improving materials technology to build more fuel-efficient rocket launchers and civilian aircraft.



# Irish rugby team show 82

## you really are what you eat

In a world first report linking exercise to gut microbiome diversity scientists at the Science Foundation Ireland funded APC Microbiome Institute at University College Cork have studied the gut profile of 30 elite athletes from the Irish rugby football team. The study revealed a connection between exercise and protein consumption to the diversity of microbial colonies in their guts, an important revelation as gut diversity is known to be associated with superior health and a reduction in several diseases and syndromes, including obesity.

[apc.ucc.ie](http://apc.ucc.ie)



## 83 Drones

Dr Tim McCarthy and his research team at the National Centre for Geocomputation have their drones in everyone's pies, working on 4D fencing for no-fly zones with national start-up company Verifly, precision agriculture with Teagasc, marine and off-shore monitoring with Science Foundation Ireland Research Centre iCRAG, and emergency response with the European Space Agency. The sky appears to be the limit for drone technology.

[www.nuim.ie](http://www.nuim.ie)



Dr. Emma Teeling is looking at the genetics of bats. Why? Because therein could lie clues about how genes play important roles in health. At University College Dublin her work compares genomes of bats and various other animal species to tease out how nature has addressed particular problems. The findings could help us better understand conditions such as inherited deafness, as well as more general topics such as ageing and the immune response. Dr. Teeling's work also feeds into a wider international project that is using "phylogenetics" to examine evolution, and the analysis is uncovering new information about how mammals diversified when dinosaurs became extinct.

[www.ucd.ie](http://www.ucd.ie)

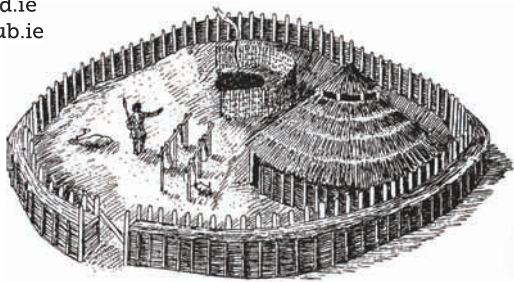


# 85 Who we are and

## where we came from...

Genetic inheritance is not just relevant in bats though, just ask the team of geneticists from Trinity College Dublin and archaeologists from Queen's University Belfast who have sequenced the first genomes from ancient Irish humans. The remains uncovered in 2 settlements near Belfast are dated at 5,200 and 4,000 years old, placing them in the Neolithic and Bronze Ages respectively. The information buried within the genomes has provided answers to pivotal questions about the origins of Ireland's people and their culture, including the prevalence of the condition haemochromatosis, often known as a "Celtic Disease" due to the frequency of the associated genetic mutation in the Irish population.

[www.tcd.ie](http://www.tcd.ie)  
[www.qub.ie](http://www.qub.ie)



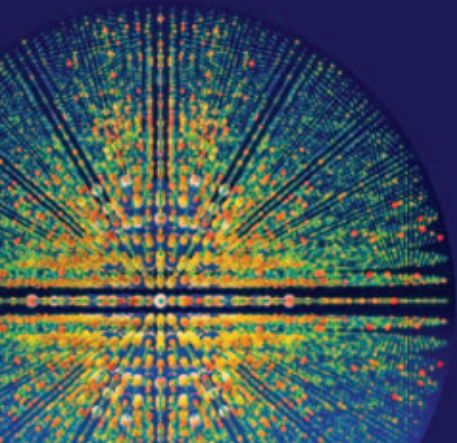


86 1929

Kathleen Lonsdale from Kildare was the first to show that the benzene ring was flat.

87 1901-1971

Tipperary born, John Desmond Bernal, known as the Sage because of his extensive knowledge, was considered an expert in X-ray crystallography.





88 1945

Irishman, Joseph 'Spud' Murphy, the man behind Tayto, came up with the modern day flavourings on crisps, it all began with cheese & onion, barbecue and salt & vinegar.



89 1680

Hans Sloane, born in County Down, brought milk chocolate to the UK after discovering on a trip to Jamaica that mixing chocolate with milk made the bitter cocoa more palatable.



In July 2014, the Football World Cup semi-final between Germany and Brazil generated 35.6 million tweets, a Twitter record at the time. Even the fastest speed readers couldn't keep up with that volume of information. Thankfully researchers in the Science Foundation funded ADAPT Centre for Digital Content Technology developed the 'Brazilator', a live tweet translation streaming service.





The clever system tracked any tweets with #WorldCup and #WC2014, translating them into the requested language and even providing sentiment analysis for the individual teams during matches. The technology was more recently used during the Irish referendum on marriage equality, the age of eligibility for election to the Office of the President and the 2016 Irish General Election.

[www.adaptcentre.ie](http://www.adaptcentre.ie)

# 91 Early warning system against stroke

What if you could predict a person's risk of stroke before it happened? This is the aim of HRB Clinician Scientist, Prof Peter Kelly at the Mater Misericordiae University Hospital and UCD. He and his team are studying plaque build-up in the carotid arteries of patients who have had a transient ischemic attack (TIA), a mild stroke that doesn't cause apparent damage. Using PET imaging and MRI to assess the extent of inflammation and the structure of plaque deposition, the team can build up a risk profile of imminent stroke and take preventative measures.

