

Introduction to Course 9.04, Vision and Audition

Vision: Peter H. Schiller

Audition: Chris Brown

Reading assignments

Lectures

Research reports

Exams

Grade breakdown:

Written report, vision	= 10%
Midterm exam	= 25%
Written report, audition	= 10%
Final exam	= 55% (Vision, 15%, Audition, 40%)

Introductions

What aspects of visual processing are we trying to understand?

The layout and organization of the visual system

Adaptation and Color vision

Movement processing

Depth perception

Object recognition

Generation of visually guided eye movements

Schedule for the section on the visual system:

Sep 9: The basic layout of the retina and the lateral geniculate nucleus

Sep 11: The visual cortex

Sep 16: The ON and OFF channels

Sep 18: The midget and parasol channels

Sep 23: Adaptation and color

Sep 25: Depth perception

Sep 30: Form perception

Oct 2: Illusions and visual prosthesis

Oct 7: The neural control of visually guided eye movements, 1

Oct 9: The neural control of visually guided eye movements, 2

Oct 16: Motion perception and pursuit eye movements

Oct 21: Overview

Oct 23: Midterm exam

Tools of the trade:

Psychophysics

Anatomy

Electrophysiology

Pharmacology

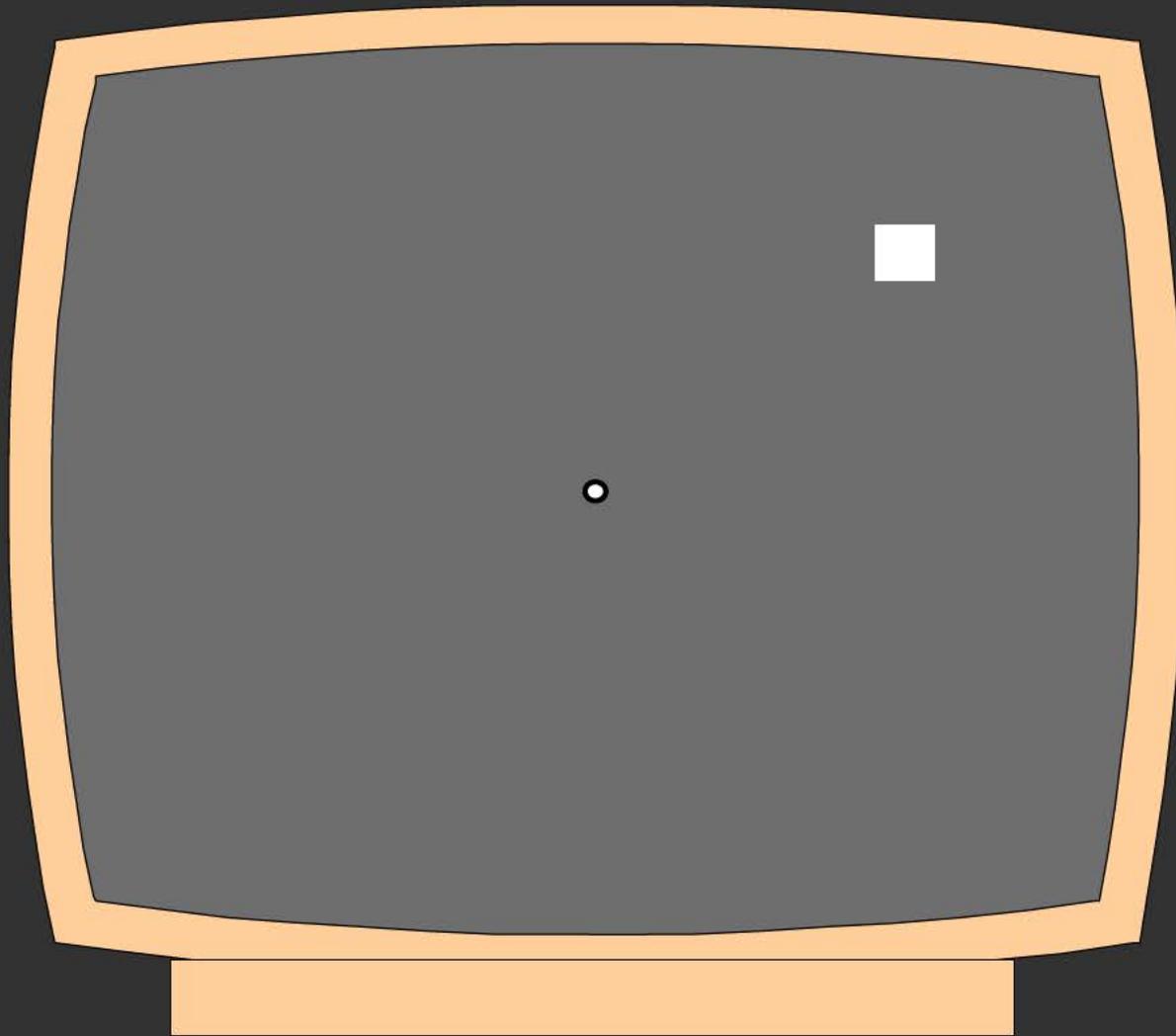
Brain lesions

Imaging

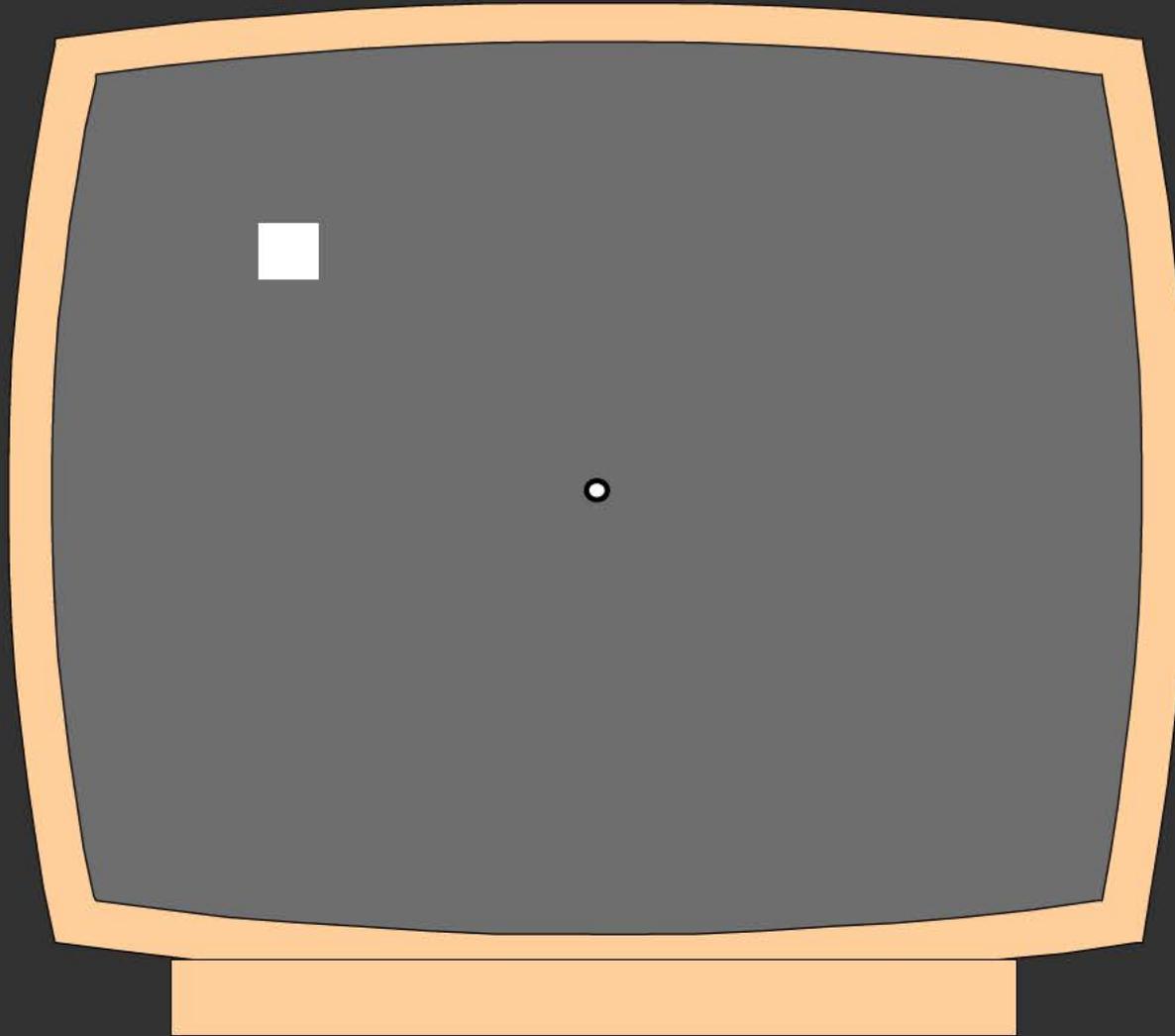
Optogenetics

Psychophysics

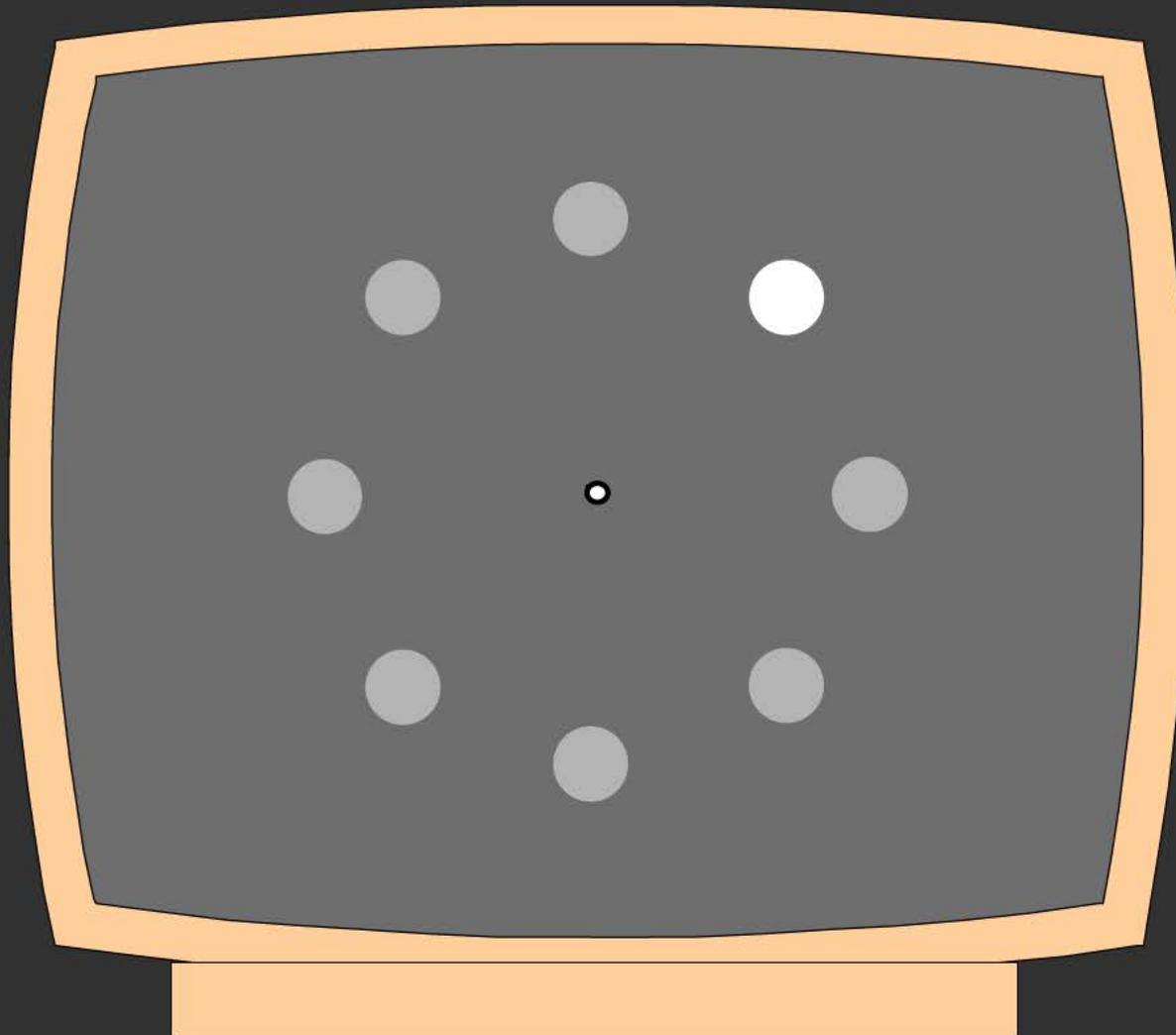
Detection



Detection



Discrimination



Anatomy

Monkey brain

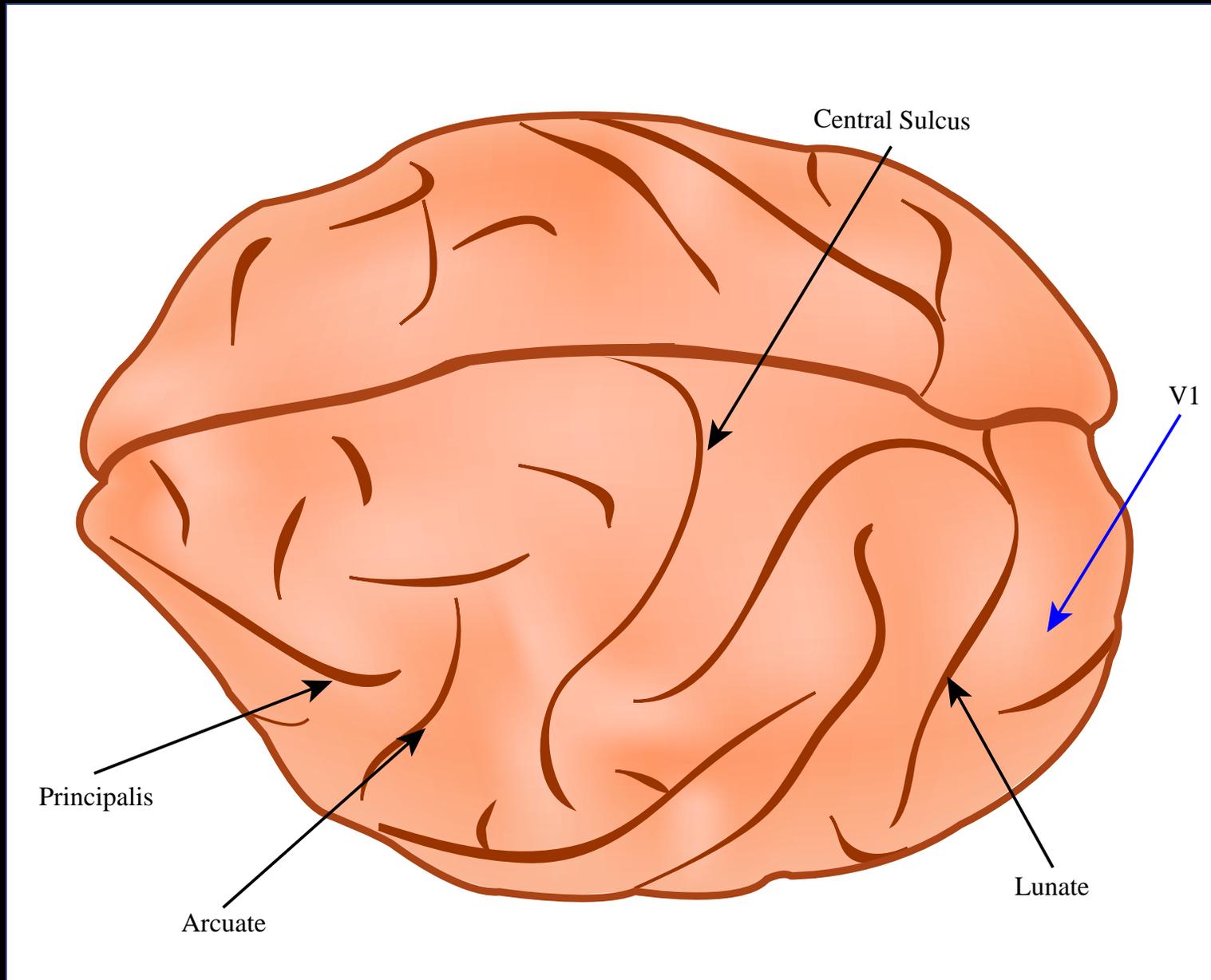
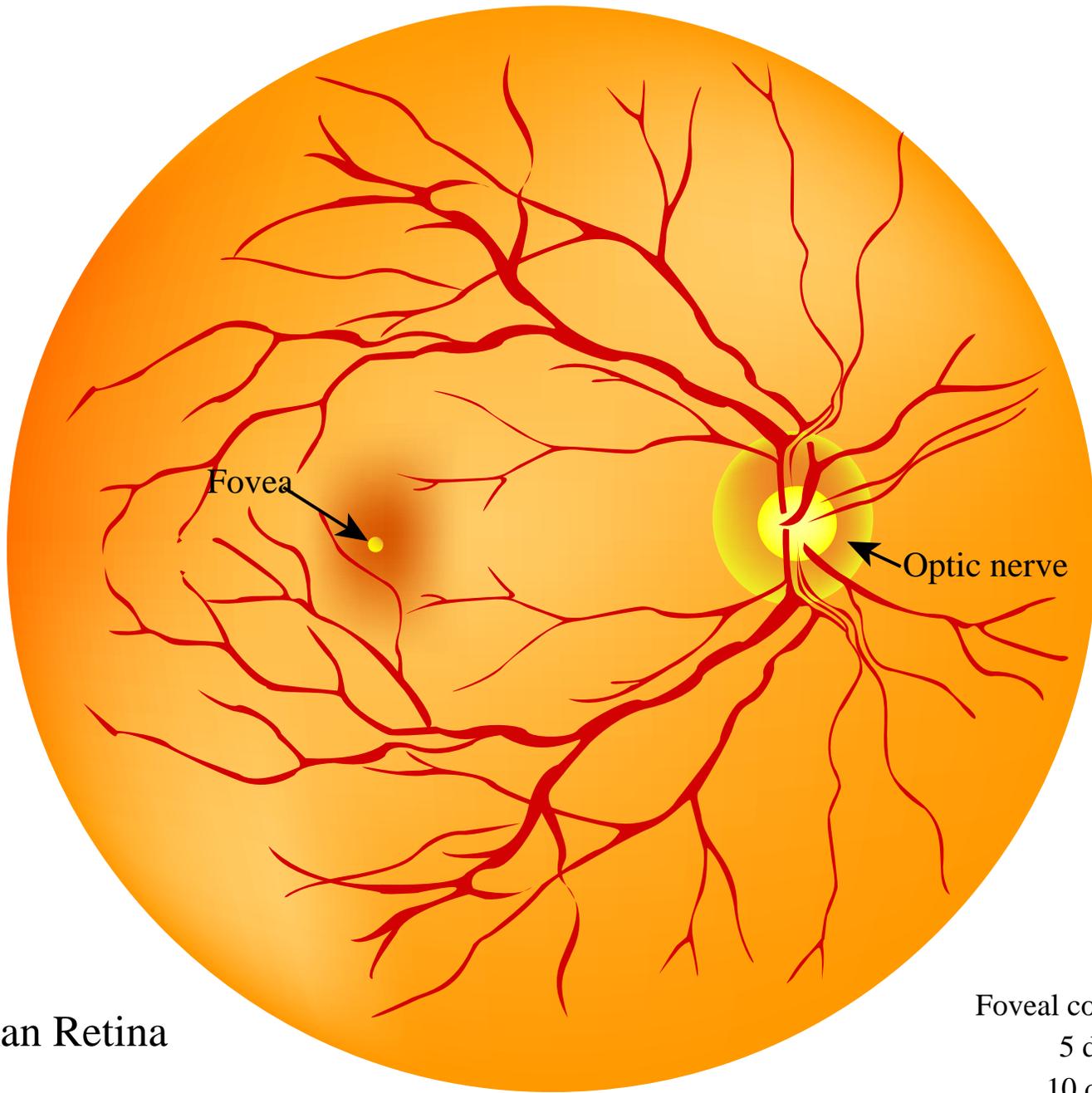


