9.01 Introduction to Neuroscience
Fall 2007

Complex cell receptive field

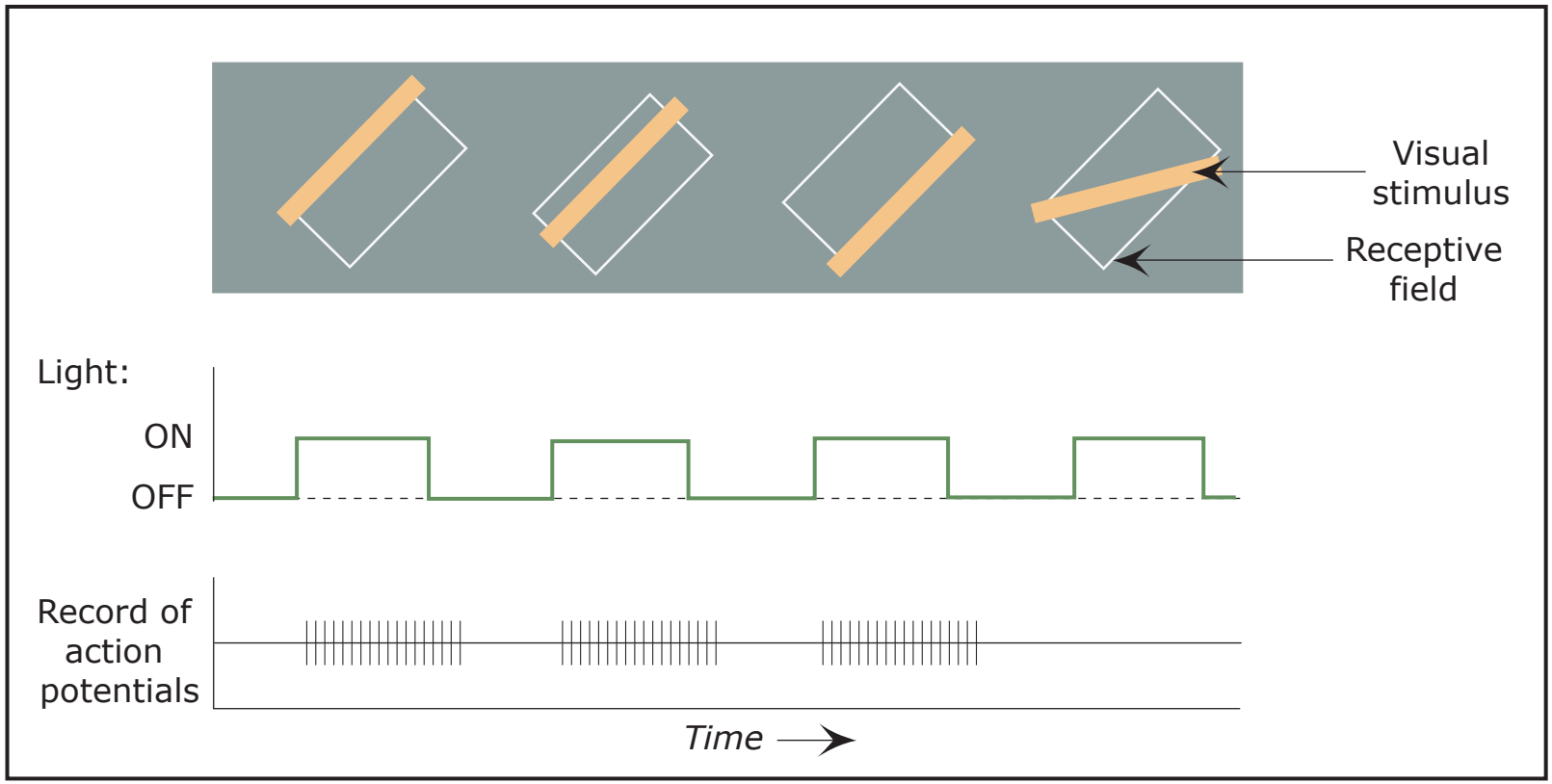

Figure by MIT OpenCourseWare. After figure 10.24 in Bear, Mark F., Barry W. Connors, and Michael A. Paradiso. *Neuroscience: Exploring the Brain.* 2nd ed. Baltimore, MD: Lippincott Williams & Wilkins, 2001. ISBN: 9780781760034.

