Women in Science in Scotland

An exhibition celebrating some of Scotland's finest female scientists

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Seven of the women featured were or are members of the RSE Young Academy of Scotland.

They are:

Professor Sharon Ashbrook
Professor Ineke De Moortel
Professor Karen Faulds
Professor Eva Hevia
Professor Catherine Heymans
Professor Nicola Stanley-Wall
Dr Silvia Paracchini

Women in Science in Scotland

As Scotland's National Academy, the Royal Society of Edinburgh is proud to number amongst its Fellowship some of the most talented leaders, thinkers and practitioners working in Scotland today.

In this exhibition, we have chosen to focus on and celebrate some of the exceptional women scientists within the Fellowship. Leaders and pioneers in their fields, they are at the vanguard of new ideas, new knowledge and new technologies which are shaping our understanding of the world, supporting a more sustainable use of resources and securing advances in health care. Some are from Scotland, others have chosen to base their research and make their homes here; all of them are making a positive contribution to society.

When we approached the women to be part of this exhibition, we asked them why they chose to become scientists. The responses were varied and enlightening: for some it was always their dream or passion or they had been encouraged and inspired by family, friends and colleagues. For others, the desire to become a scientist came later whilst studying at university and realising that, not only did they enjoy and were good at science but, it was also a realistic career choice.

And what a career choice! Throughout the exhibition, we gain a sense of what these women love about their life in science: the joy in discovering and learning new things; the satisfaction that comes from working in teams and collaborating with colleagues from a wide range of disciplines; the pleasure in supporting and nurturing talent; and the fulfilment that comes from doing something which is making a difference to people's lives and the way in which they live.

I hope that when you read these women's stories and learn about their work, you will not only feel pride in what Scotland as a scientific nation is achieving but realise that, with science, anything and everything is possible.

Dr Rebekah Widdowfield
Chief Executive

Women in the Royal Society of Edinburgh

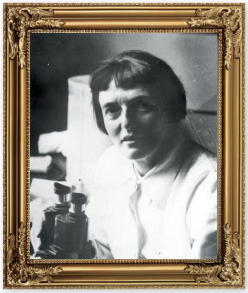
RSE Fellows, past and present, are an illustrious roll call of leading scientists and thinkers. In common with other similar organisations with such a long-standing history, women were only able to join its ranks relatively recently. In 1949, five women were welcomed as the first female Fellows of the RSE and the RSE is proud to celebrate them here.

Dr Sheina Marshall
OBE FRSE

From the Isle of Bute, Sheina Marshall was a Scottish Marine Biologist who played a crucial role in medical research during the Second World War. She researched different ways of obtaining agar, which was required to produce vaccines, by scouring the shores for seaweed. Marshall and her colleague, Andrew Picken identified a strand of seaweed, 'False Irish Moss' as the best local source of agar. Prior to the war, Britain used to import agar from Japan and Marshall was able to identify sources of agar from many British beaches thanks to this common seaweed.

Dr Christina Cruikshank Miller
FRSE

Christina Cruikshank Miller made crucial discoveries in analytical chemistry. She was the only female amongst the first 25 Fellows of Heriot-Watt College and consistently fought for her place as a female in a male-dominated research field. An inspiration to her fellow teachers and students, she was partially deaf and suffered blindness in one eye following an accident in her lab. Her pioneering work included producing the first sample of pure phosphorous trioxide which proved that it was not responsible for the glow emitted from phosphorous, as had been claimed by others.



Dr Charlotte Auerbach
FRSE

Charlotte Auerbach was a Zoologist and Geneticist. Charlotte fled from Nazi Germany in 1933 aged 34, after being dismissed from her teaching posts for being Jewish. She fled to Edinburgh and gained her PhD in 1935; she researched the effects of mustard gas, finding that it caused often lethal mutations in fruit flies.

Dr Doris Reynolds
FRSE

Doris Reynolds was a British Geologist who made considerable contributions to the field of Geology and was awarded the Lyell Medal from the Geological Society of London in 1960. During the 1940s, Reynolds developed the theory of 'granitisation' to try to explain the formation of granite in the Earth's crust. Although the theory was later disproved, it led to greater research and understanding in this area.

Dr Ethel Currie
FRSE

Ethel Currie was an esteemed Scottish Geologist, who worked at the University of Glasgow as Assistant Curator of the Hunterian Museum, focusing on Palaeontology as her specialism. In 1945, Currie was the first woman to be awarded the Neill prize by the RSE and in 1952, she became the first female President of the Geographical Society of Glasgow.

The RSE Today

In 2014, the RSE elected its first female President, Professor Dame Jocelyn Bell Burnell.