[www.mater.ie](http://www.mater.ie)  
[www.ucd.ie](http://www.ucd.ie)



International research continues to highlight the importance of giving young people access to role models if negative stereotypes about STEM are to be challenged, and we are to see greater participation by females and students from lower-economic backgrounds. Science Foundation Ireland's Smart Futures programme gives school students in Ireland access to over 1,500 volunteers from STEM-related industry and research centres across the country. Since 2013, over 92,000 students have had an opportunity to hear first-hand how diverse careers in science, tech and engineering are, with over 50+ partners donating approximately 5,000 hours each year to deliver free school visits.

[www.smartfutures.ie](http://www.smartfutures.ie)

SMART  
FUTURES

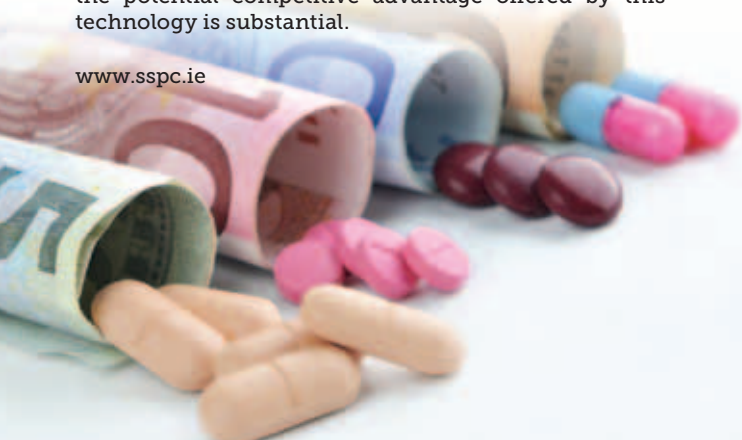


## 93 Efficient Drug

# Manufacturing

The Science Foundation Ireland funded Synthesis and Solid State Pharmaceutical Centre (SSPC) is working on a potential game-changer for the pharmaceutical industry that could see drugs manufactured by more efficient processes. To do this, the centre is focusing on overcoming the problems of continuous crystallisation. The approach could potentially save pharmaceutical companies billions of Euro in manufacturing costs. With nine of the top ten global pharmaceutical firms located in Ireland, all of which are partnered with SSPC, the potential competitive advantage offered by this technology is substantial.

[www.sspc.ie](http://www.sspc.ie)



Nine out of the top-ten medical device companies have a presence in Ireland and we are one of the largest exporters of medtech products in Europe. Based in the west of Ireland, the home of med-tech, is CÚRAM, the Science Foundation Ireland centre for research in medical devices. Their aim is to develop 'smart' medical devices with a focus on chronic illnesses such as heart disease, musculoskeletal and neurodegenerative diseases, respiratory illnesses and diabetes.

[www.curamdevices.ie](http://www.curamdevices.ie)



## 95 Oxymem

Did you ever consider how much energy goes into treating our wastewater? Well the award-winning UCD spinout company Oxymem did, and now they have revolutionised the wastewater sector by developing a cheaper more efficient way of bringing much needed oxygen to the bacteria that are used to purify water. Their membrane aerated biofilm reactor (MABR) delivers oxygen directly to the bacteria resulting in a 4 fold saving on energy costs.

[www.oxymem.com](http://www.oxymem.com)







## 96 Digging Deep

Ireland is not widely known for having extensive natural resources or a rich mining culture but in fact Ireland is Europe's largest producer of zinc and second largest producer of lead. Leading the charge in unearthing the wealth of resources in the Irish landscape are the researchers at iCRAG, the Science Foundation Ireland funded Irish Centre for Research in Applied Geosciences. Their activities range from building 3D models of the subsurface, and methods to unlock our energy and raw materials reserves, to discovering new ways to manage our groundwater, which supplies an incredible one fifth of all water used in Ireland.

[www.icrag-centre.org](http://www.icrag-centre.org)



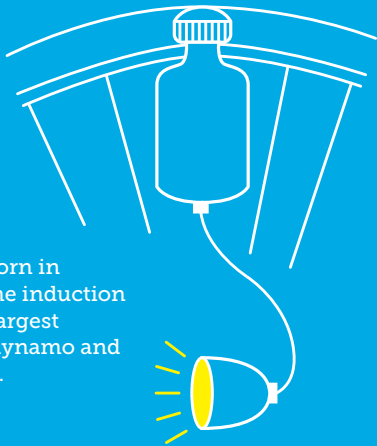


97 1854

George Boole was a professor in University College Cork who wrote 'The Laws of Thought' which contained Boolean Algebra, a form of logic that was later used to develop electronics systems that used binary instructions.

98 1799-1864

Nicholas Joseph Callan, born in County Louth, invented the induction coil as well as the worlds largest battery, the self-exciting dynamo and numerous electric motors.





99 1904

Dublin born Lucien Bull pioneered high-speed photography, capturing a fly in slow motion.



100 1930

County Down native, James Drumm invented the nickel-zinc rechargeable battery.

**#BelieveInScience**







## Acknowledgements

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# #BelieveInScience

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