Female scientists

Overview

In this resource to celebrate International Women's Day (8 March), students learn about the work and lives of nine female scientists. They discover the achievements of these scientists, and consider the influences on their work and the challenges they faced.

Learning objectives

Students will be able to:

- describe the achievements of nine female scientists
- suggest influences on their work and the challenges they faced.

Curriculum links

- England National Curriculum KS3 – Working scientifically: Scientific attitudes
- GCSE Combined Science subject content – Working scientifically: The development of scientific thinking

Resources required

- Student sheet 1 – diamond-ranking activity, cut into nine cards
- Student sheet 2 – scientist pro-forma
- Student sheets 3, 4, 5 and 6 – information sheets on scientists
- Access to ASE's Big Research Question Activities, which feature five of the nine female scientists in this resource http://www.schoolscience.co.uk/bigresearch
- ***Optional:*** access to poster-making equipment and/or ICT poster or presentation software

Lesson plan

Starter (5 min)	In pairs, ask students to list the names of famous scientists, and take brief feedback. It is likely that most scientists listed are male. Point this out and tell students that in this activity they will find out about the lives and work of some female scientists.
Main	Ask the pairs to write down what scientists do.

activity 1 (15 min)	Establish that, among many activities, scientists ask questions. They do investigations and make observations to answer their questions. Tell students they will now consider some scientific questions. Which questions would they most like to be answered? Still in pairs, ask students to diamond-rank[1] the scientific questions on student sheet 1. Then ask them to consider what influenced their ranking – curiosity? Wanting to help others? The desire for fame or wealth? Point out that all these factors – and others – influence the questions that scientists choose to answer.
Main activity 2 (20 min without optional activity)	Allocate one of the nine scientists below to each student, and ask them to read about their life and work on the source indicated. ● Maggie Aderin-Pocock (student sheet 3) ● Mary Anning (student sheet 4) ● Stephanie Dancer http://www.schoolscience.co.uk/invisible ● Kimberley Fornace http://www.schoolscience.co.uk/macaques ● Dorothy Hodgkin (student sheet 5) ● Angela Lamb http://www.schoolscience.co.uk/richardiii ● Liese Meitner (student sheet 6) ● Beth Penrose http://www.schoolscience.co.uk/contaminatedcrops ● Anna Rocca http://www.schoolscience.co.uk/protectingcommunities Students complete the pro-forma for their scientist on student sheet 2. This requires some thought, since not all the answers are given directly on the information sheets or websites. In some cases, students will have to use their imagination to infer suitable answers. The challenges faced by scientists interviewed on the ASE website are not given, so students tackling these scientists will need to leave this section of the pro-forma blank. ***Optional:*** Students make a poster or presentation about their scientist to share what they have found out with others in the class.
Plenary (10 min)	Students share what they have found with others in the class, either by giving brief talks, or by looking at each other's posters or completed pro-formas.

[1]In diamond ranking, students put the one question they would most like answered on the top row, the next two questions they would most like to be answered on the second row, their next three priorities on the next row, their next two priorities on the next row, and their lowest priority on the final row at the bottom. The questions then form a diamond shape.
There isn't one correct answer to this task – its value is in the discussion generated, and in the discussion afterwards in which they consider the factors that influenced their ranking.

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Possible pro-forma answers

Straightforward answers are not included here, only those that are less obvious. Of course there are no single 'right answers'.

Scientist	Example questions	Influences	Challenges
Maggie Aderin-Pocock	How can we find out about the chemical reactions in stars?	Was good at science at school	• Dyslexia • Overcoming prejudice as a woman and black person
Mary Anning	Which animal is this fossil from?	Family – collected fossils to sell	• Rich people taking the credit for her discoveries
Stephanie Dancer	How can hospital patients get germs that cause infection?	Wants to answer questions in subject that no one has answered before	
Kimberley Fornace	Is there a link between deforestation and how many monkeys get malaria?	Always interested in biology, health and travel	
Dorothy Hodgkin	How are the atoms arranged in biological molecules?	Always interested in science	• Saw parents rarely during childhood • Rheumatoid arthritis
Angela Lamb	What can the bones and teeth of Richard III tell us about his diet?	Loved geography and the environment as a child	
Liese Meitner	How can we explain these strange results?	Interested in observations of oil	• Being Jewish in Germany • Not being awarded the Nobel Prize for work she contributed to
Beth Penrose	How can we make grasses that reduce the threat of a cattle disease?	Industrial placement	Finishing PhD thesis
Anna Rocca	How can we make an effective malaria vaccine?	TV documentary about effects of malaria on children	

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Diamond ranking

How can breast cancer be cured?	Is there life elsewhere in the universe?	How can we make non-polluting cars?
How can malaria be cured?	What is the best way of keeping healthy?	What is the best way of revising for exams?
How can we predict when a volcano will erupt?	What is the best way to avoid spots?	How can we prevent animals and plants from becoming extinct?

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Pro-forma

Name of scientist	
Year of birth (if given)	
Questions asked	
Achievements	
Influences (including what attracted her to a career in science)	
Most interesting and rewarding parts of the job	
Challenges	

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Maggie Aderin-Pocock, MBE

Image: Richard Saker/REX/Shutterstock

At school, Maggie wanted to be an astronaut. She has come close to living this dream – now working as a space scientist and presenting *The Sky at Night* – but would still love to travel in space.

