EPIC The Irish Emigration Museum

QUIZZES!
PUZZLES!
GAMES!
AND MORE

HISTORY-AT-HOME

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Learn about Irish astrophysicist Jocelyn Bell Burnell

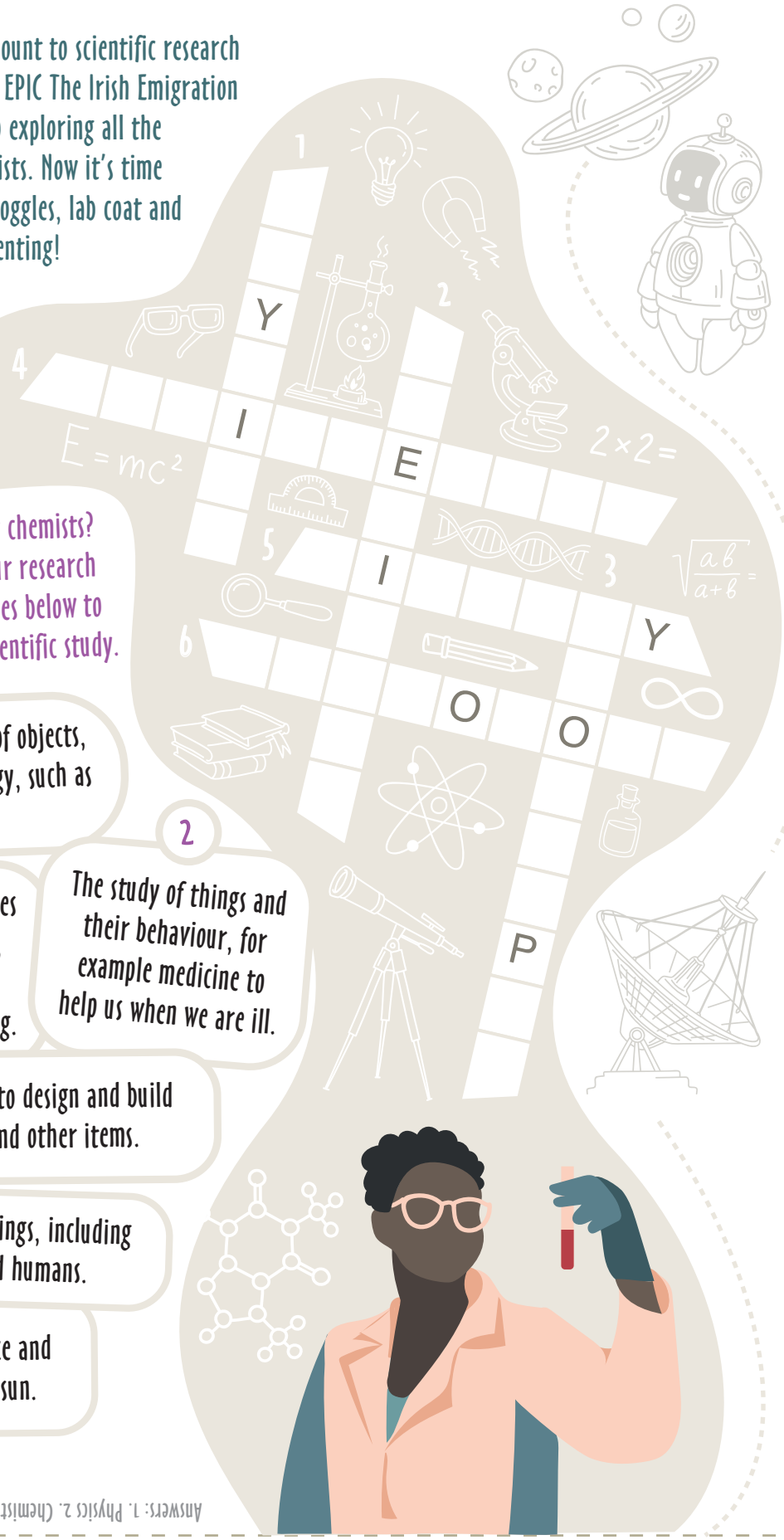
Become a Nobel Prize Winning Scientist!