Complex cell

- Invariance to location within receptive field
- No subregions

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Video screenshot.

Direction selectivity

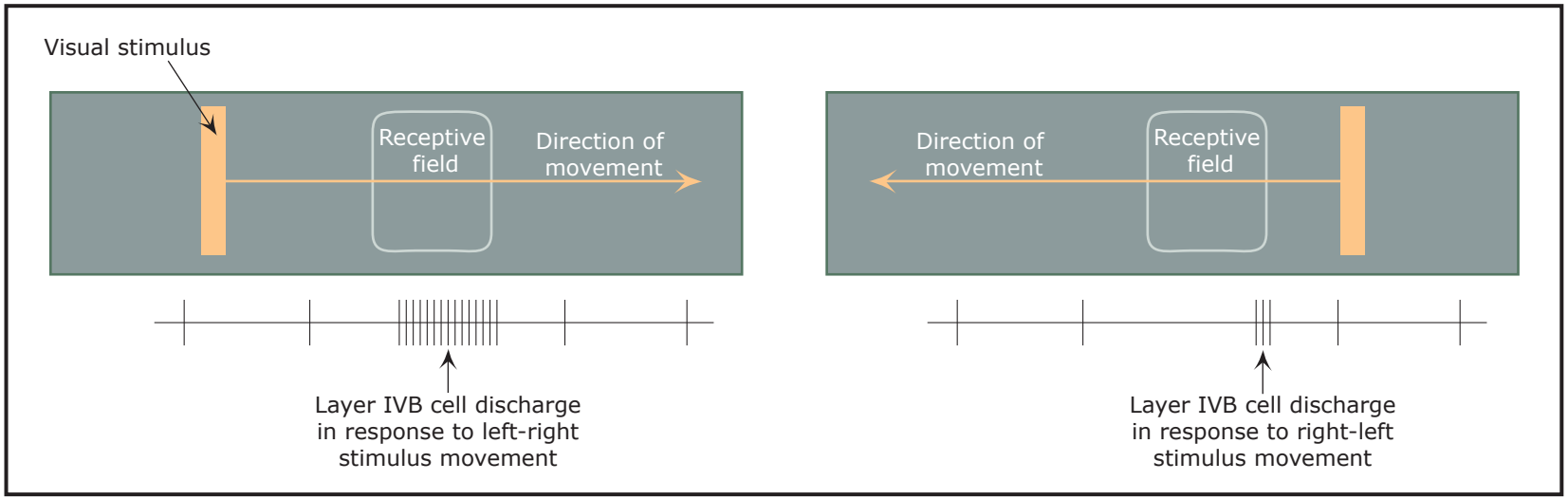

Figure by MIT OpenCourseWare. After figure 10.23 in Bear, Mark F., Barry W. Connors, and Michael A. Paradiso. *Neuroscience: Exploring the Brain.* 2nd ed. Baltimore, MD: Lippincott Williams & Wilkins, 2001. ISBN: 9780781760034.

Retinotopy

- Neighboring cells have neighboring receptive fields.
- Magnification of map for central vision.