The organisation is now led by its second female President, Professor Dame Anne Glover and its first female Chief Executive, Dr Rebekah Widdowfield. Its Council (Board of Trustees) has a 50:50 gender balance and 40% of Fellows elected in the last five years have been women. It's also noteworthy that the RSE's Young Academy of Scotland (YAS) which comprises 135 early to mid-career leaders from science and the humanities, the professions, the arts, business and civil society, has 57% female membership.

The RSE seeks to address gender issues through its policy work. In 2012, it published its seminal report on women in STEM, 'Tapping All Our Talents'. The report featured the now infamous 'leaky pipeline', highlighting the fact that almost three-quarters of female graduates were lost from STEM and that, where women did stay in the STEM sector, they were significantly under-represented in top positions across business, public service and academia. The RSE's follow up report, 'TAOT 2018' published in association with YAS, showed that some good progress had been made in the intervening years but that more needs to be done to attract women to study and work in science and to retain them within the profession.

The report highlighted the importance of positive role models, providing the inspiration for this exhibition, which seeks to give higher visibility to women scientists and celebrate their successes. The RSE also recognises the lack of prominence of many female leaders online and is delighted that YAS has committed to ensuring that all the women featured in this exhibition have up-to-date Wikipedia pages.

There is still work to be done to enable all our young people to achieve their potential and for Scotland to achieve its national ambitions, but there are positive signs of progress and the RSE is hopeful that we are heading in the right direction.

Professor

Mandy MacLean

MBE, FMedSci, FRSE

Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde

I am a Pharmacologist and studied Pharmacology at Edinburgh University both for my BSc and PhD. I was always interested in biology at school and I found reading about pharmacology, and how many drugs were derived from plants and animals, fascinating.

My studies took me to the USA and Cambridge. I now carry out research into pulmonary arterial hypertension, which is a disease of the lungs caused by the arteries of the lungs closing down. It is a fatal disease for which there is no cure and it mainly affects women. We are currently looking at how oestrogens and serotonin play a role in the development of this disease to see how a new drug might intervene to treat patients.

I am currently Vice-President (Life Sciences) of the RSE; the Scottish Regional Champion for the Academy of Medical Sciences (AMS); and sit on a MRC grant panel. In my 'spare' time I am mum, wife, friend, carer, artist and hold public engagement in science events.

Survival is very poor in pulmonary arterial hypertension and I am most inspired and motivated by the needs of these patients. I am also motivated to progress the careers of the young researchers who work with me wherever I can. The discipline of Pharmacology, and how the Pharmacology alters with disease, fascinates and inspires me. My roles in the RSE, AMS, MRC and in public engagement reflect my wish to engage in, and contribute to, science and the scientific community at all levels.

Mandy is holding Gaddum's Pharmacology, *the first textbook that she bought in 1978 whilst studying Pharmacology at Edinburgh University.*

Professor Mercedes Maroto-Valer

FIChemE, FRSA, FRSC, FRSE

Assistant Deputy Principal (Research and Innovation); Director of the Research Centre for Carbon Solutions (RCCS); Buchan Chair in Sustainable Energy Engineering, Heriot-Watt University

I have a natural curiosity for knowledge, so research and university are natural fits for me. I came to Scotland in 1992 as an Erasmus student to Strathclyde University and stayed on to do my PhD on developing novel methods for understanding coal plasticity for steel-making applications. After completing my PhD, I took academic positions in the USA and UK and then returned to Scotland and joined Heriot-Watt University in 2012. I find myself privileged to work in an area that I truly enjoy and also that will help future generations.

My research focuses on addressing global challenges to ensure the sustainability of resources and energy. I lead an international centre with over 50 researchers working at the interface between science and engineering for the wider deployment of carbon solutions.

Working with a large number of industrial and academic partners around the world, our research has applications in several sectors related to electricity production, as well as heat/cold and transport. My team has developed several technologies that are placed to become genuine game changers. Some examples include conversion of carbon dioxide (CO_2) into aviation fuels or construction feedstocks, nature-inspired materials for capturing CO_2 from industrial sources, reduction by 50% energy consumption from data centres and understanding microscopic processes in the subsurface that control global sustainability.

I am passionate about nurturing talent, and particularly helping under-represented groups to realise their full potential. I enjoy instilling curiosity driven behaviour into my students and colleagues, and the continuous influx of challenges and radical ideas they present. I aspire to leave a legacy of future leaders who will continue working on ensuring sustainability of coming generations.

Mercedes is holding carbon dioxide (CO_2) locked up inside rocks. The block she is holding contains 5.5 litres of CO_2. Her first CO_2 project focused on converting CO_2 into building materials, that are similar to the replica she is holding.

Professor Muffy Calder

OBE, FREng, FRSE

Professor of Computing Science, Vice-Principal and Head of the College of Science and Engineering, University of Glasgow

I wanted to be a scientist for as long as I can remember, and I went to university to study Mathematics and Physics. I didn't know about computing then and indeed a teacher at school had told me that I wouldn't like computing but I took a course in programming at university and just loved it! I found it was my calling.

