

29th RAP Seminar

The 29th Seminar on RIKEN Center for Advanced Photonics

Language: Japanese

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Location: **Cooperation Center, 3F, W319, Wako Campus, RIKEN**

(理研 和光キャンパス 研究交流棟3階会議室 W319)

Title: **The structure and function of the brain visualized by MRI at macro-scale**

MRI でみるマクロスケールの脳構造と機能

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Brief reviews on the following topics will be made.

In spite of recent efforts to reveal local microstructures in the brain and of ultrahigh field imaging, MRI lacks enough structural information to differentiate functional specialization of cortical areas or to distinguish functional parcellation as seen in cytoarchitecture.

For brain function, direct detection of electrophysiological changes has not been achieved. So far main way in MRI to find local functional activity (fMRI) is to resort to vascular responses, such as BOLD effect. With BOLD signal at a spatial resolution of sub mm scale, orientation columns in V1 have been imaged. fMRI signal is associated with local synaptic activity, relying on the tight neuro-vascular coupling. There have been interesting studies with opto-genetic technique. One is on the coupling mechanism questioning the generally accepted model with astrocyte. Another interesting opto-genetical approach was the modification of output neurons of cortical layer V in a functional area to make selective photo excitation. There was BOLD response sensing various patterns of excitation at those neurons.

The brain has been found quite restless even it is resting without any special functional efforts. The so called resting state (rs-) fMRI revealed the presence of BOLD signals associated with slowly modulated (< 0.1Hz) spontaneous neuro oscillation synchronizing in a functional cluster. There are many such clusters in the resting brain and groups of clusters with coherent activities form functional macroscopic networks. Such networks resemble to those found in task oriented fMRI.

It has been shown that the brain is quite plastic even in adult stages. Small changes in functional anatomy such as subtle cortical volume changes or changes in number of synaptic buttons after hard physical or mental training are apparently observable. After such training, new connections are formed and even new networks can be generated in rs-fMRI patterns.



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