A HISTORY OF... The Irish in Science

The Irish have contributed a massive amount to scientific research and discoveries all around the world. At EPIC The Irish Emigration Museum we dedicate an entire gallery to exploring all the amazing accomplishments of Irish scientists. Now it's time for you to join their ranks - grab your goggles, lab coat and notebook, for it's time to start experimenting!

SCIENCE SCRAMBLE!

Do you know your geographers from your chemists? Like any good scientist, we need to do our research first! Figure out the crossword puzzle clues below to discover a number of different fields of scientific study.



Down

1. The study of the relationship of objects, forces (like gravity), and energy, such as how things move.
2. The study of things and their behaviour, for example medicine to help us when we are ill.
3. The study of the physical features of the earth such as volcanoes, and the human activity that affects these, like global warming.

Across

4. The use of scientific ideas to design and build machines, structures and other items.
5. The study of life and living things, including plants, animals, fungi and humans.
6. The study of the stars, space and the universe, such as the sun.

Answers: 1. Physics 2. Chemistry 3. Geography 4. Engineering 5. Biology 6. Astronomy

EPIC The Irish Emigration Museum

A HISTORY OF... Irish Science

Newgrange, Co. Meath
Built 3300 BC

winter solstice
December 21-22

EARLY IRISH SCIENCE

Did you know that science has been used in Ireland since the Stone Age? Early Irish settlers used astronomy to aid them in living their lives, tracking time and the seasons through the movements of the planets and stars. We know this because there are stone carvings and monuments such as Newgrange in Ireland. Older than the Great Pyramids of Giza, Newgrange, a passage tomb in Co. Meath, was built around 3300 BCE. It was built by farmers in such a way that the sun light hits the middle of the chamber on the morning of the Winter Solstice, acting as a massive human-sized calendar!

CHRISTIAN SCIENTISTS

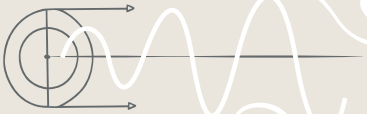
The first known Irish scientist was Augustine Hibernicus, a Christian named after the philosopher Augustine of Hippo. He wrote a book called 'On the miraculous things in Sacred Scripture' around AD 655. It documented the natural things in Ireland such as the plants and animals, while also trying to offer scientific explanations for events in the Bible. Impressively, it also suggested that Ireland had been cut off from continental Europe by marine (water) erosion – something that wouldn't become commonly accepted for centuries!

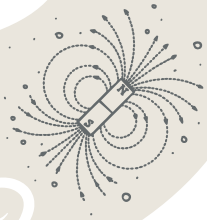
THE RENAISSANCE

Most scientific exploration in Ireland has taken place since the Renaissance, a period in the 14th – 16th centuries where fields of knowledge such as maths, science, art and intellect gained more interest and support. Since the 17th century, Irish scientists have been at the forefront of many scientific discoveries around the world. However oftentimes, Irish people had to emigrate in order to pursue a career in science. This might have been because there were limited facilities in Ireland, they came up against discrimination or challenging religious beliefs. While we can't highlight all of their accomplishments, we can take a whistle-stop tour through some of them now.

17TH CENTURY

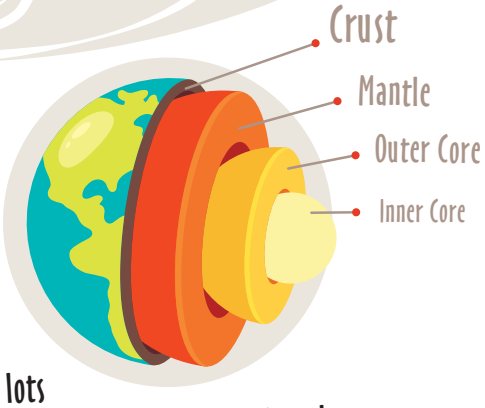
The 'Father of Chemistry' Robert Boyle – from Lismore, Co. Waterford, who settled in London, England – carried out various ground-breaking experiments, such as illustrating how air carries sound, and how the volume and pressure of a gas are related. Often compared to Da Vinci, he also came up with a list of 24 inventions he hoped to see created in his lifetime, including human flight, exact navigation technology and what would later become electricity!





