

Molecule movements that make us think

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Every thought, every movement, every heartbeat is controlled by lightning-quick electrical impulses in the brain, the muscles, and the heart. But too much electrical excitability in the membranes of the cells can cause things like epilepsy and cardiac arrhythmia. A research group at Linköping University has now published new discoveries that can lead to new medicines for these diseases.

The key molecules behind the [electrical impulses](#) are voltage-activated ion channels - pores in cell membranes, the opening and closing of which are controlled by the electrical potential between the inside and outside of the cell.

Research over the past few years has revealed the ion channels' molecular structure, and how the pores change form when they open and close. On the other hand, the mechanism explaining how the electric potential is detected on the molecular level remains unclear.

LiU researchers have now shown how an ion channel's voltage sensor can change its form. This change of form leads to the pore in the channel opening up.

Ulrike Henrion, Jakob Renhorn, Sara Börjesson, and Erin Nelson, all in Professor Fredrik Elinder's research group, have succeeded through comprehensive experimental work in identifying 20 different molecular interactions that occur in the voltage sensor's different states.

In collaboration with Professor Erik Lindahl's group at the KTH Royal Institute of Technology, and associate professor Björn Wallner at the Department of Physics, Chemistry and Biology at LiU, the group has built five different molecular models of the voltage sensor, which together can explain all the experimental data. The five models were then linked together to a film that shows how a central part of the voltage detector moves between the outer walls of the voltage sensor.

The published work is an important piece of the

puzzle in the research group's quest to develop substances with raised electrical excitability, which hopefully can lead to new medicines for [epilepsy](#) and [cardiac arrhythmia](#).

More information: Tracking a complete voltage-sensor cycle with metal-ion bridges by U. Henrion, J. Renhorn, S. I. Börjesson, E. M. Nelson, C. S. Schwaiger, P. Bjelkmar, B. Wallner, E. Lindahl and F. Elinder. *Proceedings of the National Academy of Sciences (PNAS)* early edition 23-27 April 2012.

Provided by Linköping University

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