Computing science is science, with fundamental laws and principles, and engineering, because we apply those laws to test out ideas and construct new software.

A beautiful thing about computing is that you can do it anywhere; you don't always need a computer. You can think about a program – how to encode an algorithm or the data you want to collect – out on the hills, in the bathtub, or walking to work.

My research focuses on modelling and reasoning about complex, interactive sensor-based systems, for example, systems that are used to monitor and manage environmental conditions; smart water networks where valves and pumps are switched on and off remotely; and mixed-reality systems that blend computer, human and physical behaviours.

I construct computational models and use them to test how the system behaves under different circumstances. The questions that drives me are, 'does your system do what you think it does; what you want it to do; and can the data be trusted, as sensors get damaged, moved, hacked or have a software upgrade?

Muffy is holding a copy of the front page of the book, *The Laws of Thought*, on which are founded the mathematical theories of logic and probabilities, written by George Boole in 1854. Boole is the inventor of Boolean Logic, one of the foundations of computing science. Boolean algebra is Muffy's favourite algebra!

Professor
Niamh Nic Daéid
CChem, FCSFC, FHEA, FRSC, FRSE

Professor of Forensic Science, University of Dundee, and Director of the Leverhulme Research Centre for Forensic Science

I was born in Dundee and grew up in Ireland in a family of scientists. My parents were scientists involved in the investigation of fires. From an early age I knew that women could be successful scientists and that science could be used as a real world, practical, problem-solving tool from which you could earn a living. Indeed, my brother and I used to earn our pocket money by sticking our parents' fire scene photographs into reports – this was long before digital photography! Now, I am an academic and a Forensic Scientist undertaking casework in fire investigations, terrorist events and the illegal manufacture of drugs.

Forensic Scientists are obligated to deliver scientifically valid, unbiased and impartial evidence in a way that is communicated and understood by the jury, but Forensic Science is at a crossroads, with little valid science underpinning much of the evidence commonly appearing in our courts.

As Director of the Leverhulme Research Centre for Forensic Science, a £10 million, ten-year interdisciplinary research centre established in 2016 at the University of Dundee, our mission is to identify and address the scientific and communication challenges that face Forensic Science.

We challenge the *status quo*, break down silos and barriers across disciplines to find that elusive common ground, empowering our practitioner community of scientists, law enforcement and the judiciary to work with us and help us build scientifically robust solutions for current and future challenges. We have been awarded a further £15 million to establish the first Institute of Innovation for Forensic Science to further develop our emergent research and ensure safe convictions through the provision of justice for victims, survivors and their loved ones.

Niamh is holding the heating element of a kettle which shows arc melt damage as a result of overheating which caused the kettle to ignite.

Professor Nicola Stanley-Wall

FRSB, FRSE

Professor of Microbiology, University of Dundee

I've always been interested in biology. I was that child who got the frog spawn out of the pond and watched the tadpoles develop into frogs; and I was the child who worked at the local country park looking at how trees broke down through the action of fungi. I went to the University of East Anglia thinking that I wanted to study Ecology but during my time there I realised that I preferred the more intricate details of how biology worked; I ended up becoming a specialist in the field of microbiology.

My work involves studying bacteria. Bacteria are everywhere, but you often need a microscope to see them. Bacteria are typically single cells which form social communities called biofilms. When they are living in a biofilm, they make a sticky matrix and it is this that allows the cells to live together and gives protection from the outside world. Sometimes biofilms can be detrimental: the plaque that builds up on your teeth is an example of a biofilm that can cause harm, and the reason we need to brush our teeth regularly. Some biofilms though are beneficial, such as those that help break down sewage in processing plants or that form on plant roots and help growth. My lab looks at how bacteria makes the sticky biofilm matrix. We want to understand how we might be able to stabilise the matrix in situations where the bacteria could be helpful or how to destroy the powerful matrix where the bacteria are not wanted.

Nicola is holding her sixth-year studies biology project report which she wrote in her final year of secondary school.

Professor

Polly Arnold

OBE, FRS, FRSC, FRSE

Crum Brown Chair of Chemistry, University of Edinburgh

I make unusual molecules from the metals at the bottom of the periodic table. We don't know enough about their bonding, and the more unusual the molecule, the better we are able to challenge preconceptions, and improve our understanding of their behaviours. This is important as many of the metals are technology-critical elements that find use in wind-turbine magnets, while others are present as unwanted radioactive isotopes in spent nuclear fuel.