18TH CENTURY

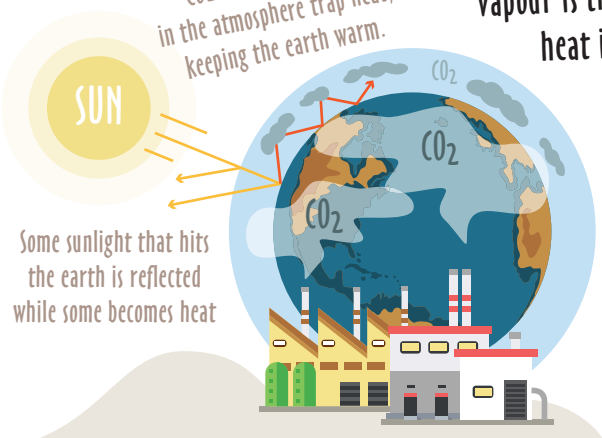
Francis Beaufort, a Royal Navy officer from Meath, invented an entirely new scale for estimating the force of wind at sea, called the Beaufort scale. This scale goes from 0 – 12 and has things to look out for such as 'Calm: sea like a mirror'. It is still in use today.

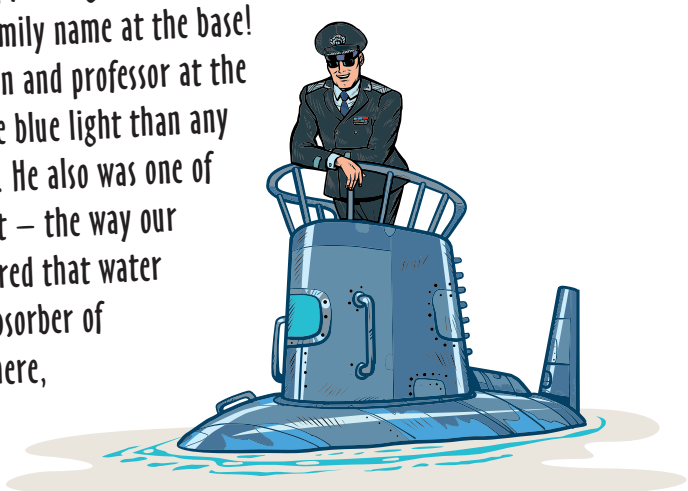


19TH CENTURY

Robert Mallet wanted to find out why the Earth's crust buckled, and in 1846 he presented a paper to Royal Irish Academy which is considered to be one of the foundations of modern seismology – the study of earthquakes. This coined lots of terms we still use today such as 'epicentre' – the point of the earth's surface directly above an earthquake. He also worked in his family's iron foundry, and built everything from lighthouses to the characteristic iron railings that surround Trinity College. See if you can spot his family name at the base!

Ever wondered why the sky is blue? John Tyndall, a Carlow man and professor at the Royal Institution in London, discovered that air scatters more blue light than any other colour from the sun and we pick this up with our eyes. He also was one of the earliest people to research the greenhouse effect – the way our earth retains heat. He discovered that water vapour is the strongest absorber of heat in the atmosphere, locking it in.





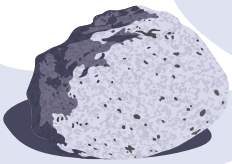
Meanwhile, John Philip Holland designed the first submarine to run successfully. Born in Liscannor, County Clare in 1841, after emigrating to the USA in 1873, he had an unfortunate accident where he slipped and fell on an icy street and broke his leg. While recovering, he started designing his submarine, which he sold to the US Navy in 1897.

20TH CENTURY

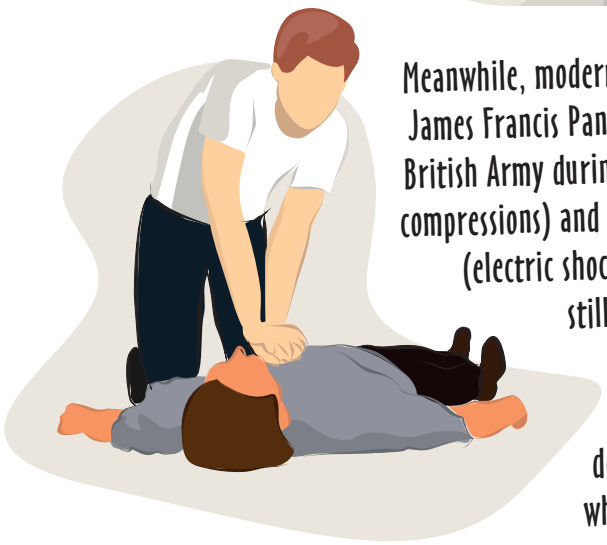
Irish people played a great hand in the milestones of space science in the 20th century. Not only was NASA astronaut Neil Armstrong, whose family can be traced back to cattle rustlers in Co. Fermanagh, commander of the Apollo 11 mission and the first man to walk on the moon in 1969; but one of the first hands to touch moon rock was Professor Denis O'Sullivan. From Dublin, he was studying space radiation at the University of California, Berkeley.