Cortical maps

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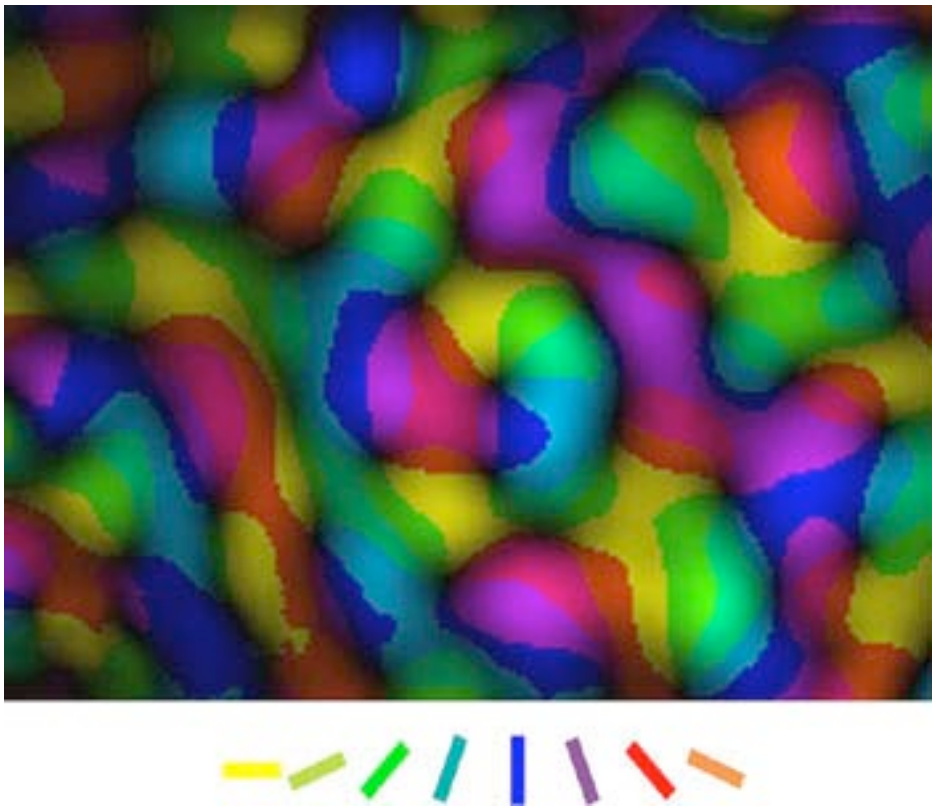
Orientation map



Courtesy of Prof. Dr. Ralf A. W. Galuske. Used with permission.

Galuske

Columnar organization

- Column: group of cells encountered in radial direction
- Cells in a column have similar receptive field properties

Laminar organization

- basic six-layer design
- striate cortex has nine layers

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Figure 10.12, Bear, Mark F., Barry W. Connors, and Michael A. Paradiso. "The Cytoarchitecture of the Striate Cortex."
In *Neuroscience: Exploring the Brain.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins, 2007. ISBN: 9780781760034.

