

NeuroCampus – Inside Out:

## Jens Christian Hedemann Sørensen Leader of CENSE (Center of Experimental Neuroscience) at Dept. of Neurosurgery

Jens Christian's research group investigates basic mechanisms and clinical possibilities of repairing the brain using the mini pig as a model. This includes research in stem cells, deep brain stimulation and other aspects of neural plasticity. Clinically Jens Christian's focus is on neuromodulation.



Jens Christian H. Sørensen. Photo. Karoline Klitgaard

### Can you describe your research in a nutshell?

Roughly, my research has two different legs; one basic leg and one clinical leg. Our basic research evolves around the neurobiological questions of brain damage and brain repair, focusing especially on stem cells. This has been a research area of mine for many years and has evolved from using stem cells from fetal tissue to our current focus on adult stem cells.

The other part of my research has a clinical focus. My research group CENSE conducts neurosurgical experiments in the brain of mini pigs with the primary focus on the clinical implications of neural plasticity. We have particularly focused on the effects of Deep Brain Stimulation (DBS). We have examined the effect of DBS on Parkinson's disease (PD) when it comes to symptom expression but we also study the effect of stimulation on the neurons of the cerebral cortex and the synaptic activity. One of our next projects will be a study of potential epigenetic effects.

Another major clinical focus area of mine is neuromodulation for patients suffering from eg. chronic neuropathic pain. Here we can place electrodes over the spinal cord or peripheral nerves and block the patient's pain. Together with colleagues in the PET Center and Neurology, we are currently running a clinical trial on spinal cord stimulation for PD patients with gait and balance problems which is very promising. Another new finding is that peripheral nervestimulation of the major occipital nerve (ONS) seems to abolish cluster headache. This year, we have started a randomized clinical trial of the effect of ONS on this severely affected group of patients.

### What clinical impact may your research have for people?

It is obvious that our clinical trials could impact the quality of life for both patients with PD and cluster headache.

Likewise, the potential clinical implications of more knowledge about stem cells, neural plasticity and DBS are many. It could lead to better treatment of chronic pain, epilepsy, spinal cord injury as well as psychiatric diseases.

The use of brain stimulation is e.g. being increasingly investigated in connection with depression.

### How did you end up where you are today?

As medical a student, I did a research year in Chicago working with brain repair of traumatic brain injuries. In this project, we transplanted fetal tissue and focused on how the traumatized brain could be helped to repair itself via fetal transplants in combination with training. I then returned to Denmark and became a neurosurgeon, which led the way to my research in large animal brains as well as clinical studies.

### What does a (local) strong neuroscience research network mean for you and your research?

Cross talk between different fields is extremely important in research. Often we have a problem or an idea to which we do not ourselves have the solution or the right approach. It is particularly crucial that we establish connections between basic and clinical scientists. For instance, we collaborate with Prof. Marco Capogna who studies the neural circuitry in human cortical tissue. Here the neocortical tissue from tumor operations enables important basic studies of the human cortex. Likewise, we, as clinicians, need to get in contact with basic researchers with knowledge of gene expression in order to conduct studies on DBS neuroplasticity and epigenetics.

We have a strong neuro network here in Aarhus with many different fields and methods, but we need even better opportunities for informal meetings. This requires the right facilities, which is one of the reasons why we are currently working to realize a new building for Danish Neuroscience Center at Aarhus University Hospital. The building will host collaborative activities for both basic and clinical researchers. Moreover, the new building will include an experimentarium-like venue which will be open to patients, students, school classes, etc. with the aim of inspiring and educating about the brain. A part of this will be dedicated to education about psychiatric diseases with the hope of minimizing the stigma surrounding these diseases.

### If you had unlimited resources to conduct a big, multidisciplinary neuroscience project, what would you like to do?

One of our current research foci is DBS, which is an example of brain computer interfacing (BCI). I would like to investigate the area of BCI and its potential clinical implications in much greater detail. In this regard, we are collaborating with Prof. Farshad Moradi in the brAln center on developing the next generation of BCI. One the projects involve small nano devices, NeuroDust that can be put on the cortex to measure activity and potentially stimulate specific cortical areas. Our research in this area would among other things focus on possible feedback loops between the brain and the devices making potential treatments more flexible and efficient.

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