Behind the surface

Professor Anne Neville is a specialist in surface engineering and interfaces. Support from the Royal Academy of Engineering secures her the academic freedom to work confidently across the boundaries between engineering and other disciplines.

ROYAL ACADEMY OF ENGINEERING

Research area

Professor Anne Neville FREng is a Royal Academy of Engineering Research Chair in Emerging Technologies at the University of Leeds, a 10-year funding scheme that allows outstanding academics to focus not on the here and now but provides academics with long-term support to focus on developing emerging fields of engineering and how to bring them to their maturity.

She is a leading researcher in the field of tribology – the study of what happens on surfaces of and at the interfaces between materials. It focuses on a deeper understanding and manipulation of friction, lubrication, wear and corrosion.

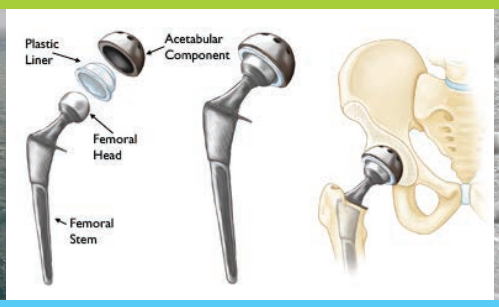
Professor Neville, who leads a team of 50 researchers, thanks the Academy's Research Chair scheme for the freedom to explore new avenues of research she experiences and the freedom to apply tribology methodologies to solve problems in of mainstream engineering and other fields from offshore oil exploration to robotic surgery devices.

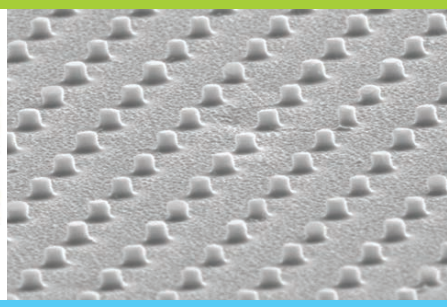
Professor Neville does not consider herself a conventional corrosion scientist or tribologist; her research interests take her from engineering to biology and many other diverse areas.

She began her career with a final-year project on corrosion in her degree in mechanical engineering, and continued with PhD at The University of Glasgow. After her graduation, she moved straight from her doctorate into a lectureship at Heriot-Watt University, progressing to reader and then professor. During this transition, she focused her research on flow assurance in oil and gas.

While this still remains an important part of her work, since her move to the University of Leeds, her interests have further expanded into new areas of research, including biological systems alongside the more usual mechanical and chemical aspects of her work.

Professor Neville's research has been wide-ranging. For example, she has been investigating the tribological systems that are available in nature, such as the ability of tree frogs to attach and detach themselves from surfaces – with the aim of replicating this in engineered devices for surgical applications.





Academy support

Professor Neville has been awarded a Royal Academy of Engineering Research Chair in Emerging Technologies, the first funding scheme of its kind which enables her, in her own words, to take a 10-year view on the direction of the technologies that she is researching. "It gives me the freedom to do some things which are a little bit whacky," she says.

"A lot of current research funding" she adds, is short-term – perhaps three years – and geared towards achieving a specified result. But to answer the big research questions does take more than three years and this kind of support is just fantastic, because it encourages you to look into things that are just that bit more risky and exciting."

Other support

Professor Neville's research group is widely supported by UK and international businesses. In recent years, she received several million pounds' worth of funding for her research work from the EU, UK and overseas industry and UK government.

Research impact

The impact of Professor Neville's work is found in several areas and disciplines. Some of her recent work has focused on surgical robots that can work inside the human abdomen. She engineered a robotic system that can attach itself to biological surfaces within the patient's body with sufficient strength to be able to collect images and carry out its tasks and then detach itself without causing damage to the tissue where it was attached.

The key to this work has been observing the mechanisms used by nature in frogs' and lizards' 'sticky fingers' and then replicating them with the help of chemical and mechanical engineering. "It's about the bigger picture, – she says – I look at surfaces as part of a larger system, and this can be a surgical system or an engineering system such as a wind turbine". Professor Neville is also involved in the development of a robot that can perform minimally invasive colonoscopies.

Her work in the oil and gas industries is tackling corrosion, scaling and crystalline deposits during oil and gas extraction and transfer procedures.

Future challenges

Professor Neville's research on surfaces and interfaces has the potential to benefit several industries and sectors and in return, the issues these sectors will face in the future will drive her research even further. In the oil and gas industry, for example, increasing prices and dwindling reserves made oil and gas extraction from difficult sources and in harsh environments viable and necessary. Oil is and will be sought in even deeper waters, high pressures and corrosive environments; this will demand new technologies from the tribologists to be successful.

Applying her newly developed adhesion/detachment systems to other robotic formats, such as the snake robot technologies that are used to inspect hard-to-reach places like aeromotive engines, could also be among Professor Neville's next targets. Applications of these new robots could span both engineering and medical sciences.

Biography/ Career Progression

1995 PhD in Corrosion Engineering, University of Glasgow

1995 - 2002 Transition from lecturer to a reader and then to a professor, Heriot-Watt University, Edinburgh

2003 Appointed to Professorship in Tribology and Surface Engineering, School of Mechanical Engineering, University of Leeds

2003 - 2011 Founding Director of Institute of Engineering Thermofluids, Surfaces and Interfaces and leader of the Corrosion and Surface Engineering Research Group, University of Leeds

2009 - Present Royal Academy of Engineering Research Chair in Emerging Technologies, University of Leeds

2010 Elected as a Fellow of the Royal Academy of Engineering (FREng)

Key achievements

Professor Neville's most notable research is in investigating the role of corrosion of metal components in the degradation of hip replacement joints including how the corrosion processes interact with the proteins in the synovial fluids that surround the joint. She is also focusing on what she calls some 'very rewarding'work on nanotechnology in the oil and gas sector. Other highlights of her research are in the use of nanotechnology in the field of surgical robotics.

"One of the things that's great about my job is that one day I'll be talking to orthopaedic surgeons and the next I'll be with one of the big oil companies discussing offshore corrosion"

Professor Anne Neville FREng