NEUROSCIENCE IV

Prof. Alexander Huth

2/4/2020

LAST TIME

* cortex
* cortical cell types
* methods
  * lesions

TODAY

* methods
  * lesions
  * neurophysiology
* cortical maps
* receptive fields

METHODS

* **Break it**

* Measure it

LESIONS

* First scientific way to study human brain function

* Led to idea of **localization of function**

  * The brain is divided into parts or **areas**

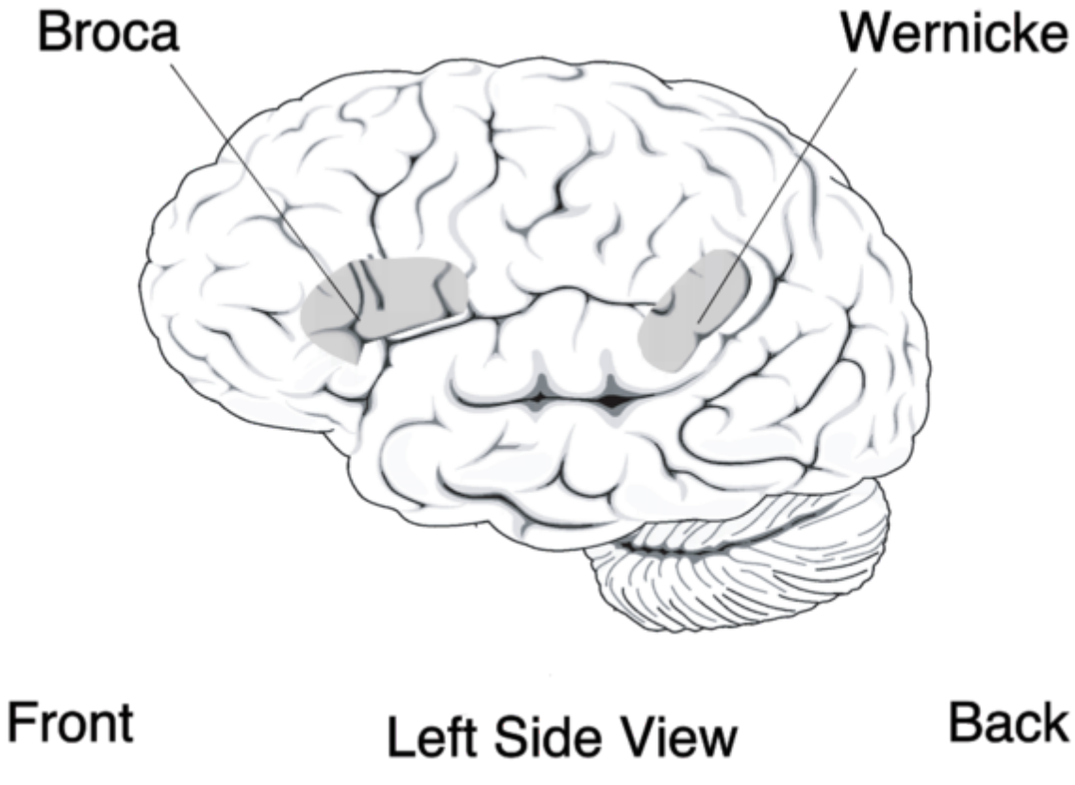
  * What is the function of each area?

LESIONS

* Broca’s aphasia: the inability to **produce** fluent speech

Paul Broca (1824-1880)