Neil Armstrong, The Moon, July 20, 1969

Prof. Denis O'Sullivan, from Dublin

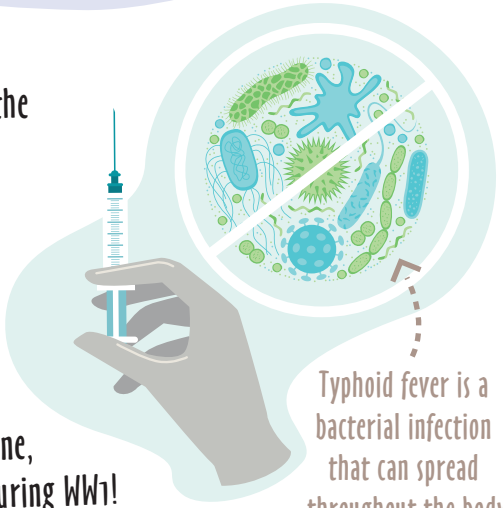


Moon rock



Meanwhile, modern medicine advanced quickly. James Francis Pantride from Co. Down served in the British Army during WWII and devised CPR (chest compressions) and the first portable defibrillator (electric shock machine) – which is how we still treat heart attacks today.

While, Sir Almroth Wright developed the first typhoid vaccine, which saved some 100,000 lives during WW1!



Typhoid fever is a bacterial infection that can spread throughout the body

Crystals

Women scientists were given more opportunities in the 20th century too, and Kathleen Lonsdale a crystallographer (someone who studies crystals) from Co Kildare made history in 1945 as one of the first two women to be elected as fellow of the Royal Society in London – a very prestigious scientific society.

While Cynthia Longfield (aka Madame Butterfly) from Cork studied insects. She travelled extensively throughout Europe, South America, the Pacific, Africa and Asia collecting specimens which later became the basis of the collections at the Natural History Museum in London – where she was resident dragonfly expert!

THE IRISH IN SCIENCE
TRIVIA QUIZ

1. The monument that early astronomers in Ireland constructed to celebrate the winter solstice.

2. The well-known religious book that the Irish philosopher Augustine tried to explain scientifically.

3. The period in the 14th – 16th centuries that made the study of science more popular.

4. The name given to scientist Robert Boyle: The Father of

5. The Beaufort scale estimates the force of wind at

6. One of the terms coined by Robert Mallet, the 'Father of Seismology'.

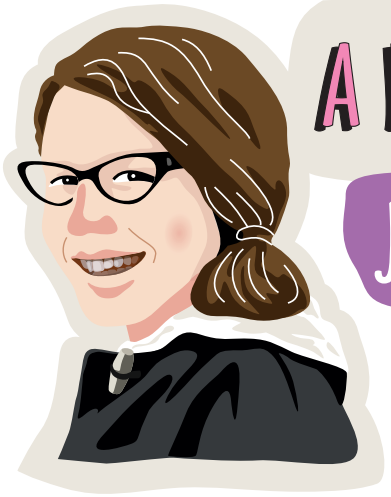
7. Neil Armstrong was the first person to walk on the

8. James Francis Pantride from Co. Down devised this three letter acronym for treating heart attacks.

9. Cynthia Longfield became better known as Madame _____, for her discovery and study of these insects.

10. The study of places and the relationships between people and their environments.

Answers: 1. Newgrange; 2. Bible; 3. Renaissance; 4. Chemistry; 5. Sea; 6. Epicentre; 7. Moon; 8. CPR; 9. Butterfly; 10. Geography.



A FOCUS ON

Jocelyn Bell Burnell

Jocelyn Bell Burnell is a famous Irish astrophysicist and astronomer who studies space phenomenon.