I have always wanted to do something different. When I was younger, I was frustrated that there were so many things about chemistry that I had to memorise, rather than be able to explain from a general understanding of chemical periodicity. As I grew up, I realised that it was because no one could explain these behaviours. I find enormous satisfaction in making molecules that are not meant to exist, that do not obey the rules. These are the ones that teach us about nature, and prompt interesting collaborations. Some of these will be with spectroscopists who are trying to analyse complicated real-world systems. Others will be with computational chemists who are trying to make their models clever enough to predict the future of hard-to-handle systems such as nuclear waste.

I do a lot of my thinking when I'm completely alone, ideally on a Scottish hillside, in the cold, low-angled, winter sunshine, when I have the luxury of time to sift through everything that's cramming my brain. This works best when my brain has been pre-filled with a numerous disparate concepts and reagents from research articles from different scientific disciplines.

Polly is holding an f orbital, one of the atomic orbitals that hold the outermost electrons in compounds made from f-block elements.

Professor

Raffaella Ocone

OBE, FREng, FRSE

Professor of Chemical Engineering,
School of Engineering and Physical Sciences,
Heriot-Watt University

I am an Engineer who works in academia. I was the first female Professor of Chemical Engineering in Scotland; the second in the UK. My research deals with the design and operation of industrial processes, such as oil refining.

I work with research students to find solutions to optimise these processes and to develop new technologies, such as how to utilise plastic waste in a sustainable and environmentally friendly manner. I'm currently working on modelling pyroclastic flow to gain information into the management of people safety and environmental protection following a volcano eruption.

I love what I do. I've always been interested in understanding how things work. I enjoy finding practical solutions that can change the way we live, such as clean water and clean energy. My work allows me the opportunity to travel and meet people from different backgrounds and cultures and I really hope I can inspire our younger generation – especially young women – to study engineering.

As a child growing up in the south of Italy, I greatly enjoyed chemistry, maths and physics at school. I was interested in seeing them 'in action' and using them in a creative way. My dad was not trained as an engineer, but he represented the quintessential engineer to me, always finding a solution to fix or re-invent things around the house, including our toys (latterly he substituted toys with my beloved shoes!) I soon understood, through his skills, that as an engineer I could make a difference to people's lives and make them happy!

Raffaella is holding a small-scale model of a conical hopper, which is used to analyse the flowability of powders.

Professor Rona MacKie

CBE, FMedSci, FRCP, FRCPath, FRCPSG, FRSE

I was Professor of Dermatology at the University of Glasgow 1978–2000, the first time in its 500-year history that a woman was appointed to an established Chair.

My major area of research was the epidemiology and molecular genetics of malignant melanoma. In the 22 years I held the Chair, it grew from a small department to a healthy unit comprising an established Chair, three non-clinical senior lecturers, one clinical senior lecturer, a clinical lecturer and supporting staff. We had excellent links with our colleagues in the NHS, particularly pathology and medical mycology. We raised funding to allow us to occupy two well-equipped floors in the newly-built Robertson Building in the molecular corner of the University adjacent to colleagues in Genetics and Virology.

We published high-impact papers in journals, such as *The Lancet*, in these fields, making major contributions to the epidemiology of melanoma in the UK, and collaborating as part of '*Genomel*', the EU-funded melanoma research group.

We established a large patient base with a pioneering patient-support group, and one of the most touching events around my 'retiral' was a dinner hosted for me by the patient group.

Looking back, I would do it again instantly if invited to do so. My family background was biological science rather than medicine. My father was a Biochemist, and a former President of the RSE, and my mother was a PhD Microbiologist. I chose to study Medicine, I think because of an interest in people. I was stimulated to specialise in dermatology by brisk encouragement that this was a speciality in which I could combine patient care and research. The move to specialising in melanoma came from contact with a patient in my first year after graduation and I will be for ever grateful to him for giving me the motivation to work in this area.

Professor Sharon Ashbrook

FRSC, FRSE

Royal Society Wolfson Research Merit Award Holder; Professor of Physical Chemistry, School of Chemistry and Centre of Magnetic Resonance, University of St Andrews

Although I was always interested in science at school back in Liverpool, my first aim in life was to be a primary school teacher. I applied to do this after my first degree in Oxford, but I found that I really enjoyed the research project I carried out in my final year as an undergraduate, so I stayed to do my DPhil at Oxford.

As I found I continued to enjoy research, I chose to take a postdoctoral research position, and then was awarded a Royal Society Dorothy Hodgkin Research Fellowship, which I held initially in Cambridge before coming to St Andrews in 2005. I was promoted to Reader in 2009 and Professor in 2013.

I lead a research group which is interested in understanding the atomic-level structure of solid materials. We use NMR spectroscopy (the study of the interaction between matter and radiofrequency electromagnetic radiation) to do this. We study the structure and atoms of molecules in different types of materials, including the minerals found many hundreds of kilometres below our feet and ceramic materials that store radioactive waste.

