論文内容の要旨

題目: Development of a method for interareal functional connectivity analysis in the primate inferior temporal cortex: A noninvasive approach by functional magnetic resonance imaging

（霊長類下部側頭皮質における領野間機能結合解析法の開発:

高磁場磁気共鳴画像法による非侵襲的アプローチ）

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Interaction of neurons across cerebral cortex is a building-block of complex cognitive functions such as long-term memory retrieval. The best option currently available to investigate information processing mediated by the neuronal interaction is to conduct simultaneous electrophysiological recordings from functionally interacting neurons. However, since interacting neurons are sparsely distributed across the cerebral cortex whose organizational principles is not well understood, it is often difficult to conduct such simultaneous recordings successfully: Finding functionally interacting neurons without a guiding principle is as difficult as finding a needle in a haystack. One promising approach to overcome this difficulty is to combine simultaneous electrophysiological recording with *in vivo* imaging that could map functionally interacting cortical regions. In this thesis, I developed a fMRI-based method for functional connectivity mapping that could be used to guide subsequent electrophysiology. To this end, I first compared two fMRI-based connectivity mapping methods: one using simultaneous electrical microstimulation (EM-fMRI) and

the other using temporal correlation of spontaneous fMRI activity (FC-fMRI). Direct comparison of the two mapping methods in individual macaque monkeys revealed significant differences in the 'connectivity' found by the two methods, and moreover, suggested that FC-fMRI is better suited for detecting corticocortical interactions. Next, I optimized experimental and analytical protocols of FC-fMRI to the inferior temporal cortex (ITC) of macaque monkeys whose interaction with the prefrontal cortex (PFC) is thought to be important for solving complex mnemonic tasks. Finally, to prove feasibility of the overall method, I conducted FC-fMRI guided electrophysiology from ITC and PFC. Simultaneous recordings in ITC and PFC revealed potential electrophysiological correlates of fMRI-based functional connectivity between cortical areas.