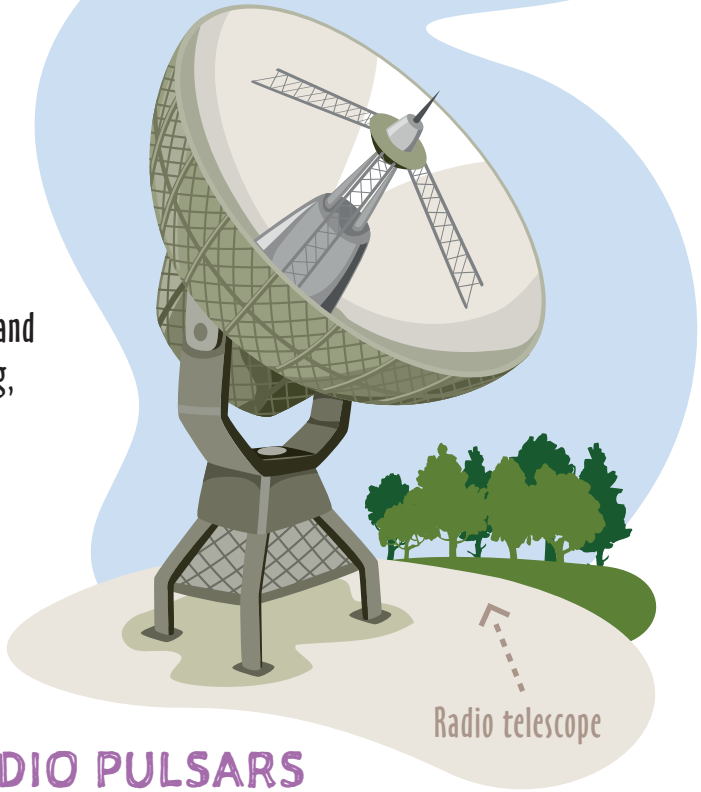
DATE OF BIRTH
15th July 1943

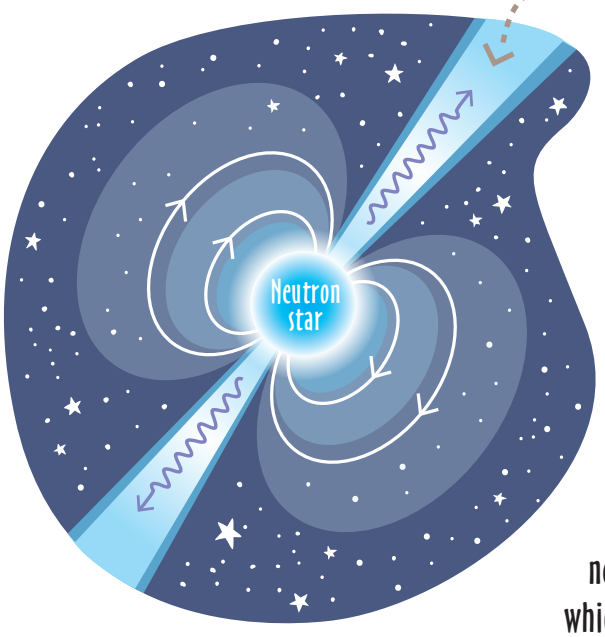
PLACE OF BIRTH
Lurgan, Northern Ireland

EPIC LOCATION
Discovering and Inventing Gallery

EARLY LIFE

Born in Lurgan, Northern Ireland, Jocelyn was always fascinated by space. Her father was an architect who helped design the Armagh Planetarium, and she spent a lot of time there as a child. Encouraged by the staff there and her family to study astronomy, she ran into difficultly at school as girls were not allowed to study science at this time, instead being encouraged to study cooking and cross-stitching. Her parents and others protested, and eventually the school relented. Excelling, she continued her education by studying science at Glasgow University and went on to complete a PhD at the University of Cambridge in astronomy. Here, she worked with others to make a radio telescope!





RADIO PULSARS

While at Cambridge she studied quasars, a newly discovered star in space made up of gas and black holes. An inventive scientist, she even flew telescopes on balloons to try to make new discoveries. One night she noticed something odd - a signal which regularly beat or pulsed across the stars, something later called 'radio pulsars'. At first she thought that this might be a kind of alien communication, so she called it LGM – or Little Green Men! However, after investigating further, it turned out that it was actually a new special kind of star, called a neutron star, that spun. This star had lights that came out of each end which made it appear to be blinking or pulsing, and emitted a very big electromagnetic charge that she had picked up.