The aim of this research is to gain a better understanding of how the position of the atoms in these materials affects their properties. Ultimately, this will help in the design of new materials in the future and improve their performance. Our work has many areas of application; from helping geologists understand the inside of our planet, to helping petrochemical companies understand the catalysts they use to improve chemical reactions or how porous materials can be used to capture and store potentially harmful greenhouse gases.

Sharon is holding a zeolite – a porous solid with industrial applications for gas storage, catalysis and drug delivery.

Professor
Sheila Rowan
MBE, HonFInstP, FRAS, FRS, FRSE

Professor of Experimental Physics, University of Glasgow; Director of the Institute for Gravitational Research; Chief Scientific Adviser (CSA) for Scotland

I'm an Experimental Physicist. I carry out research designing and building instrumentation for observatories that have detected the first gravitational signals from colliding 'black holes' far out in our cosmos. These 'gravitational waves' carry with them unique information about what objects produced them, allowing us to study dark processes in the universe.

I wanted to be a scientist, indeed a physicist and more specifically to study the cosmos, since I was quite young – about ten years old. I was hooked by the simple questions that come up when we look up at the night sky and wonder what is out there? How far could you go if you set off in a spaceship and what would you find? I found those questions so interesting that I simply couldn't think of anything more exciting to do with my time than to work on helping to try and answer them. I have been so lucky to be able to find a way to do that. My research, and that of my Institute, is targeted at detecting and studying the 'ripples in space-time' predicted to exist by Einstein more than 100 years ago. To do this, we work together with scientists in more than 20 countries around the globe.

This research pushes the state-of-the-art in technology across optical and mechanical systems needed for our observatories that have application not only in gravitational astrophysics, but also spin-offs in healthcare, satellite control, energy, and geo-science. By chasing the discoveries of tomorrow, we can help people today.

Sheila is holding a sheet showing the properties of what produced the very first gravitational wave signal – 'GW150914' – picked up by the LIGO observatories in 2015. Two black holes each tens of times the mass of our sun, collided 1.3 billion years ago and caused the universe to vibrate by just a tiny amount; these vibrations give us a completely new tool to study the universe.

Dr Silvia Paracchini ***FRSE***

Royal Society University Research Fellow,
School of Medicine,
University of St Andrews

I'm a Human Geneticist but there's nothing in my past that suggests that that's what I would become. My journey to where I am now is really a combination of different events; some choices and some chance.

When the time came to choose what to study at university, I was so undecided that one day I simply asked myself what was the single one thing that I enjoyed learning about. The answer was Gregor Mendel's experiments, considered the foundation of genetics science; and so that's how I ended up enrolling to study Biology at the University of Pavia. During my studies, I went to Denmark on the Erasmus programme and got a glimpse of research outside Italy.

I then moved to Oxford for a PhD in Human Genetics where I discovered that science can be creative and that I wanted to have my own research group. It took me two years and a few rejections before getting my Royal Society Fellowship. During that time, I applied for jobs around the world and got a job offer from St Andrews and the Fellowship more-or-less at the same time. I moved to Scotland with my husband and two young daughters in 2011.

The main focus of my research is the genetic basis of dyslexia. We know there is a strong genetic component to this condition which affects up to 10% of children but we still can't pinpoint the specific genes. In the shorter term, my research is contributing to understanding how the brain develops. In the longer term, this knowledge will help to develop better tools to manage dyslexia and other neurodevelopmental conditions. The more we study the human genome and the human brain the more we appreciate the underlying complexity.

Silvia is holding a single-channel pipette, which she likens to an extension of her arm as her work consists of mixing tiny and very precise volumes of different reagents.

Professor Catherine Heymans

FRSE

Professor of Astrophysics at the Royal Observatory, University of Edinburgh

Working as a teenage Mary Poppins on a summer 'dude ranch' in Texas, I found myself fearing that my brain may turn into mush. I headed to the local bookstore in search of their most challenging book which happened to be *Relativity*: *The Special and the General Theory* by Albert Einstein. Evenings were spent on the ranch re-deriving the equations, trying to work it all out for myself, unknowingly laying the foundations for my future life surveying the universe.

A Masters in Astrophysics from Edinburgh was closely followed by a Doctor of Philosophy from Oxford and postdoctoral Fellowships in Germany, Canada and France, returning to Edinburgh to join the Faculty as a European Research Council fellow.

I specialise in observing the dark side of our universe, the stuff that we can't see or touch but that we know is there because of the effects it has on the stars and the galaxies that we can see. This year we'll be opening the domes of a brand-new telescope called the Large Survey Synoptic Telescope (LSST). Set upon a remote mountain top in Chile, LSST will image the entire Southern sky to unprecedented depths. With this exquisite dataset, we will confront a range of different theories about the mysterious and poorly-understood dark matter and dark energy which make up 95% of our universe. It's widely believed that the nature of the dark side may only be explained by bringing about a revolution in physics that will forever change our cosmic view. It could be that we need to go beyond what I learnt all those years ago from Einstein's book, extending his theory of gravity in order to understand the true nature of the universe.