Image by MIT OpenCourseWare.



Human Retina

Foveal cone density: 200,000/sqmm
5 degrees out: 20,000/sqmm
10 degrees out: 10,000/sqmm

Coronal section of monkey LGN

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Please see lecture video or Figure 4A from Schiller, Peter H., Edward J. Tehovnik.
"Visual Prosthesis." *Perception* 37, no. 10 (2008): 1529.

Golgi stain

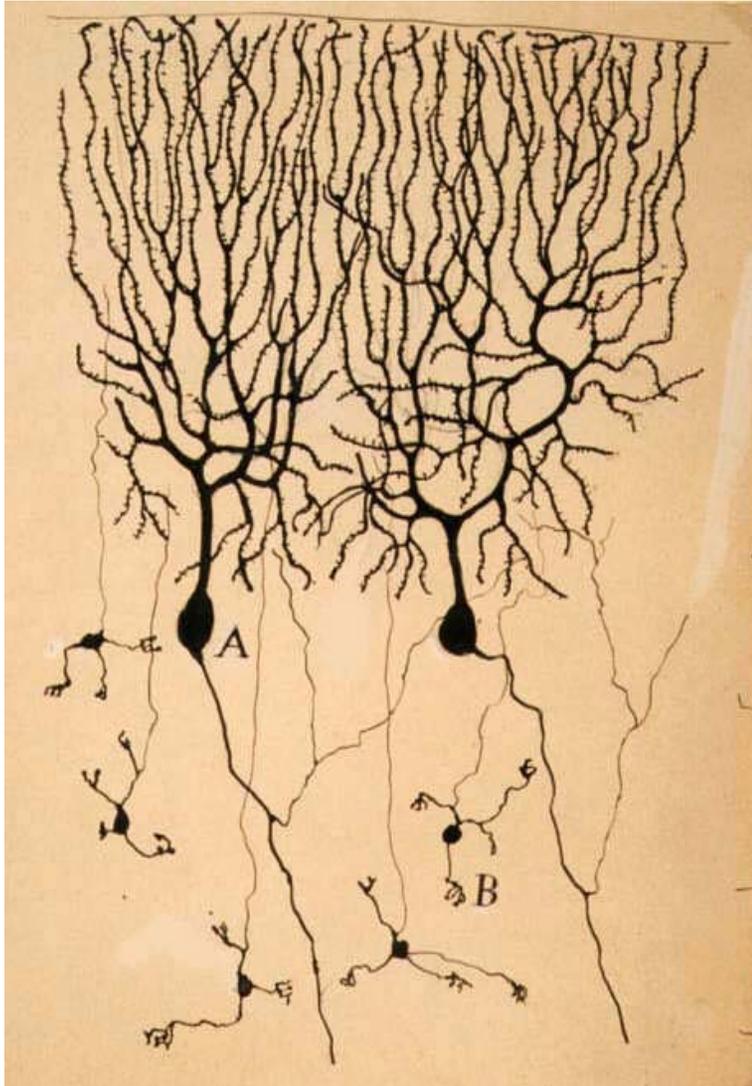


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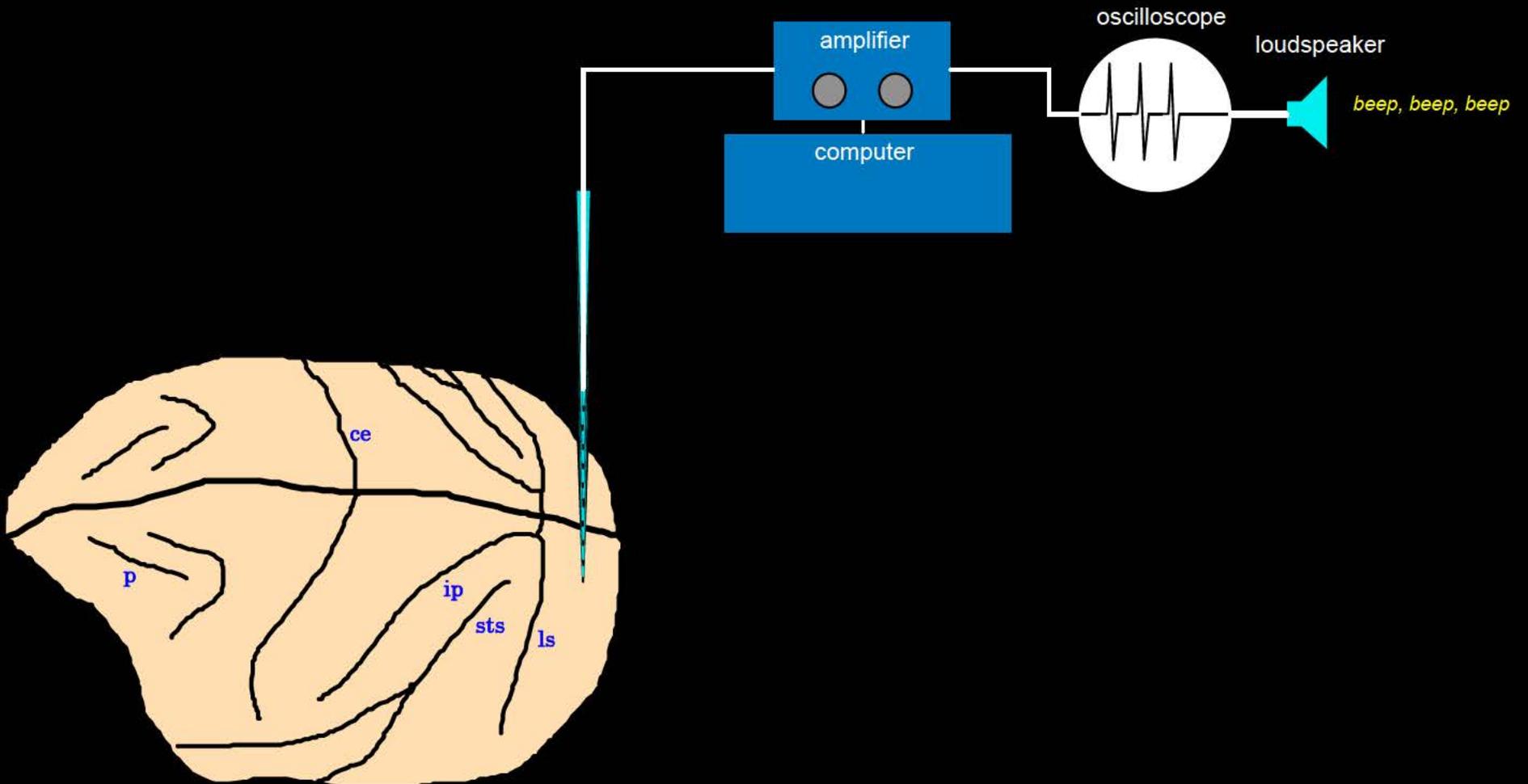
Procion Yellow labeling of a single cell