A FOCUS ON Jocelyn Bell Burnell

The Nobel Prize is five separate prizes that, according to Alfred Nobel's will of 1895, are awarded to "those who, during the preceding year, have conferred the greatest benefit to humankind." Nobel Prizes are awarded in the fields of Physics, Chemistry, Physiology or Medicine, Literature, and Peace.

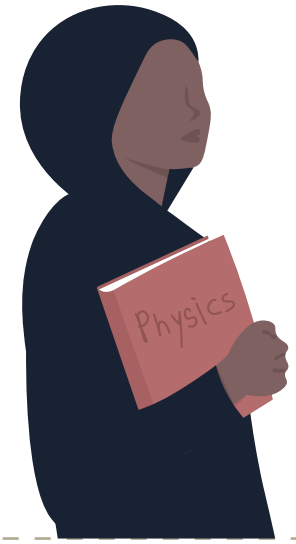
RECOGNITION

This discovery of radio pulsars was so significant that it went on to win the 1974 Nobel Prize in Physics! However, even though she was the first to observe the pulsars, Bell was not one of the recipients of the prize due to the fact that she was only a student at the time. Instead, her supervisors won the award.

However, she wasn't upset, she actually thought it made sense! Don't worry – Jocelyn's work and contributions to science haven't gone without reward. She continues to work today and has won almost 20 honours for her work overall, including being made a Dame in the UK for her contributions to science.

In 2018, she also won the Special Breakthrough Prize in Fundamental Physics – for which she received three million dollars! Most importantly, she still loves and is passionate about her work overall. At the Euroscience Open Forum 2012, she said: 'If it wasn't for the stars, we would not be here. There is stardust in your veins, we are literally, ultimately children of the stars.'

$3 million
Fundamental Physics Prize



SUPPORT WOMEN

Due to her personal experience, Jocelyn has become a passionate advocate for the rights of women and minorities to study science. Becoming the first female president of the Royal Society in Edinburgh in 2014, she also donated all of her prize money from the Breakthrough Prize in Fundamental Physics to help set up a fund for women, ethnic minorities and refugees who want to study physics.

Jocelyn Bell Burnell ...

1. Where was Jocelyn Bell Burnell born?

2. The Armagh Planetarium, which Jocelyn's father designed, is kind of like a museum for the stars. Name three other types of museum that you can think of. Hint: think of your subjects at school and the different types of sciences for clues!

3. Where did Jocelyn do her PhD and in what science did she specialise?

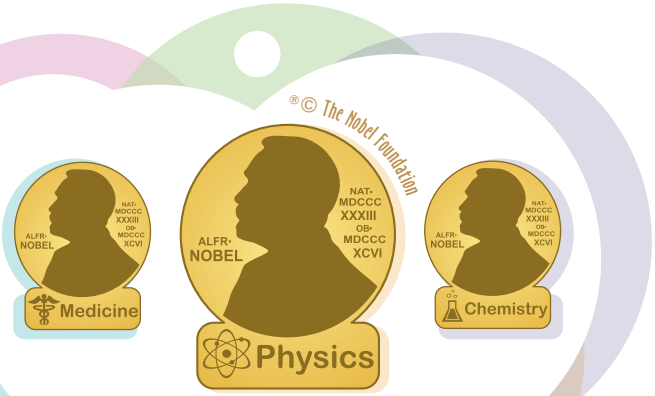
4. Unscramble the letters to find the new type of phenomenon that Jocelyn discovered. IRDOA LRUSSPA

5. Jocelyn used lots of inventive ways to try to study stars, including flying telescopes attached to balloons. Pretend you are Jocelyn and try to come up with another inventive way you could possibly study stars.

Answers: 1. Lurgan, Northern Ireland; 2. E.g. Zoology, History, Art, Sport; 3. The University of Cambridge, astronomy; 4. Radio pulsars

Activity...

Become a Nobel Prize Winning Scientist!