Hubel-Wiesel model

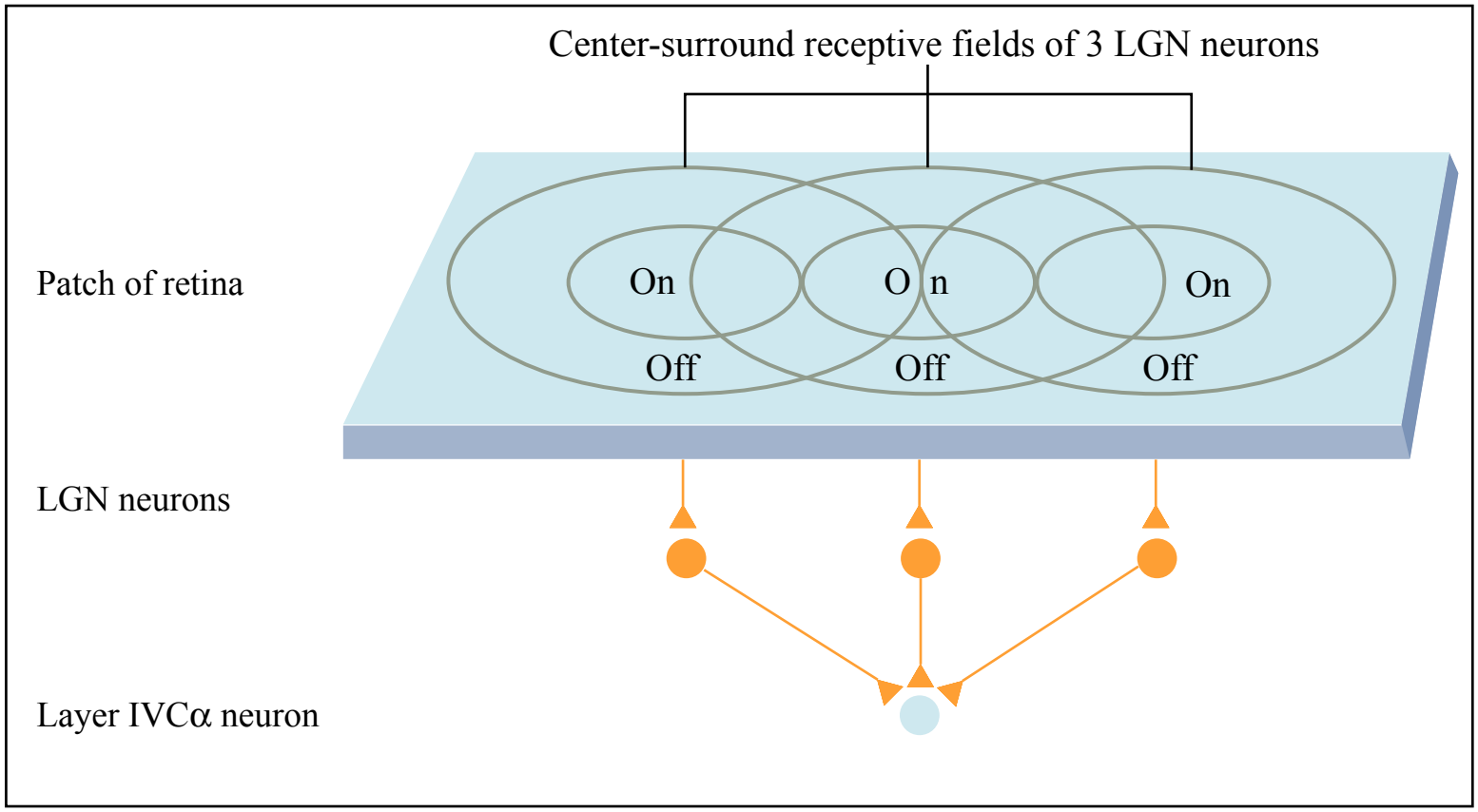