Example: https://www.youtube.com/watch?v=JWC-cVQmEmY

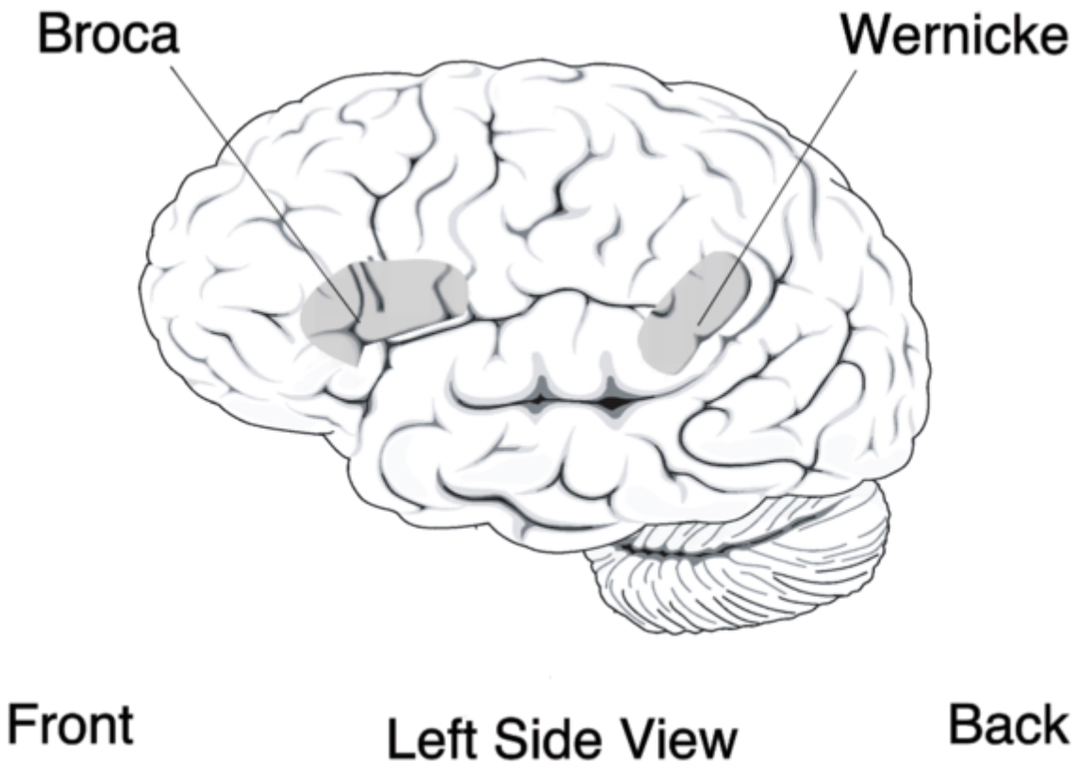


LESIONS

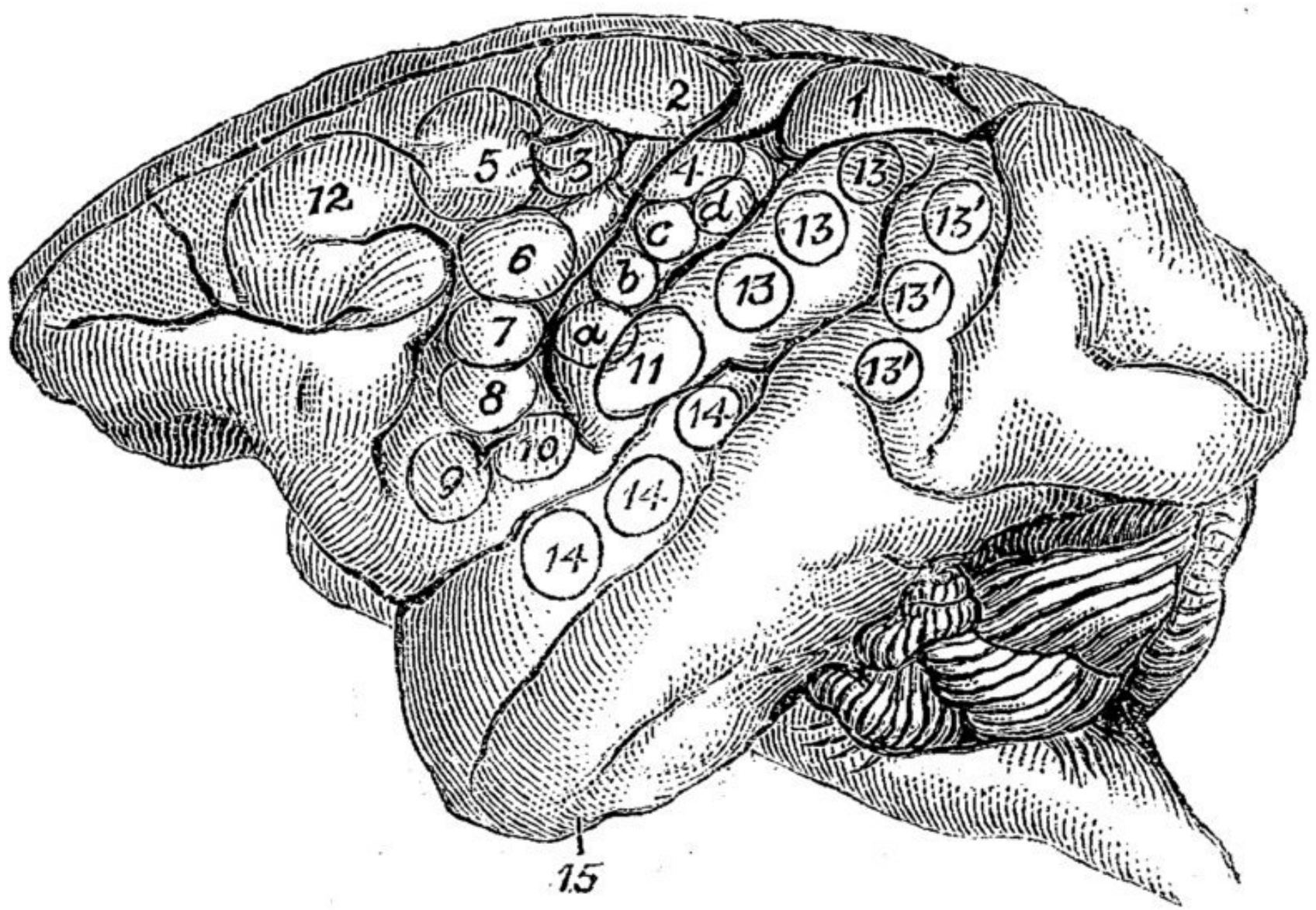
* Wernicke’s aphasia: the inability to **understand** speech

Carl Wernicke (1848-1905)

