Protecting the brain when energy runs low

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Researchers from the Universities of Leeds, Edinburgh and Dundee have shed new light on the way that the brain protects itself from harm when 'running on empty.'

The findings could lead to new treatments for patients who are at risk of stroke because their energy supply from blood vessels feeding the brain has become compromised.

Many regions of the brain constantly consume as much energy as leg muscles during marathon running. Even when we are sleeping, the brain needs regular fuel.

Much of this energy is needed to fire up 'action potentials', tiny electrical impulses that travel along nerve cells in the brain. These electrical impulses trigger the release of chemical messages at nerve endings, allowing the brain to process information and control bodily functions.

Normally, the bloodstream supplies enough glucose and oxygen to the brain to generate the large amount of energy required for these action potentials to be fired up. But things can go wrong if the blood vessels feeding the brain become narrowed or blocked, restricting the supply of vital nutrients.

A team led jointly by Professors Chris Peers (Leeds), Mark Evans (Edinburgh) and Grahame Hardie (Dundee) has now identified a way for the brain to protect itself when its energy supply is running low. This protective strategy, which is triggered by a protein known as AMPK,

reduces the firing frequency of electrical impulses, conserving energy.

The energy-sensing protein AMPK was first discovered by Professor Graham Hardie of the University of Dundee. He said: "When we first defined the AMPK system by studying fat metabolism in the liver back in the 1980s, we had no idea that it might regulate completely different functions in other organs, like nervous conduction in the brain."

"There are drugs currently on the market that stimulate AMPK, which are used to treat other conditions. In future these and other drugs could be given to at-risk patients to give them a better chance of surviving a stroke."

Professor Chris Peers, of the University of Leeds' School of Medicine, said: "Our new findings suggest that if brain cells run short of energy, they start to work more slowly. However, it is better to work slowly than not at all. It is possible that this discovery could, in the long term, lead to new treatments for patients who have problems with circulation to the brain, placing them at higher risk of conditions such as stroke."

"This research is a good example of what can happen if you pool the expertise of research groups who work in different areas."

The study details are published in the *Proceedings of the National Academy of Sciences*.

Provided by University of Leeds