بسم الله الرحمن الرحیم

علوم شناختی

جلسه ۱۷ (الف)

ساختار و کارکرد در مغز

Structure and Function in the Brain

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http://courses.fouladi.ir/cogsci

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PART 2:
MODELS AND TOOLS

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Chapter 9:
Strategies for Brain Mapping

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Chapter 9.1: Structure and function in the brain

Three general questions

1. How is the brain anatomically organized?

2. How is the mind functionally organized?

3. How is the functional organization of the kind reflected in the anatomical organization of the brain?

    (a) The localization question
    (b) The causation question

Studying neural/mental architecture

Three different frameworks for thinking about large-scale neural organization

Anatomical connectivity

Functional connectivity

Effective connectivity

Principle of segregation

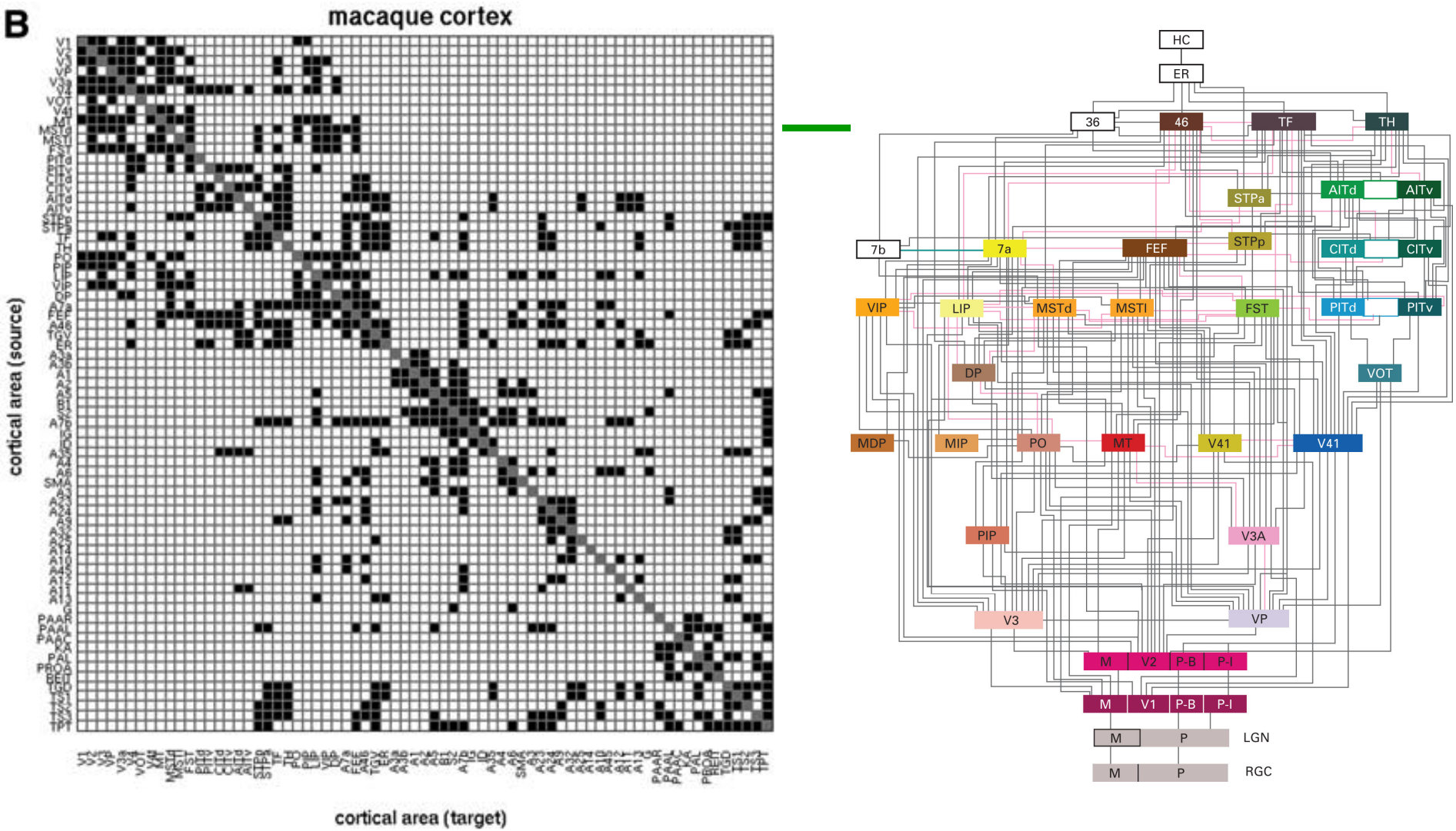
- Cerebral cortex is divided into segregated areas with distinct neuronal populations
- Brodman used staining techniques to identify cortical areas
  - types of cell they contain
  - density of cells
- Classification made on purely anatomical grounds
  – not a functional classification