Jocelyn's discovery earned a Nobel Prize in 1974, and while she may not have received it, many other Irish-linked scientists have had their discoveries recognised by the Nobel Prize too. Born in New York to Irish emigrants in 1939, John O'Keefe now shares the 2014 Nobel Prize for medicine for his work in discovering the brain's internal positioning system. Ernest Walton from Waterford received his for splitting the atom (the smallest particle) using a particle accelerator that he built from car batteries and petrol pumps!

Follow in the footsteps of these amazing scientists by using the instructions below to make a new discovery in your own home. This game is better if played with others, although you can of course do it by yourself. Don't forget to ask an adult for help! Finish by making your very own Nobel Prize and certificate, celebrating your achievements for all to see!

What you will need

- Some paper and pencils (for note taking and drawing)
- A camera (optional)
- A sheet of card (optional – for your certificate)
- A disc of card cut into a circle shape (for your Nobel prize)

DEPENDING ON THE FIELD YOU CHOOSE TO COMPETE IN, YOU WILL ALSO NEED:

BIOLOGY:
A garden or access to an outdoor space

ASTRONOMY:
A view of the sky (day or night!)

PHYSICS:
Lego or playdough

CHEMISTRY:
Slime materials
(don't know how to make slime? Check out our slime how-to guide at www.epicchq.com/makeslime)

Instructions

1. First, choose what field you are going to compete in. You can compete in either **Biology**, **Astronomy**, **Chemistry**, or **Physics**, depending on what materials are available to you. Remember to ask an adult's permission first to make sure you can go ahead.
2. It's very important that all contestants have the same materials to work with, so gather all the materials and lay them out.
3. Next choose a time period over which to compete. This could be just 15 minutes to an hour or more, depending on how detailed you want your experiments to be and how much time you have.

4

Then, it's time to get creative. Using the ingredients specified and your imagination, use the scientific principles of observation (using your senses) and experimentation (trying new things) to try to come up with a 'new' discovery. Don't forget to write down or keep a record of your progress on paper or via a camera, as a big part of science is being able to report and share your process! Here are some ideas:

BIOLOGY:

a drawing or picture of a species of plant or animal you found, or a description of a behaviour of an insect you observed.

PHYSICS:

a type of building or construction you created, or a phenomenon such as the speed of movement or collapse of your creation.

ASTRONOMY:

an interesting cloud formation or star constellation.

CHEMISTRY:

a new or interesting type of slime or slime monster you came up with.

5

When the timer is up, present your findings to one another. First, share your notes to explain your process (how you came about the discovery), and then either using pictures, drawings or the item itself, present your results. Allow time for comments and suggestions afterwards – scientists love to comment and report on each other's work, as this often makes it better. Remember to be positive not negative in your comments, and to suggest ways that the scientist who is presenting can continue on their work, such as a new angle to explore!

6

Now it's time for the awards. Each person will have to create a certificate and medal for another. Remember to organise who is doing who, so that no-one gets left out. Using our template below, either cut out or draw the certificate, dedicating it to the person you have chosen. Then, using a circular piece of card, draw on a picture of the winner, in the same style as the Nobel Prize medal on page 10. Finally, taking it in turns, present them to each other at a fancy gala award ceremony. Don't forget to dress up and make a speech!

Get an adult or your teacher to share your findings and awards with us using #EPICMuseum on social media to be in with a chance of winning a free science workshop for your class at school.

THE SCIENCE AWARD

Certificate of Completion

PRESENTED TO

_____

for their outstanding achievement in the field of

_____

DATE _____ SIGNATURE _____

EPIC
The Irish Emigration Museum

IRISH SCIENTISTS TODAY

Follow the exploits of these present day Irish pioneers of science, who are pushing the boundaries of science in Ireland and around the world today.

Dr Niamh Shaw

Niamh wears many hats: a STEM communicator, presenter, actress, author, scientist, engineer and artist, she's an advocate of curiosity and exploration in all forms, believing that we can be many things at the same time.

Website: https://niamhshaw.ie/

Twitter: @dr_niamh_shaw https://twitter.com/Dr_Niamh_Shaw

Instagram: @dr_niamh_shaw https://www.instagram.com/dr_niamh_shaw/

Karin Dubsky

Karin is a German-Irish marine ecologist working in Trinity College Dublin, notable as an environmental activist, the coordinator and co-founder of Coastwatch Europe, an environmental NGO and a member of the European Environmental Bureau.

