# Chloride channel in muscle cells provides new insights for muscle diseases

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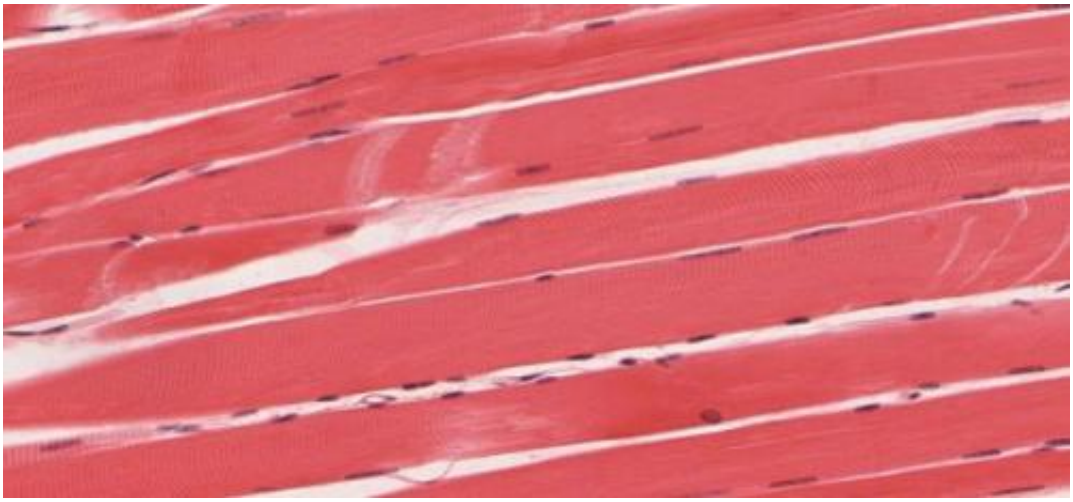

Skeletal muscle tissue. Credit: University of Michigan Medical School

Researchers from the University of Copenhagen have mapped the structure of an important channel in human muscle cells. The new insights about the chloride channel can contribute to greater understanding of muscle diseases such as ALS, and the findings may enhance drug development at NMD Pharma.

Small molecules such as hormones and ions are constantly transported in and out of cells, regulating cell activity. Researchers are trying to understand what controls the different channels in cells, and have now greatly improved this understanding for muscle cells. In the new study,

an international and interdisciplinary team involving researchers from the Faculty of Science and the Faculty of Health and Medical Sciences at the University of Copenhagen have mapped the structure of a channel that transports chloride into muscle cells. Detailed structures of the chloride channel will provide vital information in the quest to fully understand its regulation and thereby optimize development of better treatments of important diseases such as ALS, SMA or Myasthenia gravis.

"This channel in the muscle cells may be essential for the group of illnesses we call neuromuscular diseases. That applies, for instance, to ALS, which many people might know from the late physicist Stephen Hawking. Others have discovered that blocking the channel can alleviate the symptoms of ALS. Our new findings will spark ongoing development efforts to block the channel," says Pontus Gourdon, associate professor at the Department of Biomedical Sciences.

## Cryo-electron microscopy

The researchers have investigated proteins that exist in the cell membranes of human cells using a state-of-the-art cryo-electron microscope. It uses rays of electrons to visualise the 3-D structures of different biological molecules. In this instance, the researchers have taken what one might call a 3-D-photography of this chloride channel in muscle cells. Visualisations like these pave the way to more efficient drug development because they allow a more rational effort on medical compounds that can bind to that specific 3-D-structure.

## NMD Pharma

Previous work from Aarhus University revealed that the chloride channel is critical for maintenance of skeletal muscle function during

physical activity, leading to the formation of NMD Pharma, a pharmaceutical company that is pursuing new treatments for neuromuscular disorders by targeting the chloride channel.

The researchers have now initiated a collaboration with NMD Pharma that will use the new knowledge for drug development. A postdoc from the research group at the university will collaborate closely with scientists of NMD Pharma to help make the most of the new findings.

## Value in society

The new post-doc employment is part of the public-private partnership called BRIDGE between university and industry. The goal is to make sure that knowledge from research results makes it beyond scientific publications and has a positive impact in society. The program is supported by the Novo Nordisk Foundation.

"We are extremely proud of the fact that our research might lead to real impact in society through this collaboration. And also of the fact that the industry can see the values of our findings," says Pontus Gourdon. He emphasizes that drug development can take a long time and that approval of new drugs is no quick process either.

The new results are especially relevant for neuromuscular diseases such as Thomsen's disease, a heritable disease named after the Danish physician Asmus Julius Thomas Thomsen, who described it in 1876. Many in his family, including himself, suffered from the disease.

The new study is published in *PLOS Biology*.

**More information:** Kaituo Wang et al, Structure of the human ClC-1 chloride channel, *PLOS Biology* (2019). DOI: 10.1371/journal.pbio.3000218

Provided by University of Copenhagen