Example: https://www.youtube.com/watch?v=3oef68YabD0



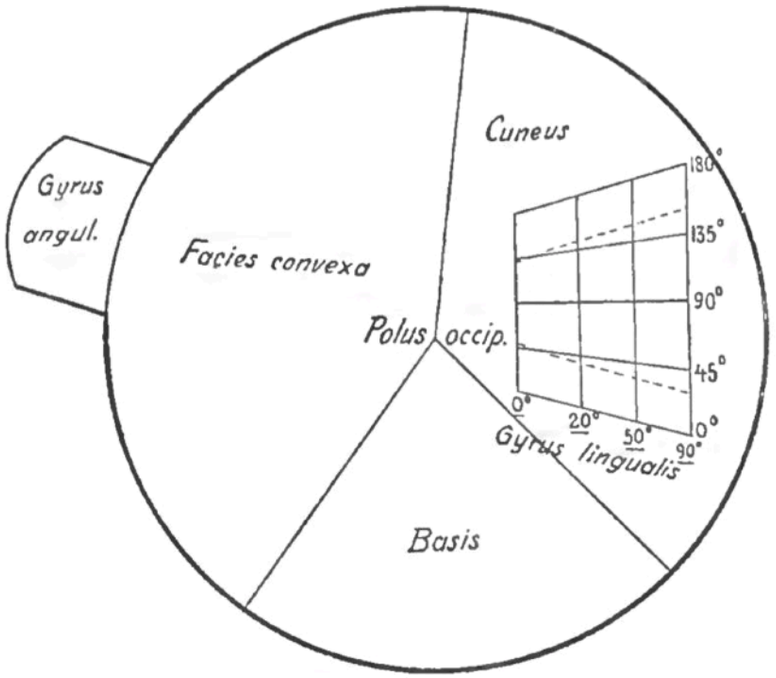
SOMATOTOPIC MAPS



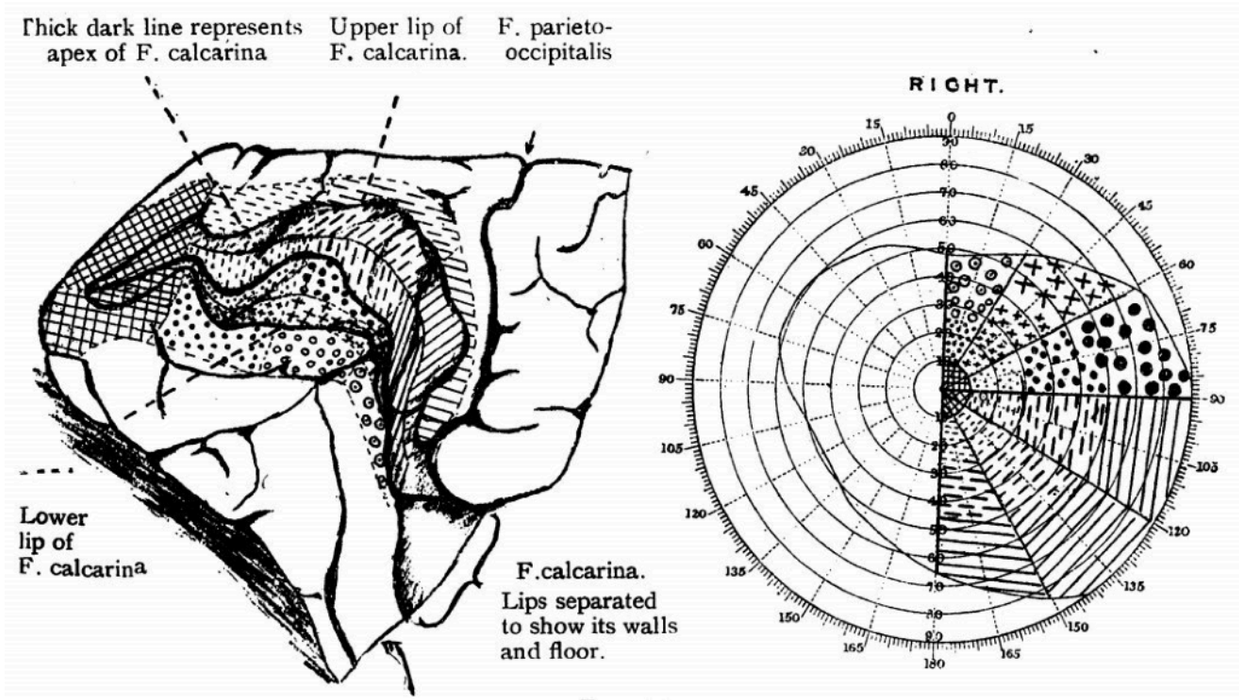
David Ferrier, 1886

RETINOTOPIC MAPS

Fig. 39.
Flächentreue Darstellung der linken Haupt- und Nebensehsphäre.



Tatsuji Inouye, 1909



Gordon Holmes, 1918

RETINOTOPIC MAPS

* https://gallantlab.org/pycortex/retinotopy_demo/

LESION DISCUSSION

* There are many problems with using lesions to **interpret** & **understand** brain function

* Can you think of some? Discuss with your neighbors for 2 minutes

METHODS

* Break it

* **Measure it**

MEASURE WHAT?

