Nanoscale whiskers from sea creatures could grow human muscle tissue

March 11 2011

Nanoscale whiskers from sea creatures could grow human muscle tissue

Minute whiskers of nanoscale dimensions taken from sea creatures could hold the key to creating working human muscle tissue, University of Manchester researchers have discovered.

Scientists have found that cellulose from tunicates, commonly known as sea squirts, can influence the behaviour of skeletal muscle cells in the laboratory.

These nanostructures are several thousand times smaller than muscle cells and are the smallest physical feature found to cause cell alignment.

Alignment is important since a lot of tissue in the body, including muscle, contains aligned fibres which give it strength and stiffness.

Cellulose is a polysaccharide – a long chain of sugars joined together – usually found in plants and is the main component of paper and certain textiles such as cotton.

It is already being used for a number of different medical applications, including wound dressings, but this is the first time it has been proposed for creating skeletal muscle tissue.

Tunicates grow on rocks and man-made structures in coastal waters around the world.

Cellulose extracted from tunicates is particularly well suited for making muscle tissue due to its unique properties.

University of Manchester academics Dr Stephen Eichhorn and Dr Julie Gough, working with PhD student James Dugan, chemically extract the cellulose in the form of nanowhiskers. One nanometre is one billionth of a metre and these minute whiskers are only 10s of nanometres wide – far thinner than a human hair.

When aligned and parallel to each other, they cause rapid muscle cell alignment and fusion.

The method is both simple and relatively quick, which could lead to doctors and scientists having the ability to create the normal aligned architecture of skeletal muscle tissue.

This tissue could be used to help repair existing muscle or even grow muscle from scratch.

Creating artificial tissue which can be used to replace damaged or diseased human muscles could revolutionise healthcare, and be of huge benefit to millions of people all over the world.

Dr Eichhorn thinks the cellulose extracted from the creatures could lead to a significant medical advancement. He added: "Although it is quite a detailed chemical process, the potential applications are very interesting.

"Cellulose is being looked at very closely around the world because of its unique properties, and because it is a renewable resource, but this is the first time that it has been used for skeletal muscle tissue engineering applications.

"There is potential for muscle precision engineering, but also for other

architecturally aligned structures such as ligaments and nerves."

PhD student James Dugan has become the first UK student to win the American Chemical Society's Cellulose and Renewable Material Division award for his work on nanowhiskers.

Provided by University of Manchester