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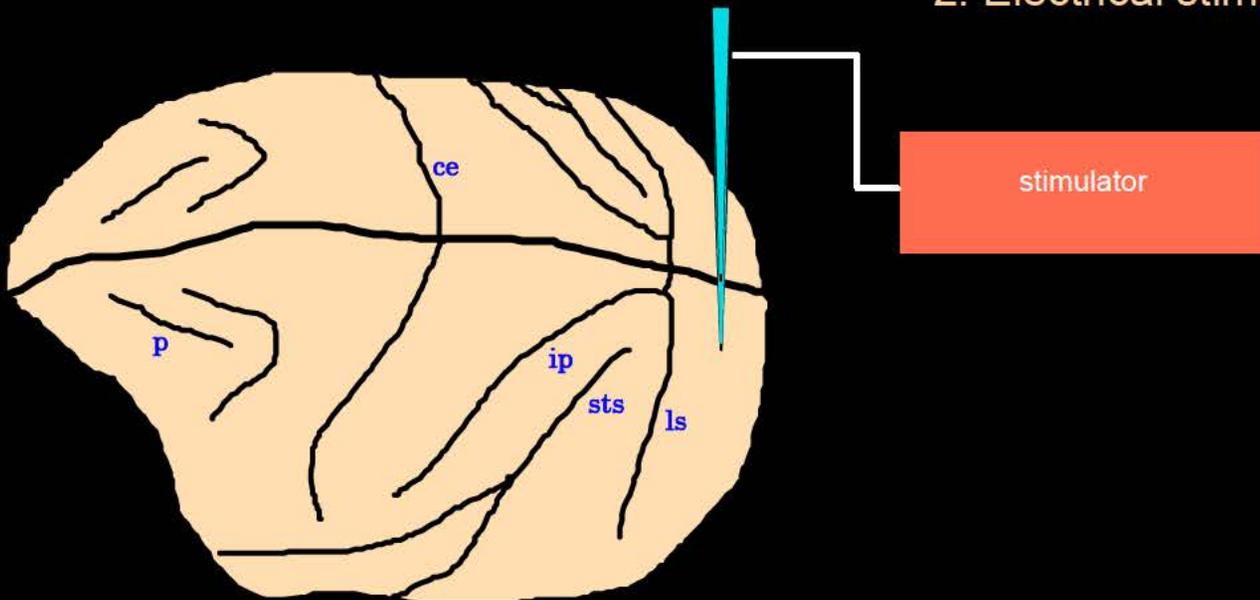
Please see lecture video or Figure & 'cZ'A Ug`UbXž'F J\W UfX' < "
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Electrophysiology