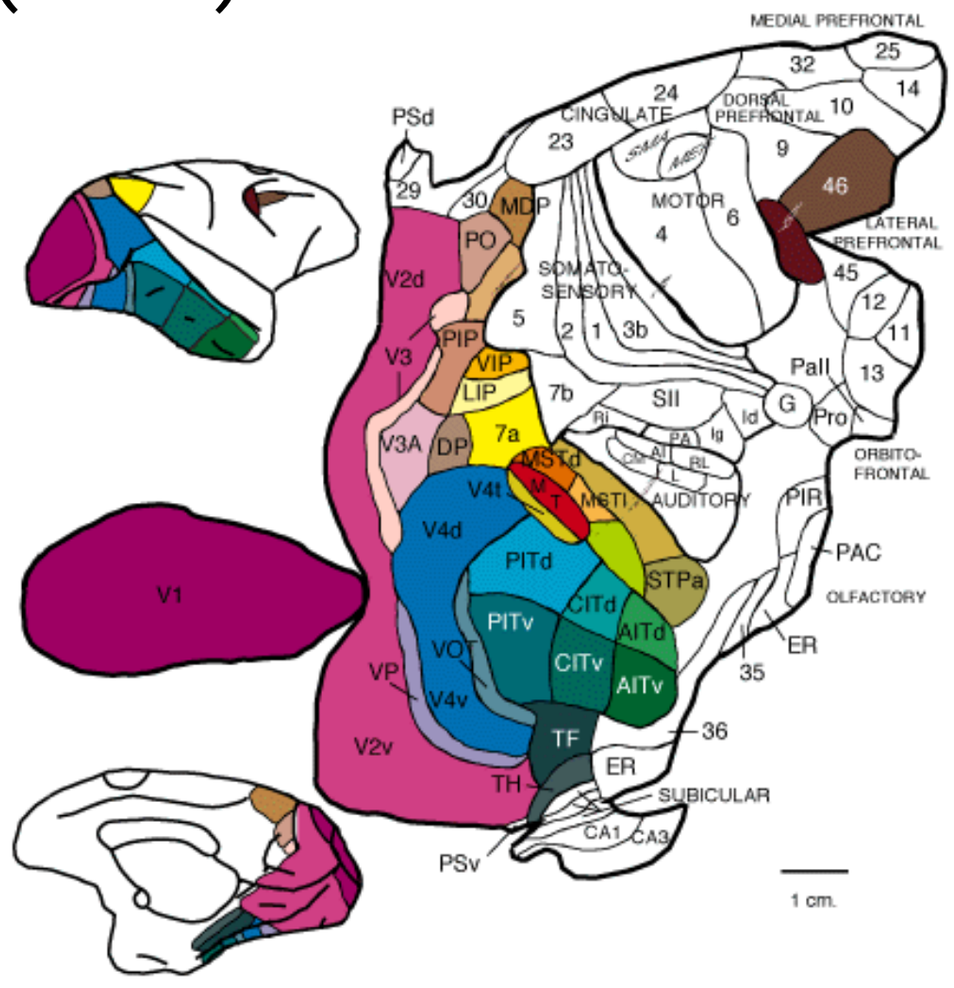
* Anatomy

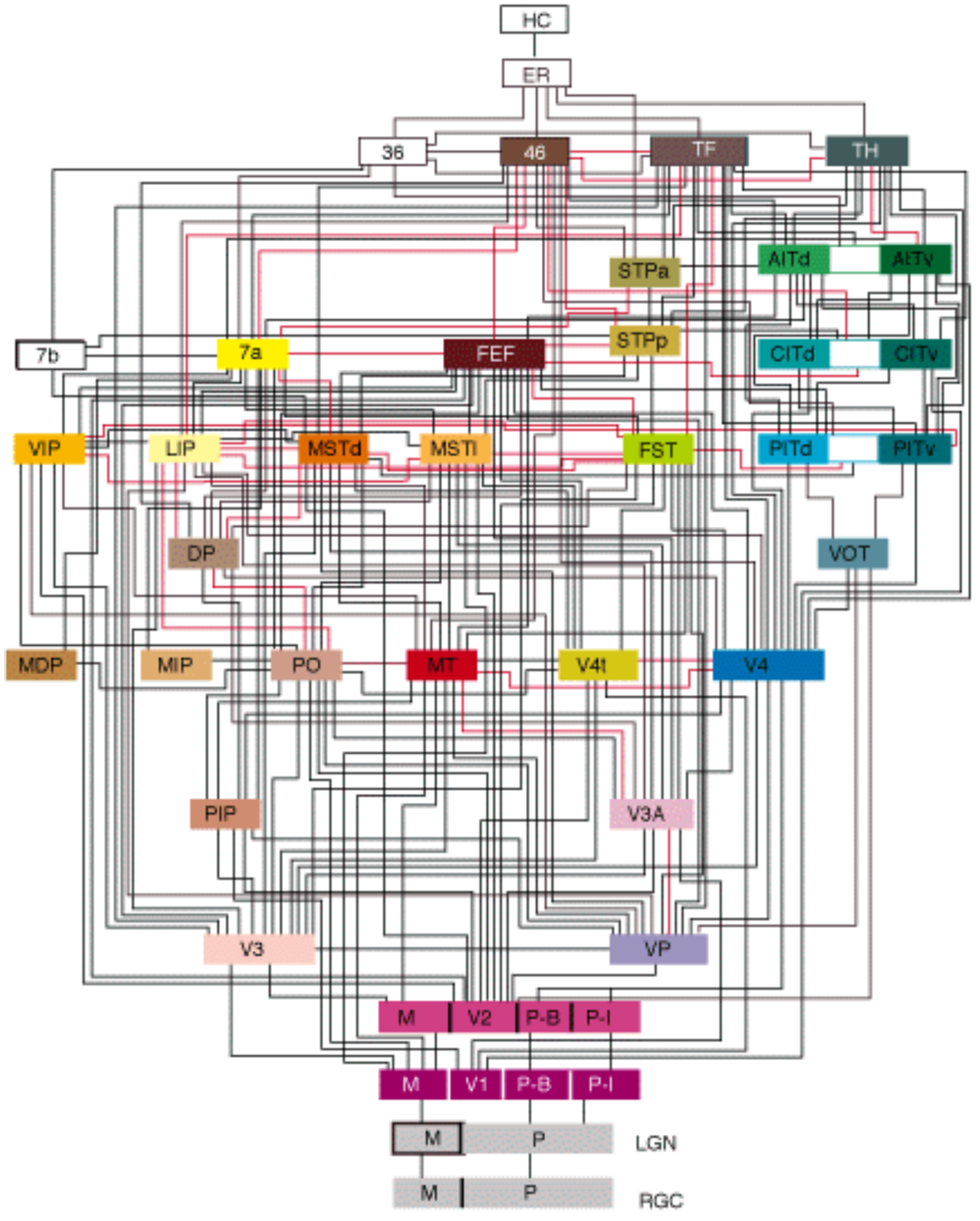
* Connectivity

* Function