Anatomical connectivity

- Given by the anatomical connections between different cortical structures
- Can be mapped using Diffusion Tensor Imaging
    - Using the diffusion of water molecules to track axonal connections between cortical regions
- The most reliable data are derived from tracing studies (invasive)

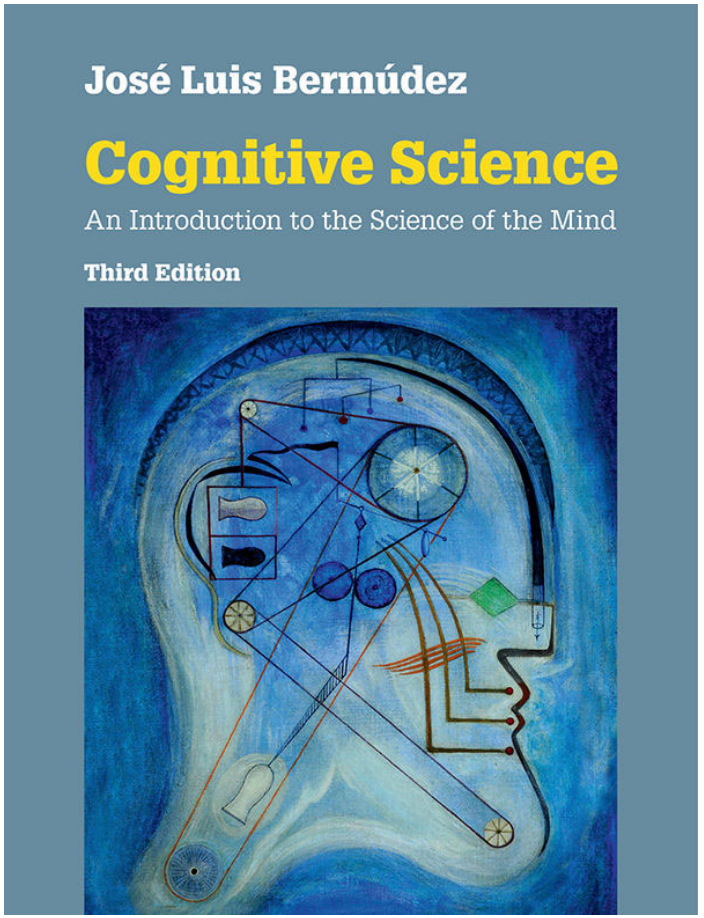
Modeling anatomical connectivity

- Network diagrams of cortical regions in non-human primates
- Wiring diagrams derived from cortical connectivity matrices
- Large-scale cortical networks can be analyzed graph-theoretically
  - Seem to have small-world connectivity patterns

