

INTERVIEW WITH DR. BERT SAKMANN

GCRI Interview with the Nobel Prize Laureate and Inaugural Scientific Director of the Max Planck Florida Institute , Dr. Bert Sakmann

Dr. Sakmann, you are currently working on a research project that focuses on the structural arrangement of nerves in the cerebral cortex, and you aim to create a three-dimensional atlas of nerve cell bodies to set up a basis for studies on brain degenerative diseases. How do you think your work will affect future medical treatment of neurological diseases?

Up to today, many so-called mouse models of neurological diseases have been developed and are available to study a number of neurological diseases, like epilepsy or Alzheimer's. Our work provides a template for the state of the rodent cerebral cortex under normal conditions, which can be used to accurately describe alterations in the anatomy that might be associated with these diseases. While done in animal models, the reconstructions can open a potential new window on the cellular structure of a significant part of the brain that could lead to a far better understanding of brain function e.g. degenerative disease processes. It may reveal parts of the network that trigger sensory-initiated behavior and lead to new discoveries in the brain's process of learning. It could lead to a far better understanding of how minor changes can cause various sensory and cognitive abnormalities.

You became the Scientific Director of the Max Planck Florida Institute in 2009. How closely do you collaborate with scientists at the other Max Planck Institutes in Germany?

My research group and I here in Florida collaborate very closely, and on a regular basis, with the Max Planck Institutes for Medical Research in Heidelberg, for Neurobiology in Munich, for Biophysical Chemistry in Göttingen, and for Genetics and Cell Biology in Dresden. I began to work here about one year ago and without their never-failing support, the Institute would not be up and running now.

Neuroinformatics has become an integral part of neuroscience. How do new software programs affect your work in illustrating and tracing the shapes of neurons?

We have already developed a number of software tools to facilitate the rapid reconstruction of neurons – their somata, axons and dendrites - the three major compartments of a nerve cell. We are currently setting up a database and also develop tools for simulations of electric signals sweeping through the reconstructed networks.

On November 3rd, you will speak about "Mapping the Brain: Unlocking the Cerebral Cortex" at the GCRI. What is the role of the touch system's digital anatomy in processing sensory information in the brain?

We use digital neuroanatomy to precisely describe the touch system of the rat and the mouse; the reason being that this system is one of the major sensory input and motor output systems in rodents. Our initial aim is to reconstruct the individual parts and later the entire somatosensory system of the rodent brain. Eventually, this will enable us to simulate, in silico, the flow of electrical signals in this system. We use the touch system because it provides a relatively simple input as well as output structure, and the general anatomy is already accurately described.

Based on your extensive research, how do sensing, thinking, and learning affect the electrical signaling in the brain?

Learning changes the electrical signalling in the brain by several different mechanisms. Electrical signals sweep through a system, and learning mechanisms may “switch” the signal flow to different locations in the brain. Addressing the questions of how these changes happen, where they are located, as well as how they change behavior, is part of our research. One question is whether learning is a process at the sensory – input, or the motor – output side. The somatomotor touch system has a relatively simple topology and is thus better understood than other sensory systems. Learning is affected in multiple small steps; different parts and structures of the brain contribute different facets to the process of learning and alterations of behavior.