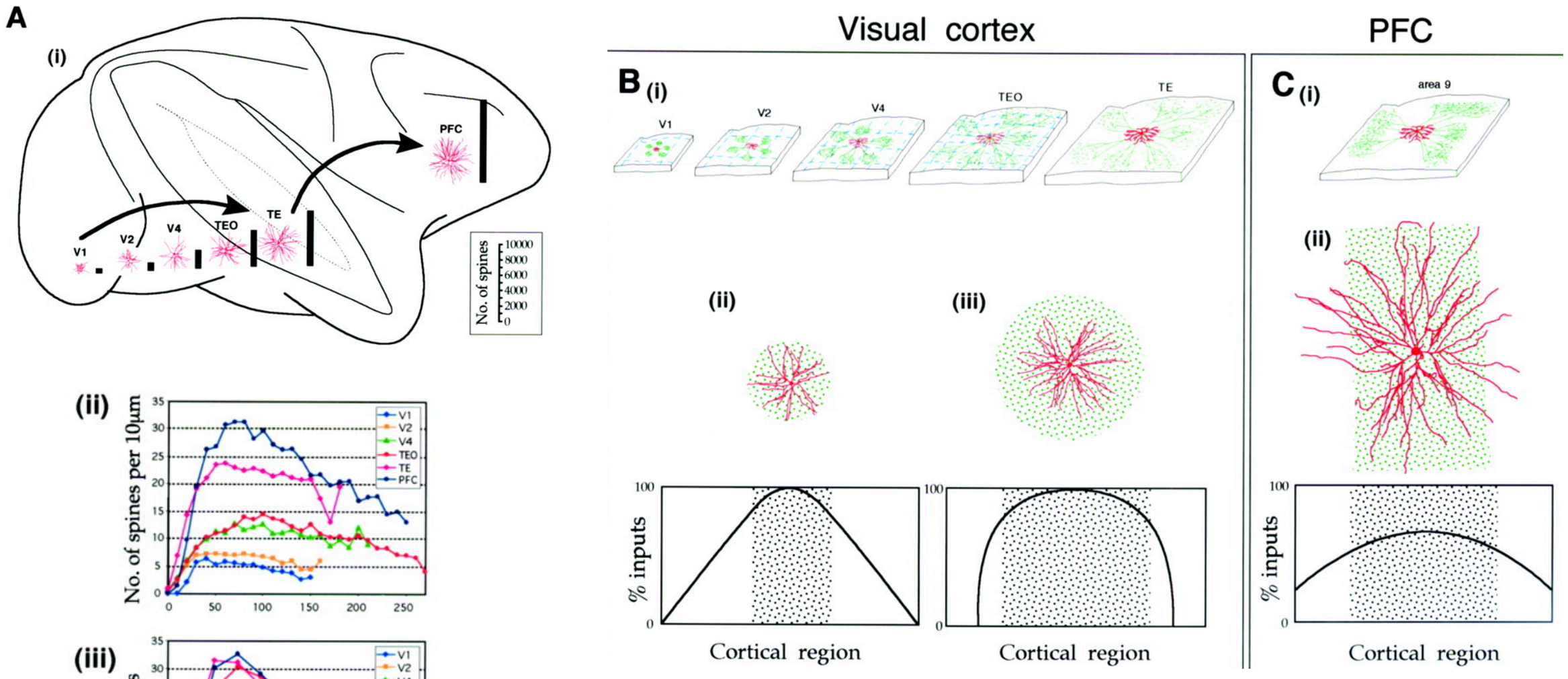
CONNECTIVITY

* **Connectivity** of areas in macaque visual cortex
* Felleman & Van Essen (1991)