Catherine is holding her well-thumbed childhood copy of *Relativity: The Special and the General Theory* by Albert Einstein, which formed the foundations of her future life surveying the universe.

Professor

Dame Anne Glover

FRS, FRSE

President, Royal Society of Edinburgh,
Special Adviser to the Principal
at University of Strathclyde

As a child, I used to sit down every week and watch Star Trek, with all its iPads, body scanners, needleless injections, hands-free communication, virtual reality and teleporters; and it seemed like a world of wonder and possibility. It's astonishing to think that all of this is now a reality, even the teleporter!

We've not yet managed to teleport a person, but we have managed to transport a photon from here to the Gobi Desert and that's a start.

It's one of the things that made me want to be a scientist. It seemed unbelievable that you could spend your whole life just imagining the impossible then making it real – and that's what scientists do. They're the most creative, imaginative people you can meet, which makes them fantastic fun to be around. As science is global, I've been lucky enough to travel all around the world and meet people and make friends, who tell me about the country they work in and their work.

I've done lots of different types of research in my career, from looking at why there are so many microbes in the environment and what they might be doing, to how the cells that make up our bodies respond to stress. What's important to me now is taking the knowledge that we generate from science research and making sure it can make a difference, by, for example; influencing government policies; using the knowledge generated by research to invent new technologies; looking at how we might protect our environment; and have better healthcare for all. That keeps me busy!

Anne is holding a lego model of a female scientist in a lab, selected to symbolise Anne's role in mentoring young women in STEM. It was a present from a colleague when she was the Chief Scientific Adviser to the President of the European Commission (2012–2015).

Professor
Eva Hevia
FRSC, FRSE

Department of Pure and Applied Chemistry, University of Strathclyde

I am a Synthetic Chemist who, in general terms, can be described as a molecular architect. Our research focuses on finding new tools that enable the construction of useful molecules, of relevance to the pharmaceutical industry and, therefore, having a direct impact on society.

We place special emphasis on the structures of reagents required to access these important molecules, in order to get a better mechanistic understanding that will allow the rational design of future synthetic strategies. The quest for sustainability underpins our research, and some of our most exciting recent work has been geared towards replacing toxic organic solvents by more environmentally benign alternatives, made of biorenewable components. Along with leading a vibrant research group, I enjoy teaching inorganic chemistry to undergraduate students. I am also a strong advocate for diversity and inclusivity and so regularly participate in outreach activities that promote and celebrate women in STEM.

Since my primary school days, I have always been fascinated with science. I did my undergraduate and PhD studies at the University of Oviedo in Spain, and in 2003 I joined the University of Strathclyde as a postdoctoral researcher, where I have remained.

Every day at work is different. Sometimes we have amazing moments, for example, when we make a breakthrough in a project or when some of our work is accepted for publication. Of course, sometimes we also have to face frustrating challenging times, but being part of a team often helps in finding solutions for those challenges. A special privilege of working in academia is to witness the spectacular progression that younger researchers make while working on their PhD or postdoctoral projects, as well as being able to share with them my enthusiasm for research and discovery.

Eva is holding the model of a molecule which the team she leads has prepared. It shows for the first time that we can use iron as an earth abundant and sustainable alternative to metallate organic molecules.

Professor Hilary Critchley

FMedSci, FRSE

Professor of Reproductive Medicine at the University of Edinburgh; Consultant Gynaecologist

I am a Clinical Academic and have the privilege of working with patients. This offers me the opportunity to understand the physiology and pathology that underpin complaints that affect, as many as, one in four women.

I work in the taboo area of menstrual disorders and these are conditions that have a massive impact on quality of life, particularly to the individual, her family, the workplace and wider society. We still don't know why women have periods and why menstrual bleeding problems occur. It's an increasingly prevalent issue because of the number of women in the workplace who are delaying starting families and need to preserve their wombs. My research team's studies 'at the bench' aim to understand the biology of the womb lining (endometrium). We ask questions about what regulates normal menstruation and what is perturbed when women have problem periods.

I have the privilege of working with colleagues across a range of disciplines, and we hope to see our studies at the bench translated to the clinic. I am very grateful to the many women who have, and continue to participate in our studies. In doing so, they are making a difference to how we approach this area of women's health and widening their choices.

I always wanted to be a Doctor. My older brother, Julian, introduced me to the sphere of not just being a Doctor but also a researcher. He joins other role models, men and women, who have influenced me, provided terrific mentorship and offered unstinting support throughout my professional career.

