Pharmaceuticals from cell physics

Understanding ion transport in cells presents a tough academic challenge – and the results are of huge interest to the pharmaceutical industry, too.

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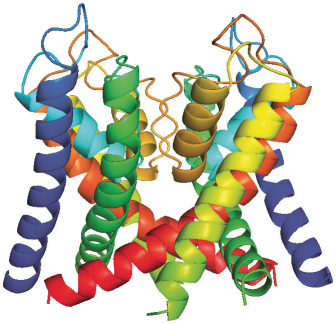

Image: S.J.Tucker

It might sound like a biological problem, but understanding how cells control their electrical charge is a scientific headache that spans disciplines - even physics. In the University of Oxford, a team of physicists and biochemists led by Dr Stephen Tucker are studying the proteins found in cell membranes, called ion channels, that open and close in order to allow the movement of charged particles. Understanding how they work at a molecular level is helping physiologists understand disease - and allowing pharmaceutical companies to develop new therapies.

The human body is home to over 90 genes responsible for encoding potassium ion channels alone - and if those genes become mutated, they cause the ion channels to work incorrectly. That can lead to illnesses such as heart disease, diabetes, migraine and epilepsy. To understand how these channels can be activated or blocked in order to treat disease, it is crucial to know how they work.

To do that, Dr Tucker's team take a bottom-up approach, studying potassium channels at a molecular level in order to understand how they can be manipulated to develop new treatments. Using a powerful combination of molecular biology, biochemistry, structural biology and electrophysiology, they are now beginning to understand how the channels open and close, and how this process is regulated by the cell.

In fact, a particular ion channel that they are studying has caught the eye of the large pharmaceutical firm Pfizer. Working collaboratively with groups in physiology and biochemistry, Dr Tucker's group is working hard to study the biophysical properties of a potassium channel, known as TRESK, which is has been found to be defective in migraine sufferers. Even though migraine is a complex condition, they hope that by understanding the impaired functionality of the proteins involved, they can develop ways to artificially activate the channels, in order to help alleviate migraine symptoms.

But that is not all Pfizer is interested in. Due to the TRESK protein's involvement with a wide range of pain sensation pathways, and its specific localisation in the brain and spinal cord, they think that drugs which target this channel could be used to create powerful, and intelligent, pain suppressants. If the problem was a headache to begin with, it seems like the team may have found a solution.

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