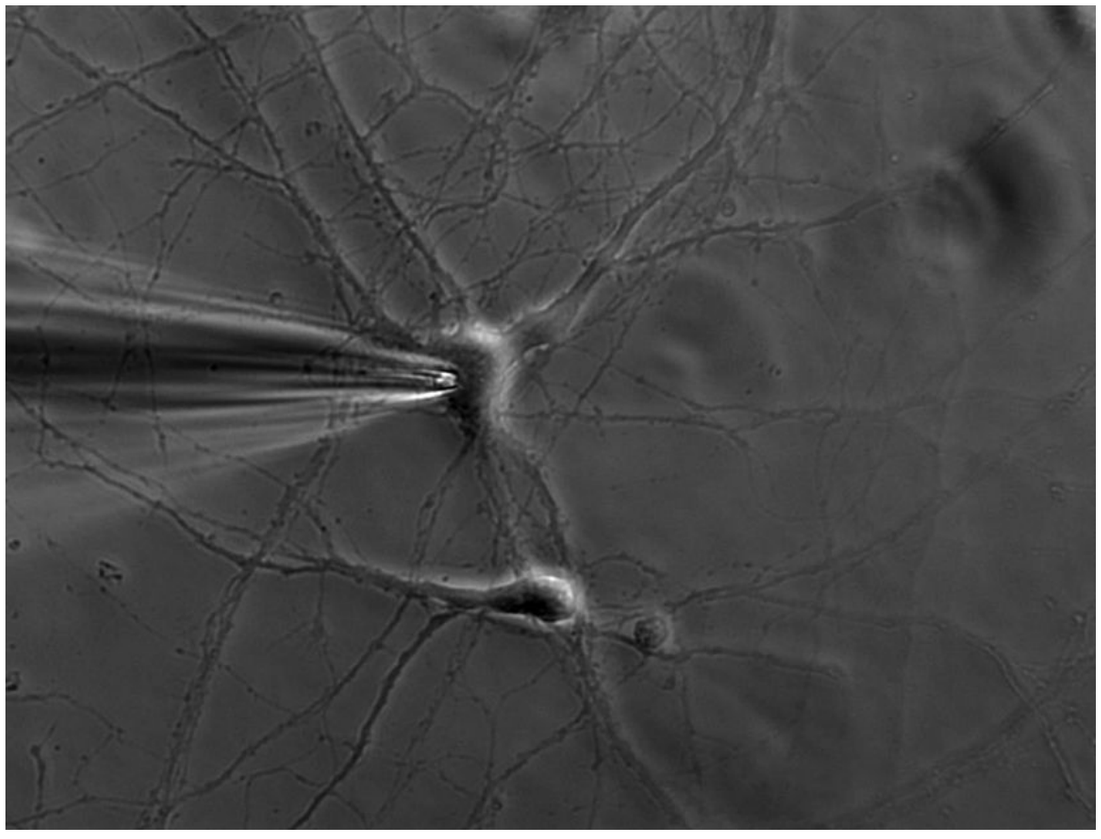
(MORPHOLOGY AGAIN)



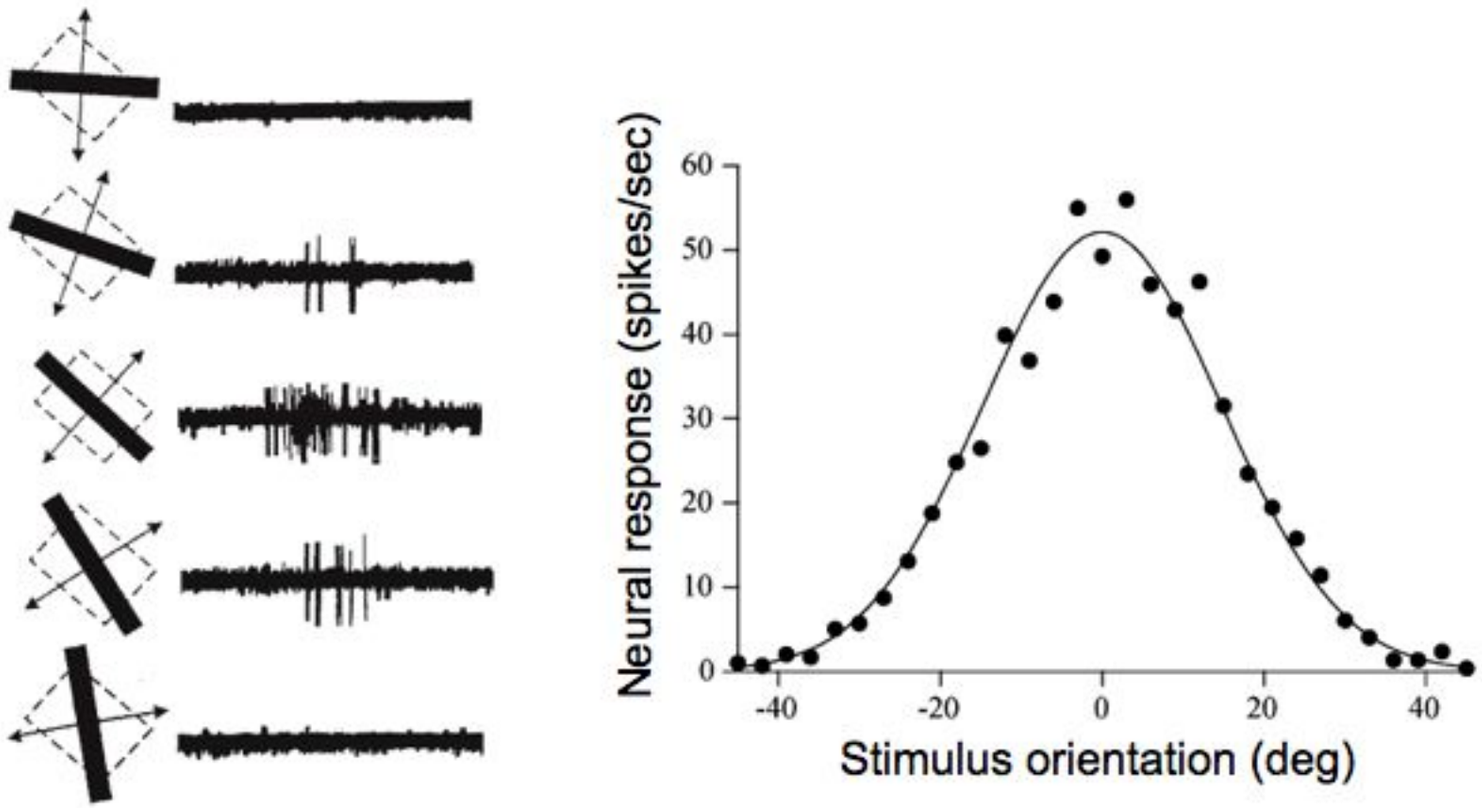
Elston (2003)