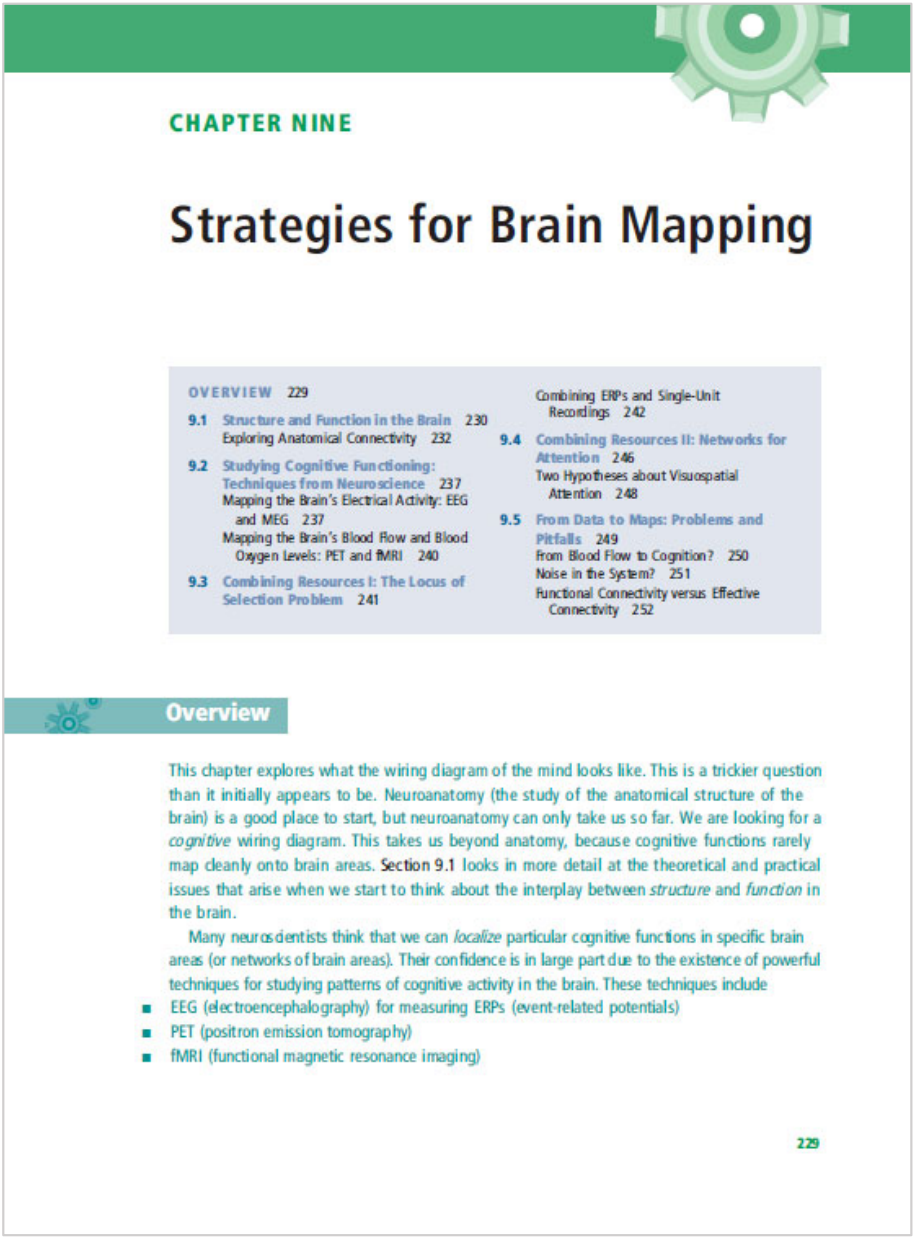


Connectivity matrix and wiring diagram for macaque visual cortex
(based on Felleman and Van Essen 1991)

منبع اصلی



José Luis Bermúdez,
Cognitive Science:
An Introduction to the Science of the Mind,
3rd ed., Cambridge University Press, 2020.
Chapter 9 (Section 9.1)



CHAPTER NINE

Strategies for Brain Mapping

Overview

This chapter explores what the wiring diagram of the mind looks like. This is a trickier question than it initially appears to be. Neuroanatomy (the study of the anatomical structure of the brain) is a good place to start, but neuroanatomy can only take us so far. We are looking for a *cognitive* wiring diagram. This takes us beyond anatomy, because cognitive functions rarely map cleanly onto brain areas. Section 9.1 looks in more detail at the theoretical and practical issues that arise when we start to think about the interplay between *structure* and *function* in the brain.

Many neuroscientists think that we can *localize* particular cognitive functions in specific brain areas (or networks of brain areas). Their confidence is in large part due to the existence of powerful techniques for studying patterns of cognitive activity in the brain. These techniques include

- EEG (electroencephalography) for measuring ERPs (event-related potentials)
- PET (positron emission tomography)
- fMRI (functional magnetic resonance imaging)

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