Andrew Taylor profile: Neutron man grapples with the invisibles

Andrew Taylor and neutrons are indivisible. Well, almost. Taylor, head of the Rutherford Appleton Laboratory (RAL) and director of the ISIS facility is highly visible. Neutrons are a mystery – one of the fundamental particles that make up matter and the motor helping to drive improvements and breakthroughs in a huge range of technologies.

By Roland Gribben Published: 3:47PM BST 13 May 2009

Taylor believes the investment and commitment that has gone into ISIS has given Britain a 10-year lead in the neutron field

"I wanted to understand how the world was made" says Taylor. That was at the age of 12. He is still finding out 47 years later but as director of ISIS he has played a major role in helping Britain develop an international lead in the fascinating but complex world of neutrons.

ISIS – wait for it – is the world's leading pulsed neutron and muon source, located at RAL. The laboratory populated by 1,600 scientists is a magnet for 10,000 scientists and engineers around the world engaged in research in physics, chemistry, materials science, geology, engineering and biology.

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Their experiments are opening new doors. ISIS is helping medical researchers develop a new type of glass that could release calcium into the body as it dissolves and could prevent the need for surgery by enabling patients to regrow their own bones. Others are using the results of ISIS studies to help develop better products to save the lives of premature babies. Neutrons scattered from hydrogen in water can pinpoint signs of microscopic cracking and early corrosion in the wings of a jet fighter.

Taylor believes the investment and commitment that has gone into ISIS has given Britain a 10-year lead in the neutron field. Others are trying to catch up. The US plans to spend £1.4bn narrowing the gap and Japan £1.8bn. "The US is perhaps being a little more arrogant. They say they are going to regain the world lead. The Japanese are a bit more sober." Taylor is optimistic that Britain can maintain its lead but with the stakes, costs and challenges rising, partnerships will play a more important role in producing the £1bn of investment needed over the next decade.

All the major neutron paths so far have led to the laboratory near Oxford, named after two of Britain's most distinguished scientists, Lord Rutherford, father of nuclear physics and Sir Edward Appleton, Nobel prize winner for physics. The site and its huge installations on the former RAF Harwell airfield are capable of handling more than 600 experiments a year and have become a scientific jewel in the crown.

Taylor believes ISIS, part of the Science and Technology Facilities Council, has made a huge economic contribution to UK Ltd through its extensive applications but it is difficult to assess. The taxpayer makes the biggest contribution while overseas research councils, governments and funding agencies chip in and the income stream comes from contracts, commercial deals and the thousands of users.

The preoccupation is with the science but the generation of business is an all-important spin-off. "We've got really good blue sky thinkers. We're maybe not good as entrepreneurs but we work with them and our ideas are taken up by the business world."

Taylor was instrumental in refocusing the RAL priorities around neutrons. A mentor at school in Scotland and an internship at Cern in Geneva helped develop the neutron fascination and after almost being tempted to join ICI as an economist he arrived at RAL in 1975, joining a small group involved in aspects of particle physics before embarking on a change in RAL's research priorities.

His neutron passion had made him an expert in a "very small" area of the science. "It's an invisible world. I found that invisible world fascinating and wanted to understand neutron scattering, neutron

beams like x-ray beams of light, helping us to see further and deeper into materials and see them in a different way."

He switched to another team deeply involved in neutron beams, beams that provided new insights into molecular structures. "It was fascinating for the academic but also had applications for industry." Unilever for example came to JAL wanting to understand more about the molecular structure of its products to improve them. Rolls-Royce wants to understand how materials – all materials – work to be better prepared for the day when the world runs out of them.

The task of refocusing the RAL team was far from easy. "We tried to show that the focus for particle physics had moved on and that their skills were much wider. All they needed to do was to refocus and move into different areas. They thought they were working at the frontiers of science. It took up to five years to refocus them and show there were other challenges for their talents. I'm hugely proud of what we achieved. We did something world leading."

ISIS arrived in 1984 with the completion of the first "target" – the station where the neutrons are made. They are siphoned off into different instruments or experiments to probe deeply into the structure of materials on a scale 10,000 times thinner than a human hair.

The second £200m station is almost ready, completed on time and budget with the first set of experiments scheduled to get under way this month. Its research priorities are soft matter, the biosciences and advanced materials.

"Our research underpins the technologies of tomorrow to deliver benefits for the nation," says Taylor. His biggest achievement? "Keeping the UK at number one for 20 years. The areas we are good at have given academics in polymer science, colloids and many other fields an edge and capability to compete on the world stage. We've been hugely lucky but I think we have been the right people in the right place at the right time because we ended up leading the world."

The youthful enthusiasm remains. "There's a phenomenon called high temperature superconductivity that has excited us for 12 years. What excites us is we don't understand how it works."

Andrew Taylor's CV

Born 1950
Family Married, four children
Education 1968 - Dux Medal, The High School, Denny; 1972 - B.Sc, Natural Philosophy and Chemistry, University of Glasgow; 1976 - D.Phil, Neutron Scattering, University of Oxford
Work 1975 - Senior Scientific Officer, RAL; 1986 - Group Leader, ISIS Science Div, RAL; 1993 - Director of Science CCLRC and Head of ISIS Facility; 1999 - OBE, services to neutron science; 2000 - Dep Chief Exec CCLRC, Director ISIS; 2006 - Elected Fellow of the Royal Sociey of Edinburgh; 2007 - Fellowship of Institute of Physics
Play Skiing, walking