It's over thirty-five years since I qualified and I've seen the balance of men and women in the profession change. We see increasing numbers of women training as Doctors and we need to ensure that we see more women joining clinical academia.

Professor
Ineke DeMoortel
FRSE

Deputy Head of School, School of Mathematics and Statistics, University of St. Andrews

I've always liked mathematics, even as a small child. I liked its rigour and simplicity, but I came to realise that what I really wanted to do was apply mathematics to understand things in nature.

I studied Applied Mathematics and Astronomy at the KU Leuven in Belgium and during my final year, I did an Erasmus exchange to St Andrews where I got interested in Solar Physics. I returned to St Andrews to do my PhD and still work there, as a Solar Physicist.

It is important that we understand the atmosphere of the sun because it has a direct impact on the earth and its near-space environment. Large parts of our society's core infrastructure (telecommunication networks, power distribution and navigation systems) are extremely vulnerable to space-weather events; magnetic storms interfere with all kinds of signals, such as satellite signals. Our society depends heavily on satellites, for example, to provide navigation information for airplanes and ships and to transmit radio, television and telephone signals. During a magnetic storm, huge electric currents are generated, which can disrupt power distribution on earth and cause blackouts, and oil and gas pipes to corrode faster due to the large currents travelling along them, induced by solar storms. A large solar storm (or 'coronal mass ejection') will bombard satellites with tons of particles, which can cause severe damage, or even disable them altogether. I use equations that describe fluids and magnetic fields and I construct models, which I then compare to observations of the sun, to try to understand more about the solar atmosphere.

Ineke is holding a pottery plate depicting the sun.

Professor

Karen Faulds

FHEA, FRSC, FSAS, FRSE

Head of Bioanotechnology and Analytical Research Section, Department of Pure and Applied Chemistry, Technology Innovation Centre, University of Strathclyde

My research involves developing the technique of surface-enhanced Raman scattering (SERS) for multiplexed bioanalytical applications.

Raman involves directing laser light onto a molecule, which results in the light being scattered with a change in wavelength that is related to the structure of the molecules, providing a molecular fingerprint that can be used for definitive identification. However, Raman is a weak process that can be greatly enhanced by adsorbing the analyse into the surface of metal (gold or silver) nanoparticles.

This technique allows us to develop bionanosensors for the specific detection of biomarkers related to disease. We are using this approach to detect bacterial pathogens related to meningitis; the onset of sepsis; indicators of cardiovascular disease; the detection and understanding of cancer and drug treatments; and to detect bacteria in both the healthcare setting and the food industry. We are also developing approaches with a view to measuring changes at depth inside the body, for example, related to cancer and bacteria biofilm formation.

I think I was always going to be a scientist or an engineer; always wanting to understand how things work. I was one of those annoying children that asked "why?" constantly at nursery and I carried out experiments and made terrible concoctions, usually involving my Mum's perfume and flower petals! I enjoyed all the sciences at school but my true passion was always for chemistry. I need to carry out work where what I am doing has a purpose; where my research could have an impact on improving people's lives or environment. My ambition is to be able to develop approaches that will allow earlier detection of disease, which will enable; faster and more patient-specific medical intervention and have an impact on patient care as well as reduce the cost of healthcare.

Karen is holding a handheld Raman spectrometer than can be used for point of use detection

Professor Lesley Yellowlees

CBE, HonFRSC, FRSE

Professor Emerita in Inorganic Electrochemistry, University of Edinburgh

I loved science from an early age. I loved doing experiments, loved mathematical challenges, loved problem solving. I was fortunate to have inspiring science and maths teachers and supportive parents who all encouraged me to study chemistry, physics and maths. I enjoyed science, found it came naturally to me and never hesitated to pursue a career in chemistry.

My whole academic career has been at the University of Edinburgh. After graduating I worked in Australia, which is where I first got interested in solar energy. I then returned to the University to study for a PhD on how to convert the energy that comes from the sun into electricity, and this has remained the focus of my research to date. I led a successful research group for many years engaging with fantastic students and wonderful colleagues before taking up senior management roles at Edinburgh. One of the highlights of my academic career was when I became the President of the Royal Society of Chemistry – their first woman President in 170 years.'

Many people are surprised that solar energy has a part to play in Scotland but, in fact, we get more than enough sunlight for solar energy to be an important component of our renewable energy portfolio – witness the increasing number of solar panels on roofs.

There's still plenty of research to be done, not only in turning sunlight into electricity and making it an efficient process using cheap readily available chemicals, but also in being able to store this energy so that we can use it during the night when the sun isn't shining.

Lesley is holding a dye sensitised solar cell as prepared in Professor Neil Robertson's research lab. The dark circle contains an organic dye to absorb the sunlight sandwiched between conducting glass to transfer the generated electrons.