Maggie studied physics and engineering at university. Since then, she has had an exciting career. She has hung outside aeroplanes taking images of missiles zooming underneath her, while developing aircraft missile warning systems. She has made hand-held devices to detect landmines. She is also developing a device to measure wind speeds on a satellite, which will tell us more about climate change.

Maggie enjoyed working with a team to create a scientific instrument for the Gemini telescope in Chile. The instrument analyses starlight from distant stars, and tells us about the chemical reactions that take place deep inside them.

As well as working as a scientist, Maggie loves talking about her work. She is passionate about inspiring young people from all backgrounds to become scientists.

She was awarded the MBE in 2009 for services to science education.

Image: Wikimedia Commons

Maggie was born in London in 1968. She has had to overcome challenges to get where she is today. She has dyslexia. As a child, she went to 13 schools, and found everything difficult, until, one day, she realised that she was good at science. Maggie has also had to overcome prejudice, both as a woman and as a black person.

Mary Anning

Image: Wikimedia Commons

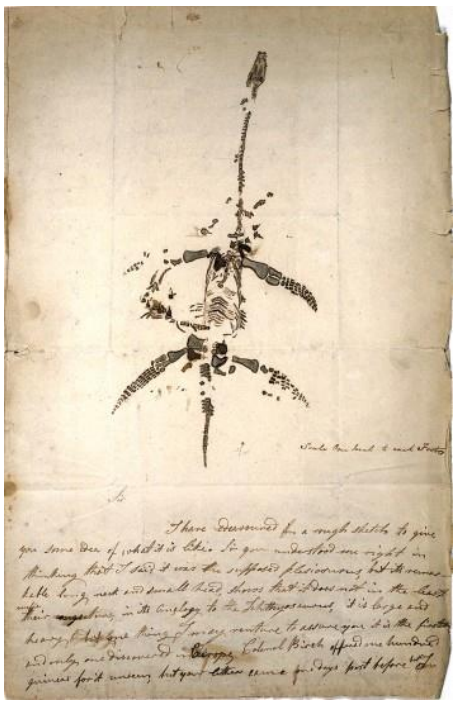
Mary Anning was born in 1799. She lived by the sea in Lyme Regis, Dorset. As a child, she helped her father to find fossils in the cliffs. The family sold the fossils to tourists to make money to buy food and other essentials.

In 1811, Mary and her brother Joseph dug up an ichthyosaur skull. At more than one metre long, it was enormous. Mary sold the fossil, and it ended up on display in London. People were fascinated, because the fossil suggested that the Earth was much older than most people thought at the time.

Mary continued to collect fossils. In 1823 she found the fossilised remains of the first complete plesiosaurus, and a few years later found fossils of pterosaurs (flying reptiles) and fish. Mary recorded her findings carefully, and drew detailed diagrams of the fossils she collected. She developed great knowledge of early life from her fossils.

Things were not always easy for Mary. She sold some of her fossils to rich collectors, who published scientific papers about them without mentioning Mary's name. Of course, Mary was not happy about this.

Mary died from cancer at the age of 47. After her death, members of the Geological Society of London and a local vicar installed a stained-glass window to remember her contributions to geology.



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Dorothy Hodgkin

As a child, Dorothy loved science. She was determined to study chemistry at Oxford University, and worked hard to pass the entrance exams. She was the third woman to achieve a first-class honours degree from the university.

Dorothy moved from Oxford to Cambridge. There, she realised that a new technique – X-ray crystallography – could unlock the secrets of some of the most important molecules of life.

Over the years, Dorothy worked with others to discover how atoms are arranged in penicillin, which is an important antibiotic. She also found out the formula of vitamin B_{12} ($C_{63}H_{88}CoN_{14}O_{14}P$) and worked out how its atoms are joined together.

Dorothy spent many years finding out the structure of insulin, and later travelled the world giving advice about insulin and its importance in diabetes. Dorothy won the Nobel Prize for Chemistry in 1964.

Dorothy's life was not always easy. She was born in Egypt to British parents in 1910. During the First World War, she lived with relatives and friends in England, and only saw her parents occasionally.

When Dorothy was 24, she started to feel pain in her hands. This was the start of rheumatoid arthritis, which got worse and worse. Eventually, Dorothy needed a wheelchair to get around, but still worked hard at her research.

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Liese Meitner

Image: Wikimedia Commons

Liese first did scientific research at the age of eight. She studied the colours in oil and reflected light, and wrote about her findings in a notebook that she kept under her pillow.

Liese studied physics at university in Vienna, Austria. She was only the second woman to obtain a higher degree from the university.

She worked with other scientists, including Otto Hahn (pictured), to make many exciting discoveries. The scientists discovered a new element, protactinium, and received a medal for this work.

Later, Liese and another scientist explained some strange experimental results. They suggested that the nucleus of an atom could be split into smaller parts. This is nuclear fission. Nuclear fission is used in nuclear power stations to generate electricity. The process is also used in nuclear bombs.

Liese was born in Vienna in 1878 to Jewish parents. She did not have an easy life. When Hitler came to power, Liese was working in Germany. As a Jew, she was not safe there, so she travelled secretly to the Netherlands, and then on to Sweden. In Sweden she got a job in a research laboratory, even though some scientists there thought that women should not work in science. In 1944 Otto Hahn received the Nobel Prize in Chemistry. Some people think that the prize should have been shared with Liese Meitner, as she made huge contributions to the prize-winning research.

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