NEUROPHYSIOLOGY

* It’s possible to measure the activity of a single neuron using an **electrode**



NEUROPHYSIOLOGY



Hubel & Wiesel, 1968

NEUROPHYSIOLOGY

* Individual neurons can be characterized as having **receptive fields**

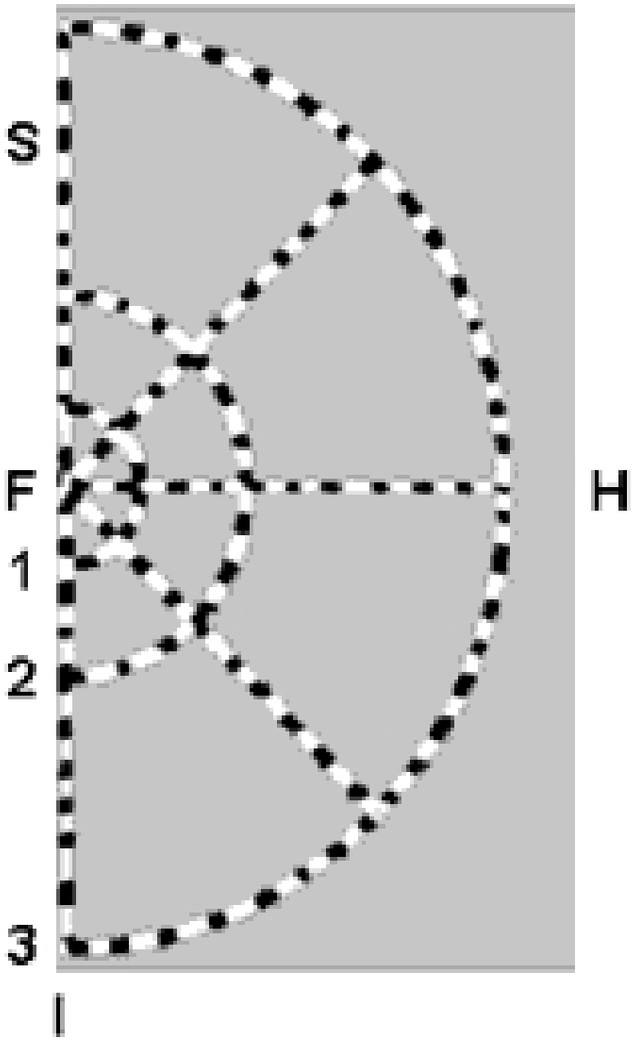
* A receptive field is the **stimulus subspace** that **elicits activity** in a neuron

