Functional connectivity: biophysical underpinnings and ramifications

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Purpose

Resting-state low frequency oscillations have been detected in many functional MRI studies and appear to be synchronized between functionally related areas [1-2]. Consistent networks have been found in large populations [3-4], with evidence from MR and other imaging modalities suggesting this activity is intrinsic neuronal activity [5]. Further, these patterns of functional connectivity have been shown to be altered in healthy controls under various physiological challenges [6].

This review will present the biophysical characterization of functional connectivity, and examine the effects of physical state manipulations (such as anesthesia or fatigue) in healthy controls.

Outline

1) Biophysical characterization
   a) resting-state MR signal properties
      i) spectral characteristics
      ii) echo-time dependence
   b) consistent networks (motor, visual, language, default)
   c) evidence from multiple modalities (EEG, PET, ASL)

2) Characterization of physiological change in healthy populations
   a) fatigue
   b) sleep
   c) anesthesia
   d) aging

Summary

Low frequency functional connectivity may be important as a potential indicator of normal neuronal activity within the brain.

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