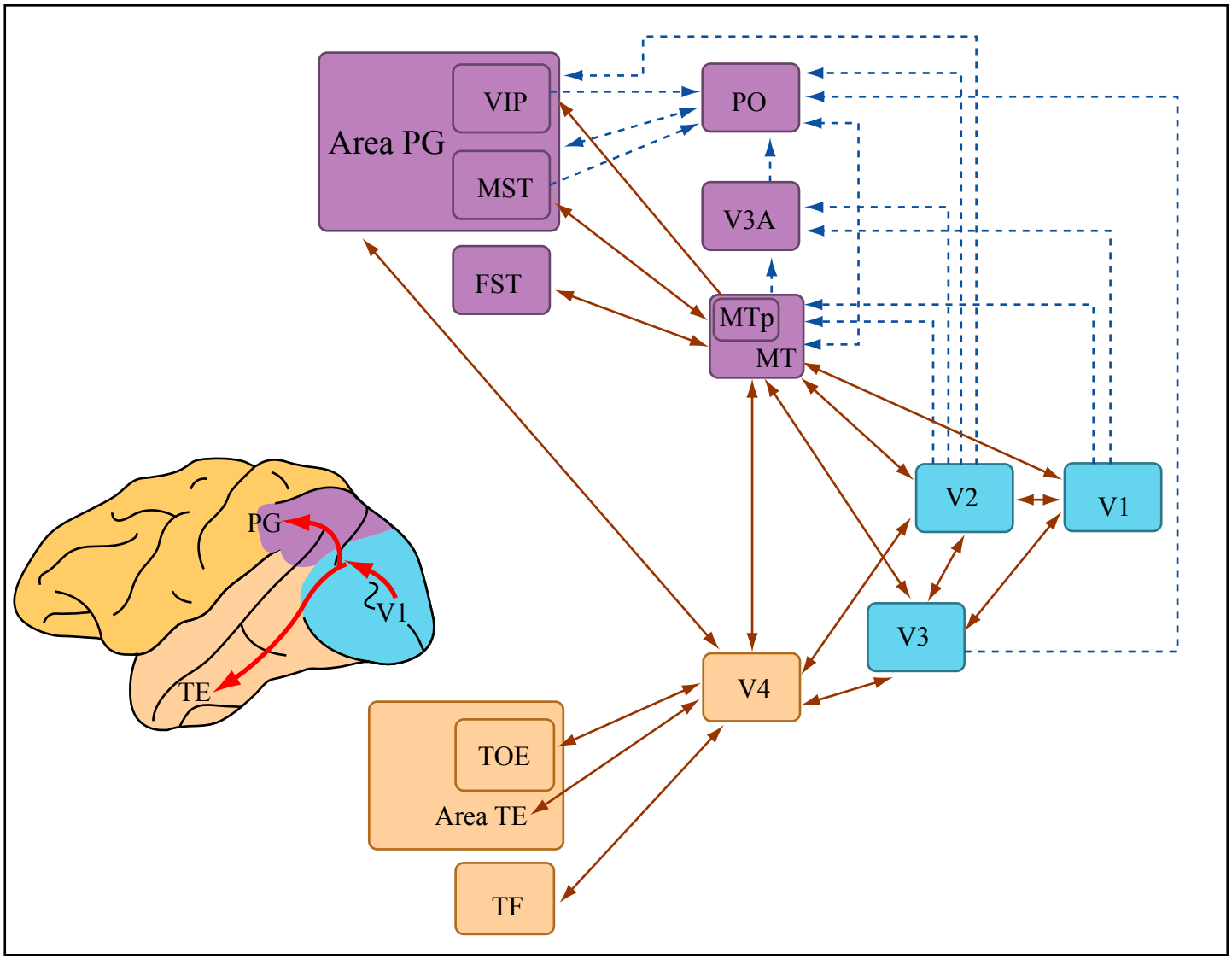