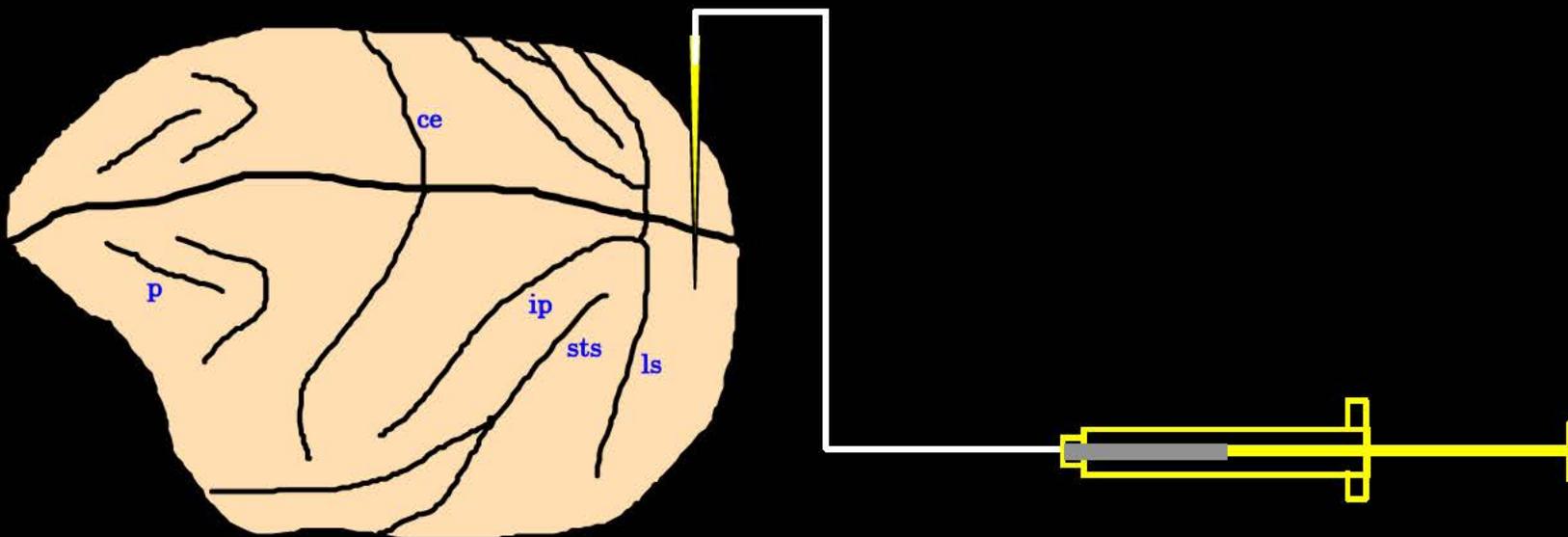
1. Single-cell recording



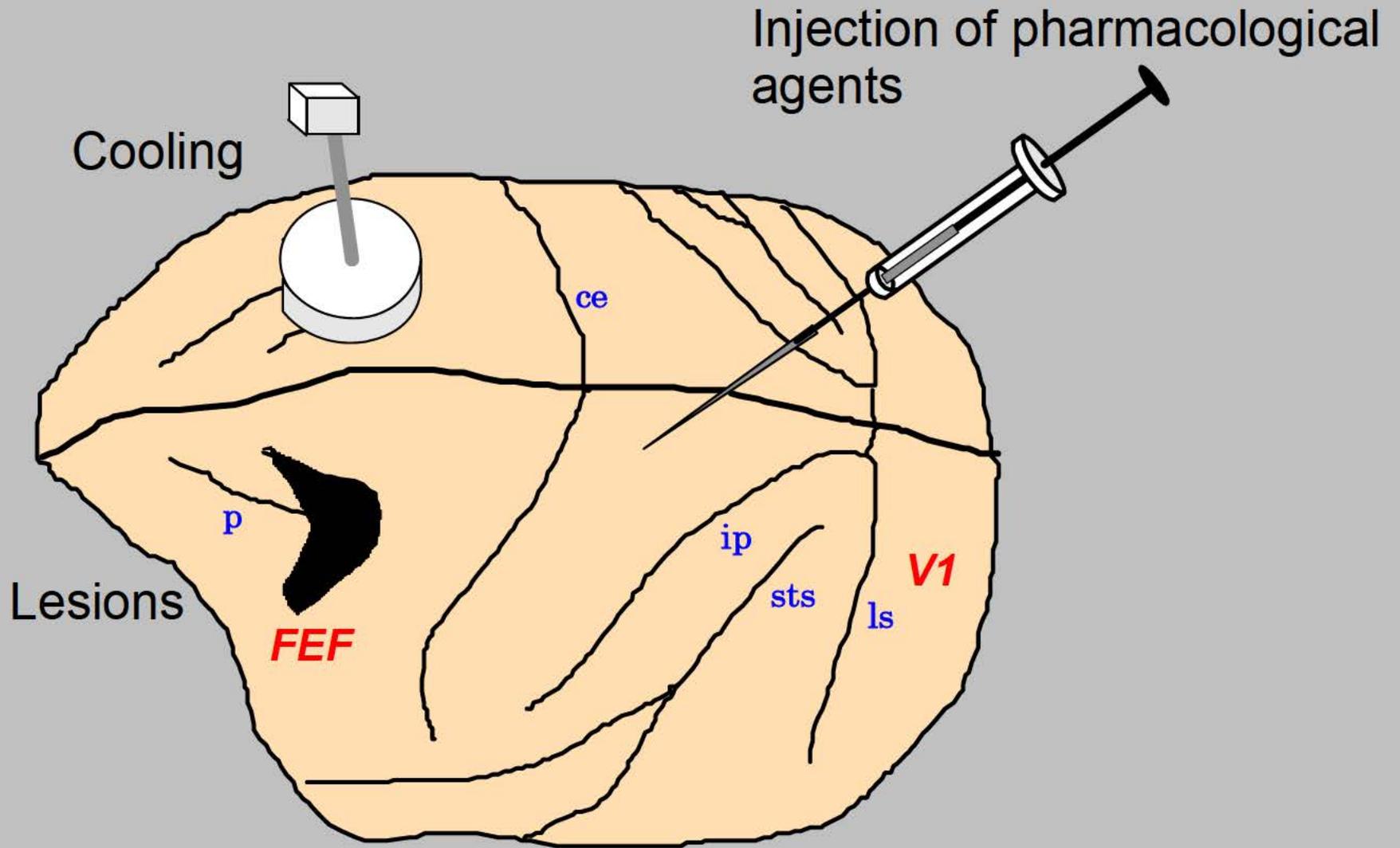
2. Electrical stimulation



Pharmacology



Brain inactivation



Imaging

A

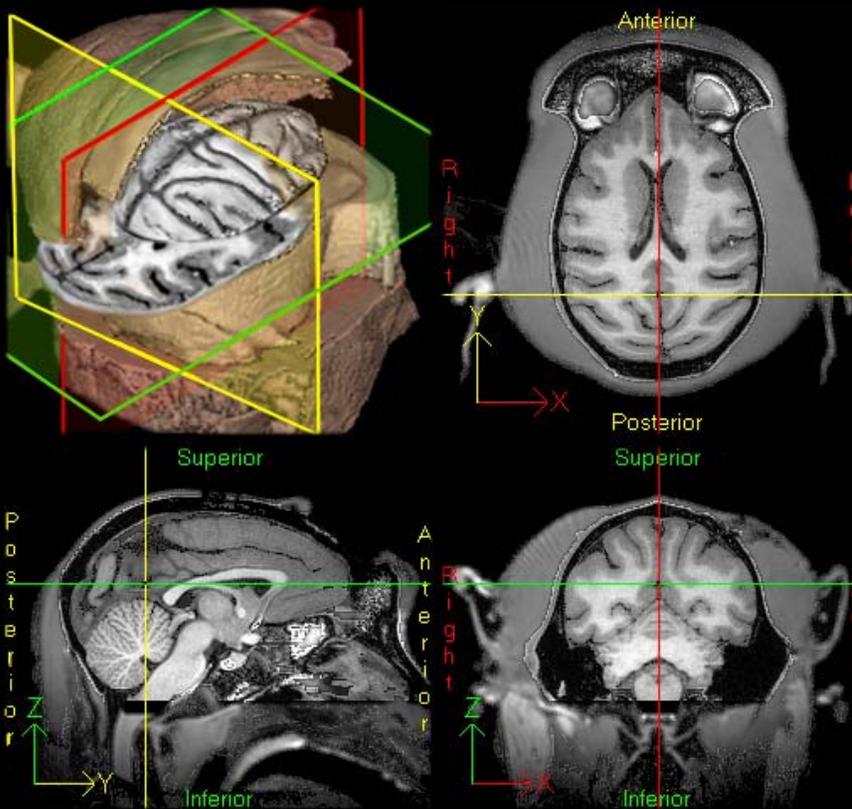


B



Figure 1B,D. Pfeuffer, Joseph, Hellmut Merkle, Michael Beyerlein, Thomas Steudel, and Nikos K. Logothetis. Anatomical and functional MR imaging in the macaque monkey using a vertical large-bore 7 Tesla setup." *Magnetic resonance imaging* 22, no. 10 (2004): 1343-1359. Courtesy of Elsevier Inc., <http://www.sciencedirect.com>. Used with permission.

C



D

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Please refer to lecture video.