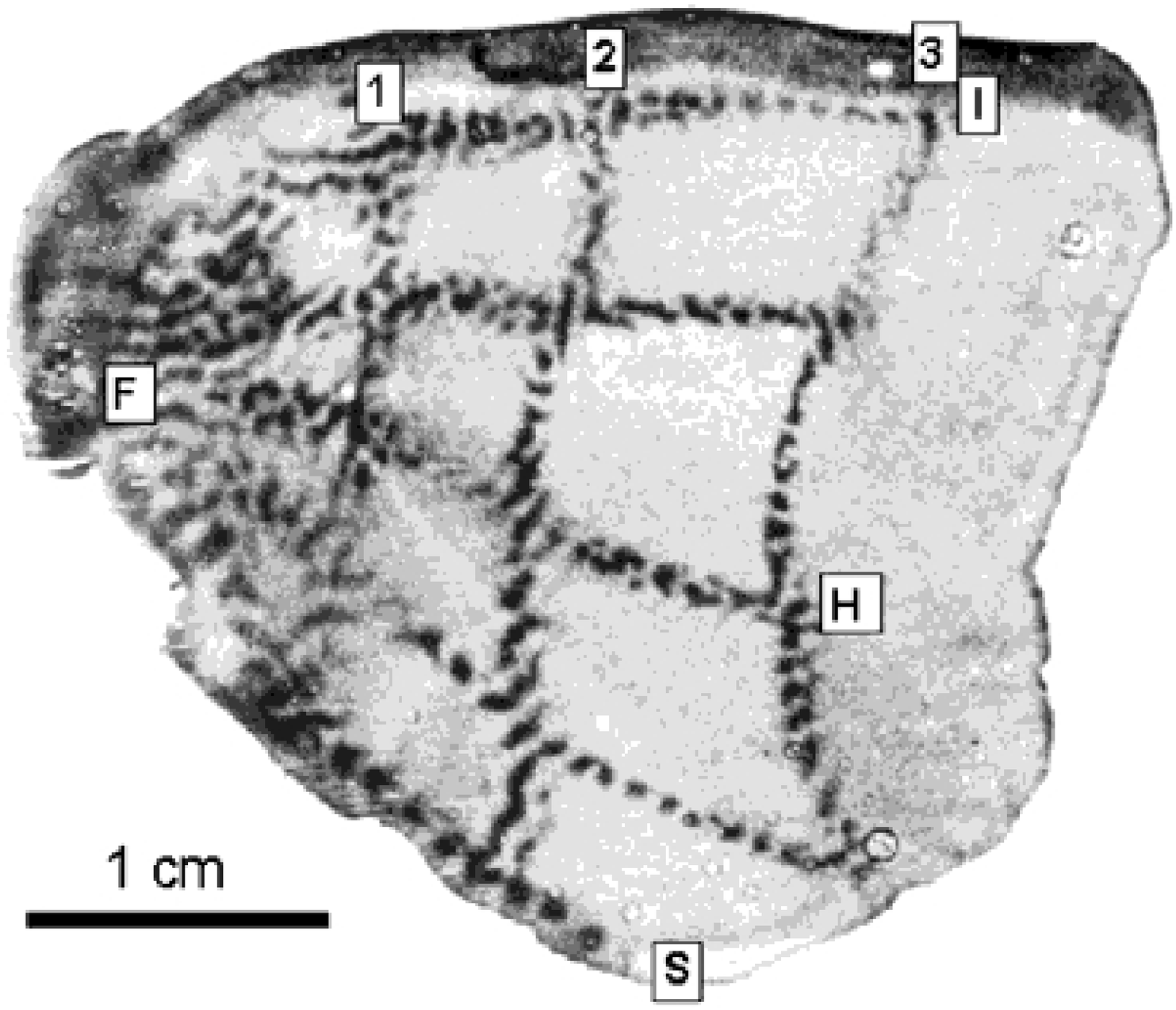
NEUROPHYSIOLOGY

* Neurophysiology can also be used to reveal **cortical maps**

* *Nearby* neurons have *similar* receptive fields

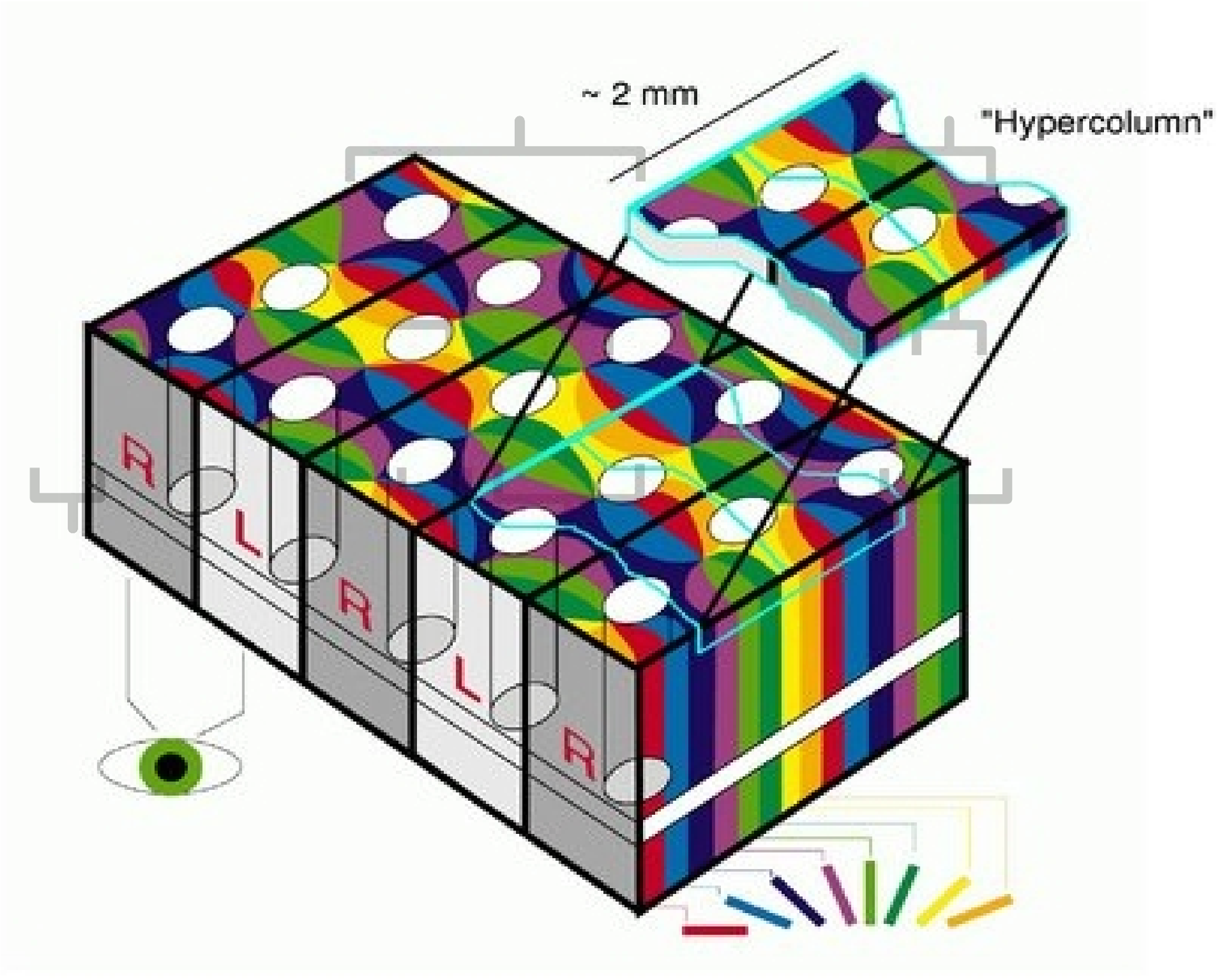
Retinotopic map in primary visual cortex





Tootell, Silverman, Switkes & DeValois, 1982

Many dimensions are coded at each position



RECAP

* methods
  * lesions
    * neurophysiology
* cortical maps
* receptive fields

NEXT TIME

* neuroscience methods & limitations