Figure by MIT OpenCourseWare. After Figure 10.23b in Bear, Connors, and Paradiso, 2007.

Dorsal and ventral streams



"where"

"what"

Figure by MIT OpenCourseWare.

Inferotemporal cortex

- neuropsychology
  - IT lesions cause agnosia (“psychic blindness”)
  - monkeys and humans
- neurophysiology
  - neurons are selective to complex features
  - high degree of spatial invariance

“Face cells”

Image removed due to copyright restrictions.
Chart showing neuron response to different monkey faces
(full frontal and at different rotations), plus a hand and brush.

Face-evoked brain activity

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Figure 10.30 in Bear, Mark F., Barry W. Connors, and Michael A. Paradiso. *Neuroscience: Exploring the Brain*. 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins, 2007. ISBN: 9780781760034.

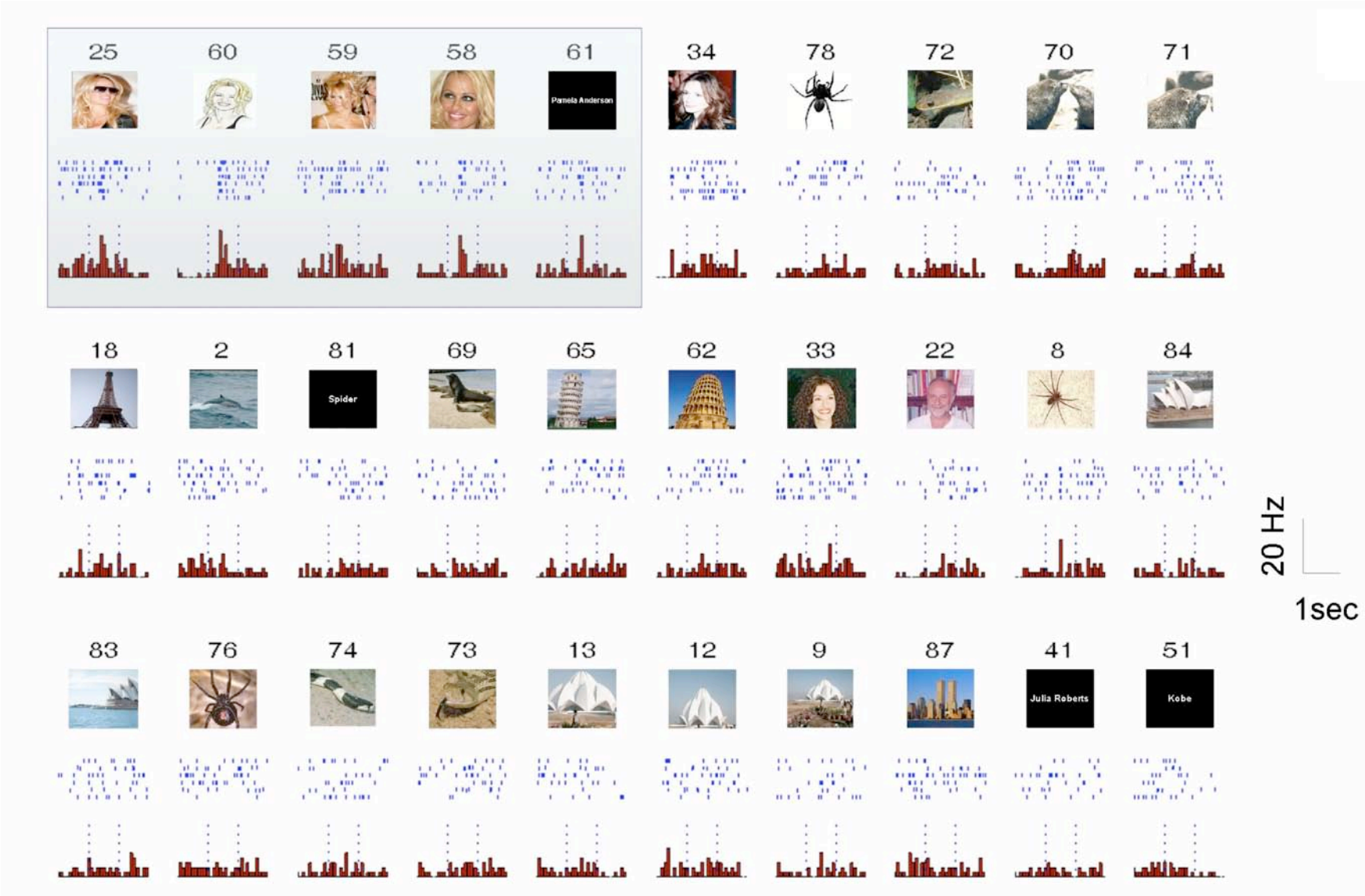
Human neurophysiology

- Medial temporal lobe
  - hippocampus, amygdala, entorhinal cortex, parahippocampal gyrus
- Stimuli
  - famous persons, buildings, animals, objects
- Quiroga, Reddy, Kreiman, Koch, and Fried. *Nature* 435:1102 (2005).

Jennifer Aniston neuron

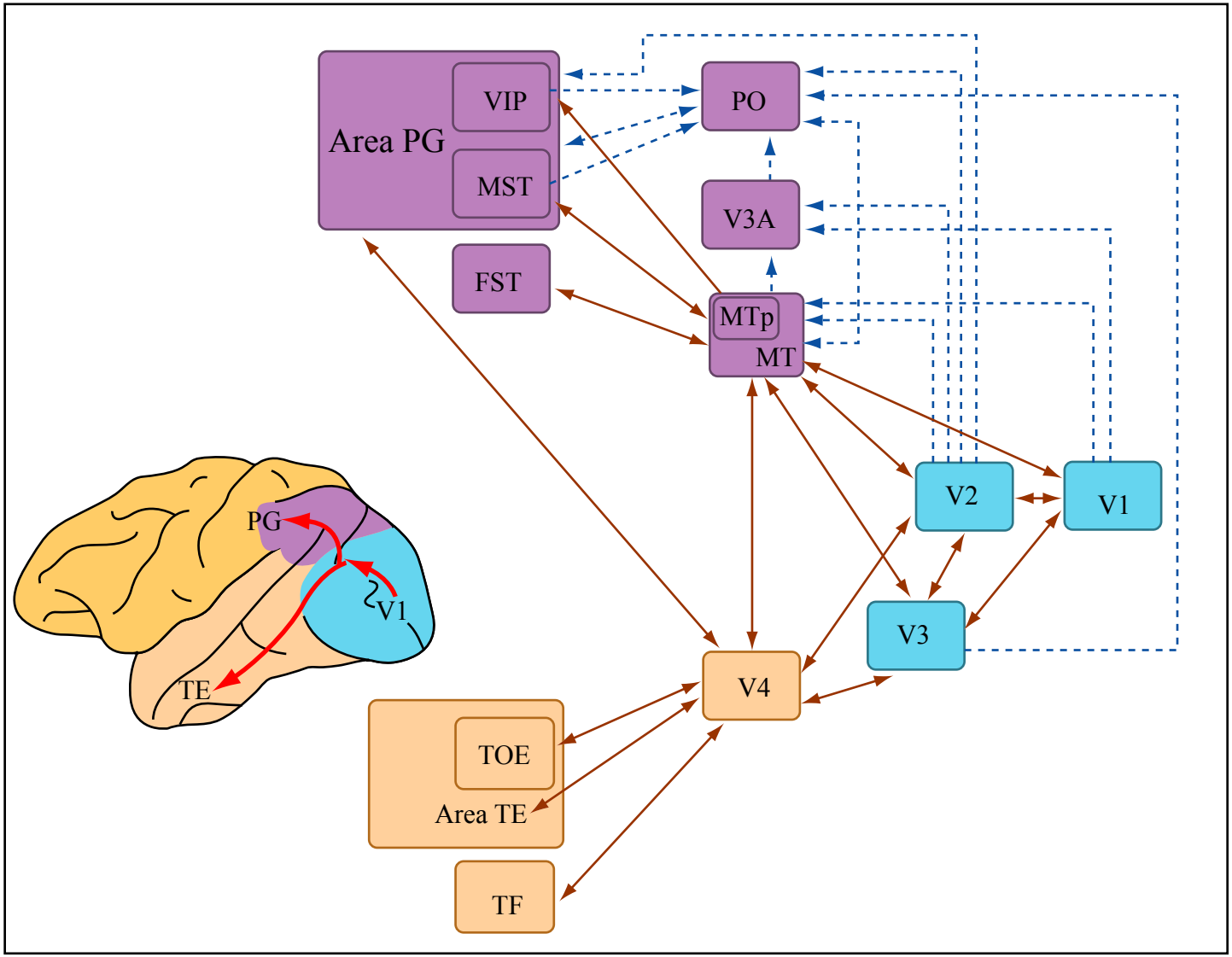
Courtesy of R. Quian Quiroga. Used with permission. Source: Quiroga, R. Q., et al. "Invariant Visual Representation by Single Neurons in the Human Brain." *Nature* 435 (June 23, 2005): 1102-1107. doi:10.1038/nature03687.