Website: http://coastwatch.org/europe/author/karin/

Twitter: @karindubsky https://twitter.com/karindubsky

Instagram: @karin_wexfordgreen

Eamon N. Doyle

Eamon is an Irish scientist, science promoter, and painter. Based in County Clare, he is the official geologist for The Burren and the Cliffs of Moher, and the geopark encompassing them. In 2017, a new species of brittle star from 435 million years ago, Crepidosoma doyleii, was named after him and he identified a further new species in 2019!

Twitter: https://twitter.com/visitBurren/status/1182240170671783936

LinkedIn: https://www.linkedin.com/in/eamon-doyle-22023113/

Derek Briggs

Derek is an Irish palaeontologist based at Yale University who specialises in researching fossil decay and preservation. He is the Yale University G. Evelyn Hutchinson Professor of Geology and Geophysics, and Curator of Invertebrate Paleontology at Yale's Peabody Museum of Natural History.

Website: https://people.earth.yale.edu/profile/derek-briggs/about

Twitter: https://twitter.com/cambriannelids/status/1010188200676032512

Peter Lynch

Peter Lynch is an Irish meteorologist, mathematician, blogger and book author. His interests include numerical weather prediction, dynamic meteorology, Hamiltonian mechanics, the history of meteorology, and the popularisation of mathematics.

Website: https://www.mathsweek.ie/2019/tag/peter-lynch/

Twitter: @thatsmaths https://twitter.com/thatsmaths

Geraldine Butler

Geraldine is a geneticist at University College Dublin. Her research career has mostly been focused on the genetics of fungi such as mushrooms. In 2015, she was elected as a member of the Royal Irish Academy.

Website: https://people.ucd.ie/gbutler/teaching

RESOURCES

The below list of resources will give you more information on the study of science and help you on your way to becoming a scientist too!

EPIC The Irish Emigration Museum

You can also visit us in EPIC The Irish Emigration Museum or take part in one of our science themed workshops, available both in-person or online. From the Irish in space and Irish female scientists to slime and beyond, there's lots to discover! Head to www.epicchq.com to find out more. And don't forget to share your projects with us on social platforms by using #EPICMuseum.

The Nobel Prize

Feeling inspired? Discover more about the work of prize-winning scientists on the official website of the Nobel Prize. With lesson plans, quick facts, podcasts, videos and articles, there's lots to explore!
https://www.nobelprize.org/

National Botanic Gardens

Embrace botany and go exploring in this city oasis of calm.
A premier scientific institution, the gardens contain important collections of plant species and cultivars from all over the world and with plenty of interactive trails for kids, there's lots to discover!

Dublin Zoo and the Dead Zoo

Who doesn't love animals? Become a biologist with a day out to Dublin Zoo and the Dead Zoo, aka the Natural History Museum in Dublin. Take your field notebooks, jot down creatures that are old, new and now extinct, and don't forget to practice your biggest RAWR!
https://www.museum.ie/Natural-History

Coolest Projects

Think you have what it takes to be the next big Irish scientist? Enter your ideas into Coolest Projects – a yearly competition for young innovators aged 7+ that showcases creativity, entrepreneurship and technology skills.
https://online.coolestprojects.org/#

SFI

Science Foundation Ireland are the authority on STEM (Science, Technology, Engineering, Maths) teaching in Ireland, and have a wonderful list of resources for families at home to explore together, including videos and experiments.
https://www.sfi.ie/

Books

Ingenious Ireland
by Mary Mulvihill

Did you know Ireland is home to genius inventions, historic industries and natural wonders? Discover it all and more in this book, written by a pioneering science writer and broadcaster. Richly illustrated it brings the reader on a fascinating county-by-county tour of Ireland, with details of what to see and places to visit.
https://ingeniousireland.ie/

Secret Science
by Dara O'Briain

The second hilarious book for curious kids from Irish comedian Dara O Briain, discover how everyday life is brimming with extraordinary science, from the moment you wake up until you go to sleep (and beyond!).

The great Irish science book
by Professor Luke O'Neill

Join Trinity Professor Luke O'Neill on the greatest journey of them all. From the very big to the very small – vast galaxies to microscopic atoms – travel through the wonders of the universe, the mysteries of the human body, and the tiny world of molecules. Discover the Irish scientists that have helped to shape our world and find out how to become one yourself.