Skin, bone and everything in between: Repairing the human body

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Following his Inaugural Lecture (http://www.birmingham.ac.uk/university/colleges/eps/events/inaugural-lecture/lectures-archive/Liam-Grover-13-02-14.aspx) , Ros Dodd met Professor Liam Grover to find out more about the pioneering Birmingham research into using biomaterials to repair and regenerate different parts of the body.

Professor Liam Grover cheerfully admits to being a nerd.

'I've always been fascinated by how things work, and my interest is very wide-ranging, so even in my leisure time you'll find me reading books about subjects from quantum physics to collagen assembly.'

Millions of us may one day feel extremely thankful for Liam's 'nerdishness': the Professor of Biomaterials Science in the School of Chemical Engineering is within touching distance of seeing patients benefit from his research into how biomaterials can be can be used to repair and regenerate different parts of the body.

Materials have been used to repair tissues for centuries, but until recently those materials were based on mechanical properties and little attention was given to composition.

'As our knowledge of the interactions between materials and biology improves, we are able to design materials that can stimulate or prevent specific biological responses,' explains Liam, whose recent Inaugural Lecture was entitled 'Skin, bone and everything in between: repairing the human body.'

An increasingly ageing population means new ways to regenerate worn out or diseased parts of the body are vital if people are to live more healthily in old age.

Working with the Birmingham Medical School, he and his team at TRAILab (Tissue Regeneration and Interface Lab) have developed cell therapy treatments for regenerating diseased or damaged bones, cartilage, ligaments, skin and even eyes, and to improve the body's ability to heal.

His research covers three main areas: developing materials that can replace bone and then degrade in response to the body regenerating its own bone formation; producing tissue-engineered ligaments and bone, and using soft solids to create dressings that will prevent scarring in a range of tissues, for which he has just been awarded a £1.8m Wellcome Trust grant.

Materials used include patients' blood and a population of their cells, which are then grown in the lab.

These cells can be encapsulated into a gel – which acts as a filler – and injected into the body. The cells will then excrete growth factors to encourage healing.

His ligament and tendon research is now being trialled at Birmingham Orthopaedic Hospital.

'We're not clinically treating people; at this stage we're just demonstrating that we can grow a person a new ligament in a clinically-relevant timeframe.'

Liam's passion for his field was ignited when the 'earmouse', a laboratory mouse that had what looked like a human ear grown on its back, hit the headlines in 1997. The 'ear' was in fact a cartilage structure grown by seeding cow cartilage cells into a biodegradable ear-shaped mould and then implanted under the skin of the mouse.

'The idea was to use the same material to transplant on to a boy who'd lost his ear, but as we heard nothing about it subsequently, it probably didn't work,' says Liam. 'But this mouse was an incredible trigger for me – a real turning point. It really blew me away.

'I was doing my A Levels at the time and looking through brochures to choose a university, and Birmingham offered a degree in Biomedical Materials Science, which was about 50 per cent biology and 50 per cent materials science, which appealed to me.

'Materials scientists and engineers are generally a little bit frightened of biology and biologists can have similar feelings about the physical sciences, but I'm a lover of both. Having a very diverse background means I can read across subjects.'

His PhD, in Dentistry, focused mainly on the formulation and evaluation of a novel calcium phosphate cement system for bone replacement.

'This was industry-driven and required both biology and materials science. After that, I went to Montreal for two years, to McGill University, and studied how the body regulates bone formation, which was much more in the way of fundamental science.'

Liam developed an expertise in the control of bone mineralisation and became especially interested in how condensed phosphate species could play both an inhibitory and stimulatory role in bone mineralisation.

He returned to Birmingham in 2006 and set up a research group to find new ways to regenerate human tissue.

'The composition of body fluid – the minerals and proteins – gives enormous scope to design materials that can be used to repair and regenerate, although we use relatively few due to strict regulations. But we've now evolved from when we implanted metallic materials into people – now it's about linking the two: the body and the material.'

So is he driven by a love of science or a desire to do good?

'At my core, I'm a scientist, which means I could be working on something really obscure and abstract, but my career has forced me towards application and that application has become very close to my heart,' explains Liam.

'The material I developed in my PhD never found its way into a patient; we got to the point of it being used, but for various reasons it was dropped, and that was very demoralising. Everything I'm doing now is getting quite close to being used – to treat people – and that is very important to me.'