Pamela Anderson neuron



Courtesy of R. Quian Quiroga. Used with permission. Source: Quiroga, R. Q., et al. "Invariant Visual Representation by Single Neurons in the Human Brain." *Nature* 435 (June 23, 2005): 1102-1107. doi:10.1038/nature03687.

Dorsal and ventral streams



"where"

"what"

Figure by MIT OpenCourseWare.

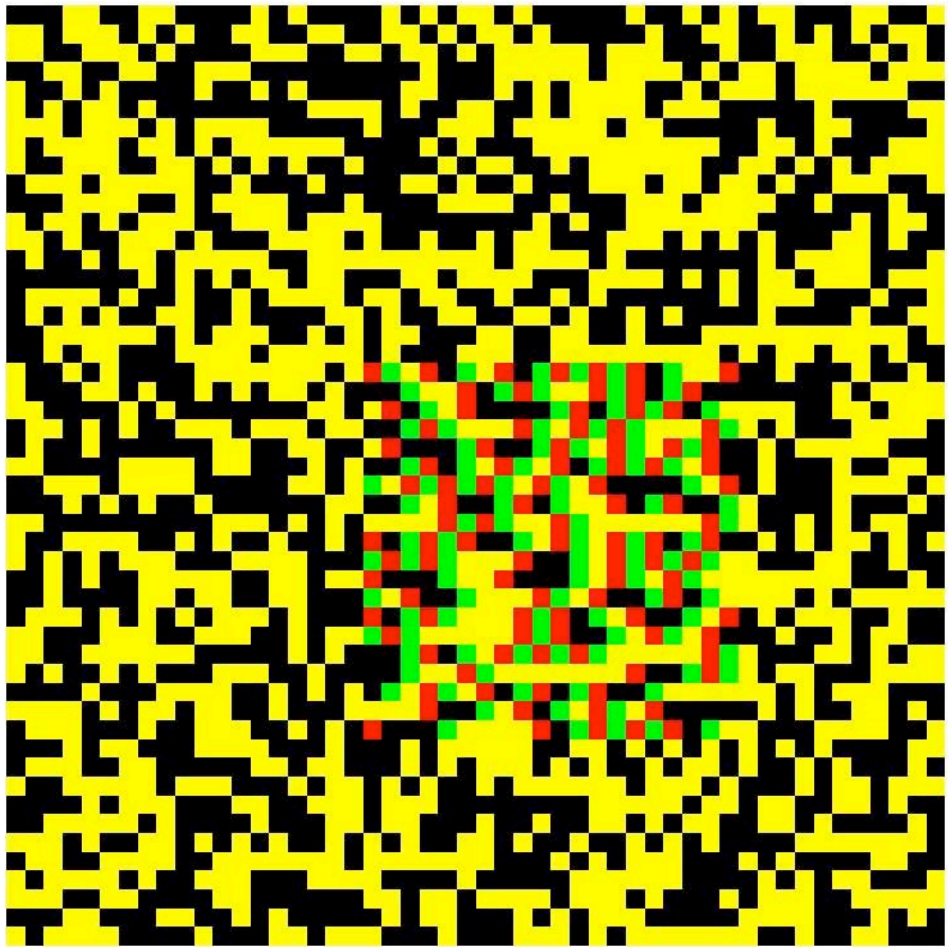
Motion sensitive areas

- Area V5 or MT
  - large receptive fields
  - direction-selective
  - columnar organization
- MST
- Other nearby areas
  - lesions produces akinetopsia

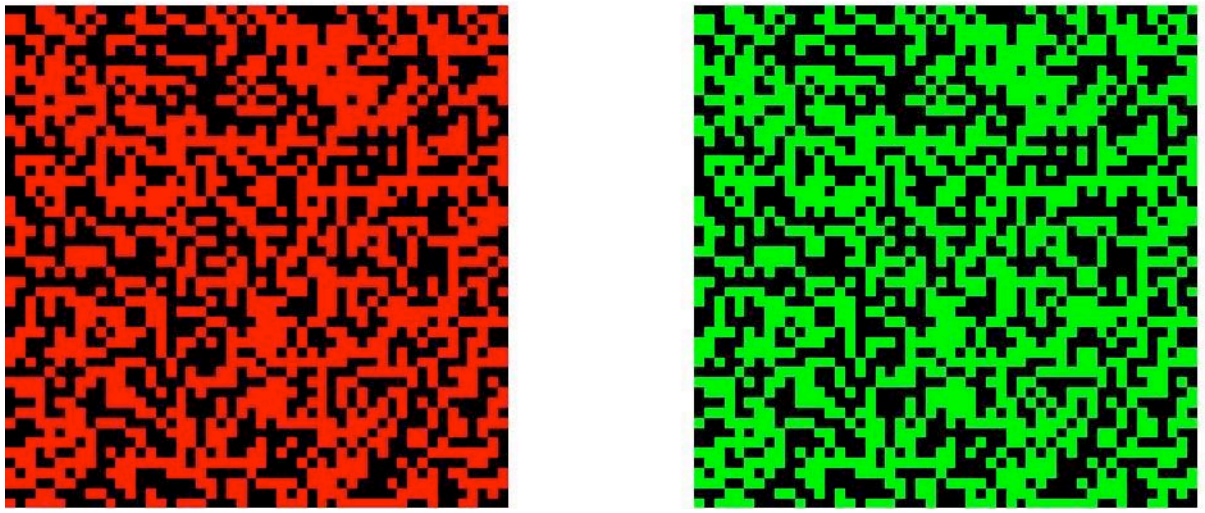
Double dissociation

- form without motion
  - akinetopsia
- motion without form
  - blindsight

Random dot stereogram



Different monocular images



Lateral geniculate nucleus

- dorsal thalamus
- major targets of optic tracts

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Figure 10.7, Bear, Mark F., Barry W. Connors, and Michael A. Paradiso. "LGN of the Macaque Monkey."
In *Neuroscience: Exploring the Brain.* 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins, 2007. ISBN: 9780781760034.

LGN input is segregated

- contra: layers 1,4,6
- ipsi: layers 2,3,5
- retinotopic map in each layer
- maps are aligned

Image removed due to copyright reasons.
Figure 10.8 Bear, Mark F., Barry W. Connors, and Michael A. Paradiso. "Retinal Inputs to the LGN Layers." In *Neuroscience: Exploring the Brain*. 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins, 2007. ISBN: 9780781760034.

Ocular dominance columns

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