Professor Louise Heathwaite

CBE, FRSE

Professor of Land and Water Science, The Lancaster Environment Centre, Lancaster University

I am an Environmental Hydrologist with a BSc in Environmental Sciences. I did a PhD in Wetland Hydrochemistry that led to my long-term research on environmental pollution, in particular, understanding the pathways of nitrogen and phosphorus loss from agricultural land to water, and the impact on freshwater quality.

I'm truly interested in how things work, and I like to work independently, so there was no career for me other than being a researcher. I like science to be useful, and when I started my PhD it was in the Somerset Levels, where pump drainage of a wetland, (part of which had just been declared a Site of Special Scientific Interest (SSSI)), was a problem, as it was polluting river water causing fish to die. It was a good problem to work out and understand and to think about the pragmatic application of the science.

I've taken this further in recent years by, first of all, working with one of the research councils, the Natural Environment Research Council, building strategic research programmes around sustainable use of natural resources, covering everything from energy use through to conservation strategies. More recently, I worked as Chief Scientific Advisor for Rural Affairs, Food and Environment for the Scottish Government, looking at the scientific evidence underpinning a lot of the decisions we make around the environment.

I guess my inspiration to become a scientist was actually not liking to be told what to do! I like working independently and science just offered that opportunity to start from scratch. I often tell my post-docs and early lecturers that the time when you're a PhD student is when you have three years ahead of you to 'do your own thing' and discover something new, which is so exciting.

Louise is holding a Munsell Soil Colour Book – Professor Albert H Munsell was the first person to illustrate colour systematically in three-dimensional space, based on experimental science and it's been the official colour system for soils research since the 1930s.

Professor Becky Lunn

MBE, FICE, FREng, FRSE

Royal Academy of Engineering and BAM Nuttall Research Chair in Biomineral Technologies for Ground Engineering; Head of the Centre for Ground Engineering and Energy Geosciences, Department of Civil and Environmental Engineering, University of Strathclyde

I currently lead a major project sponsored by the Royal Academy of Engineering and the Civil Engineering Contractor, BAM Nuttall, to take research technologies I have been developing at the University of Strathclyde into the ground-engineering industry.

Microbially Induced Calcite Precipitation (MICP) is a technique that uses a harmless bacterium found in soils to produce the mineral, calcium carbonate. This mineral binds the soil particles together, turning loose soil into rock, and thereby greatly improving its strength. I aim to treat soils without disturbing them so that we can use MICP to create engineered structures from the soil already present at the site, for example, strengthening beach sands to make coastal defences or strengthening soils to make building foundations. The use of MICP in industry could significantly reduce global cement/concrete use, which currently accounts for around 8% of global man-made carbon dioxide emissions.

I love that as a research engineer, I have the freedom to think – developing occasionally 'off-the-wall' solutions to engineering challenges. I have built a team of multidisciplinary staff and students that enables this to happen. They have skills that far exceed my own, in a wide range of disciplines, including microbiology, chemistry and physics, so there is always something new for me to learn.

Winning the Aberconway Medal from the Geological Society made a huge difference to me. Based on a nomination process in which names are proposed in strict confidence by Fellows of the Society, I had no idea that my name had been put forward. I was the first woman and the first engineer to receive the award, and as a young researcher it gave me the belief that I could perform at a national and international level.

Becky is holding the Aberconway Medal, which she was awarded by the Geological Society in 2011 for her work with industry.

Professor

Ruth King

FLSW, FRSE

Thomas Bayes' Chair of Statistics, University of Edinburgh

I am an Applied Statistician. I develop new methods and techniques for analysing different types of data, particularly in the areas of ecology, epidemiology and, most recently, within medical applications.

My work involves a combination of different aspects: constructing models to describe the processes that generated the data; applying different computational techniques to fit the models to the data; and ultimately interpreting the results obtained in light of the given application.

Some of the particular challenges that I have addressed include, for example, dealing with incomplete data; combining different forms of data; developing efficient computational techniques; and dealing with different types of heterogeneity within the observed data. As an applied statistician, a significant (and particularly interesting) part of my work involves close collaboration with other scientists to fully understand the data and application area.

I enjoy problem solving and, growing up I was an avid Agatha Christie reader – always trying, and sometimes succeeding, to work out 'whodunnit?'. To me, applied statistics is a natural extension of this: evidence collected in order to determine who the culprit was, translates into the observed data which we can interrogate in order to answer questions of interest. It is often intricate, non-obvious, details that we wish to extract from the data, and this needs to be done in a rigorous mathematical framework. Statistics provides an evidence-based approach to problems which can change/improve our understanding of systems – and hence can have a real impact, for example, with regard to medical intervention/treatments, government policies, conservation management, etc. Wherever we look, data is making a difference to how we understand the world.

Ruth is holding one of her beloved Agatha Christie books!

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