Ancient protein offers clues to killer condition

More than 600 million years of evolution has taken two unlikely distant cousins – turkeys and scallops - down very different physical paths from a common ancestor. But University of Leeds researchers have found that a motor protein, myosin 2, remains structurally identical in both creatures.

The discovery suggests that the tiny motor protein is much more important than previously thought – and for humans it may even hold a key to understanding potentially fatal conditions such as aneurisms.

Says Professor Knight of the University's Faculty of Biological Sciences: "This is an astonishing discovery. Myosin 2's function is to make the smooth muscle in internal organs tense and relax involuntarily. These creatures have completely different regulatory mechanisms: the myosin in a turkey's gizzards allows it to 'chew' food in the absence of teeth, while that in a scallop enables it to swim. Yet they have exactly the same structure."

Myosin molecules generate tension in smooth muscle by adhering to form a filament, which grabs hold of a neighbouring filament, and relaxes by letting go. When the muscle is in a relaxed state, myosin molecule folds itself up into a compact structure.

This folded structure allows the smooth muscles to adjust to being different lengths so they can operate over a large distance, such as the bladder or the uterus expanding and contracting. In contrast, skeletal muscles operate over a narrow range, defined by how much joints can move.

Professor Knight says: "We were puzzled to find that the scallop's myosin 2 had retained its ability to fold and unfold, as they don't need to accommodate a large range of movement. After all, the scallop only moves its shell a little when it swims.

"In evolution, if something is not essential to the survival of an organism, it is not conserved. The fact that the scallop has retained all the functions of its myosin 2 over hundreds of millions of years tells us that this folding is of fundamental functional importance in muscle and that we don't know as much about it as we need to know."

In humans, any changes in the composition of myosin within the muscles can be fatal. For example, a swelling in the walls of an artery can cause a brain aneurism, while an enlarged heart can lead to cardiac arrest in a young, fit person.

Says Professor Knight: "Because these malfunctions occur in our internal organs, we are often unaware of what is going wrong until it's too late. Learning how to control myosin, how to move it around without disturbing the delicate balance between filaments and individual molecules, is an emerging area and one we are only just beginning to tackle."

The research is published in the US journal Proceedings of the National Academy of Sciences (PNAS).

Source: University of Leeds