E

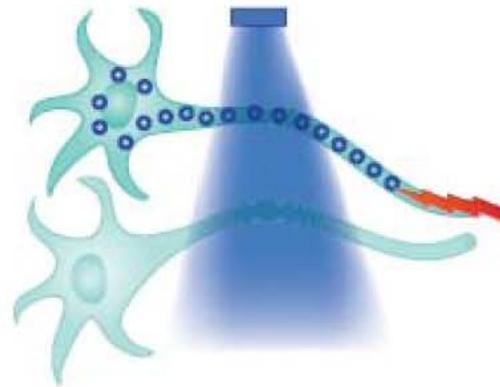
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Please refer to lecture video.

Logothetis, N, Merkle H, Augath M, Trinath T, Ugurbil K. "Ultra high-resolution fMRI in monkeys with implanted RF coils." *Neuron* 35, no. 2 (2002): 227-242. Courtesy of Elsevier, Inc., <http://www.sciencedirect.com>. Used with permission.

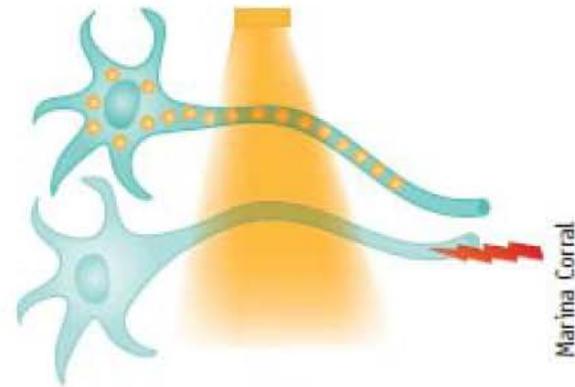
Optogenetics

Optogenetic excitation



Blue light activated channelrhodospin

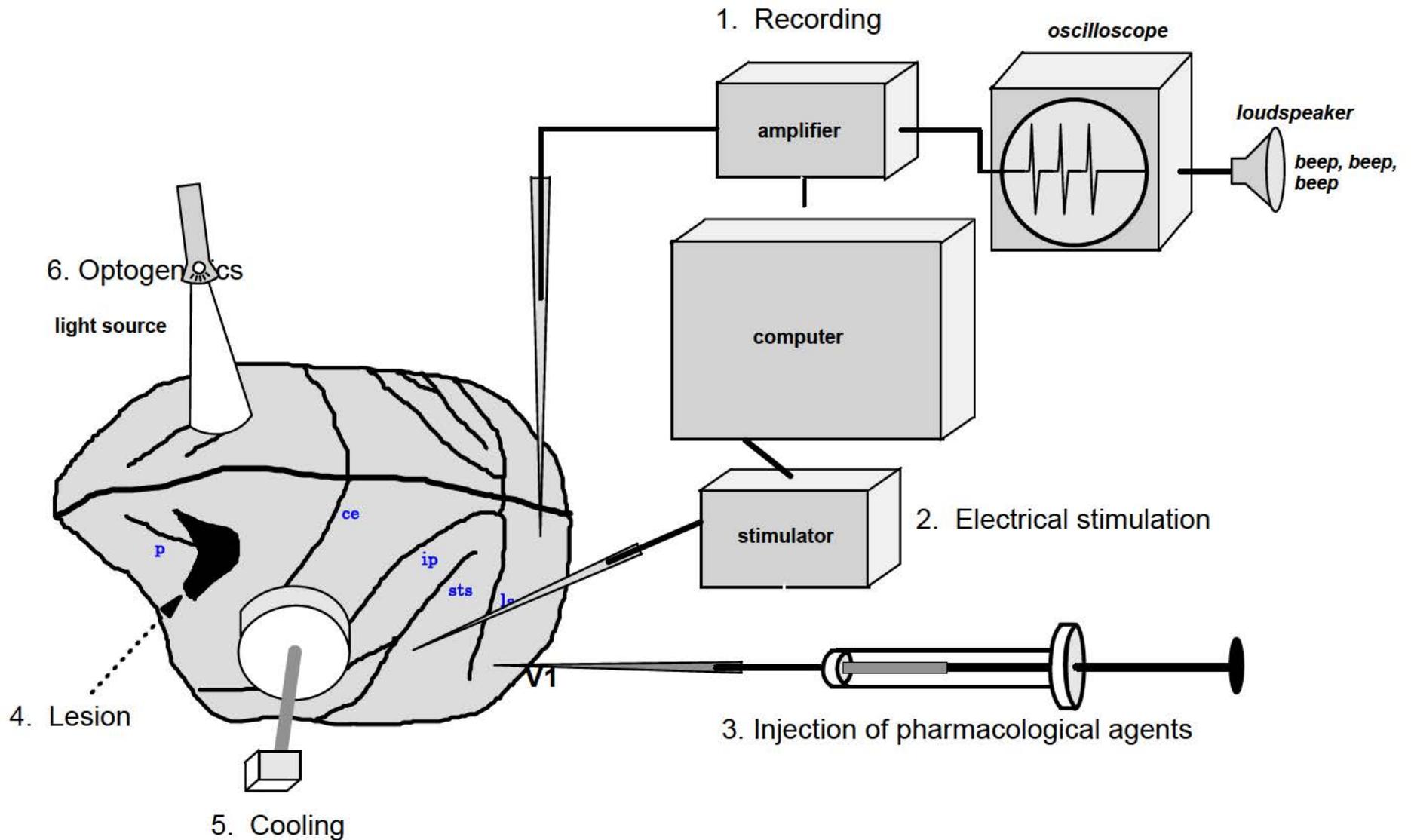
Optogenetic inhibition



Yellow light activated halorhodospin

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Source: Deisseroth K. "Optogenetics." *Nature Methods* 8, no. 1 (2011): 26-29. © 2011.

Electrical recording, electrical stimulation, injection of pharmacological agents, brain inactivation and optogenetics



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9.04 Sensory Systems

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