

SEED 1_Guide to Research Techniques in Neuroscience

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NON INVASIVE BRAIN IMAGING Chapter 1

Structural: Cerebral Angiography, Computerized Tomography, MRI, Diffusion MR Imaging

Functional: fMRI, Positron Emission Tomography, Single-Proton Emission Computerized Tomography, Electroencephalography, Magnetoencephalography, Optical Imaging (Diffuse Optical Imaging and Near Infrared Spectroscopy)

Necessity and Sufficiency of a Specific Brain Region for a Cognitive Function:

Transcranial Magnetic Stimulation; Ultrasonic Neuromodulation, Case Studies

ELECTROPHYSIOLOGY Chapter 4

Measuring Activity: electrophysiology (single electrodes, multielectrode array, tetrodes, neuropixels probe),

ELECTROPHYSIOLOGY Chapter 4

Common electrophysiological approaches: extracellular recordings (Tetrodes, Multielectrode Array), intracellular recordings, patch clamp techniques

MICROSCOPY Chapter 5

Two-Photon Microscopy

VISUALISING AND MEASURING NEURAL DYNAMICS Chapter 7

Measuring Neurochemistry: microdialysis, voltammetry, Amperometry, Fast-Scan Cyclic Voltammetry (FCV)

Imaging Voltage: Voltage-sensitive dye imaging (VSDI), Genetically Encoded Voltage Indicators (GEVIs), Calcium Indicator Dyes (Ratiometric / Nonratiometric), pH-sensitive Fluorescent Proteins. Fluorescent Activity Indicators

Visualising and Measuring Activity from Fluorescent Biosensors: Fiber photometry, Microendoscopy (GRIN Lenses, Miniscopes), Two-Photon Microscopy.

Visualizing Protein Function: reporter genes, Fluorescence/Föster Resonance Energy Transfer (FRET), Bimolecular Fluorescence Complementation, Fluorescence Recovery After Photobleaching (FRAP), Photoactivation/photoconversion

MANIPULATING NEURAL ACTIVITY Chapter 8

Electrical manipulation: microstimulation, electrolytic lesions

Pharmacogenetics: transgenes from other species, designer receptors exclusively activated by designer drugs (DREADDs: hM3Dq, hM4Di)

Optogenetics: channelrhodopsin-2 (ChR2), halorhodopsin (NpHR), archaerhodopsin (Arch), Anion-conducting channelrhodopsins (ACRs), light delivery methods

Neuromodulation in humans: pharmacology, microstimulation, transcranial magnetic stimulation (TMS), ultrasonic neuromodulation (USNM)

MANIPULATING ENDOGENOUS GENES Chapter 13

Disrupting Gene products: RNA interference (RNAi), Morpholinos, Dominant Negatives

SEED 2_Neuromethods

@Series{Neuromethods,title = {Neuromethods}, publisher = {Springer}, issn = {0893-2336}, issn-electronic = {1940-6045}, url = {https://link.springer.com/series/7657}, note = {A comprehensive series of manuals that offer step-by-step protocols in neuroscience and neurobiology research. Founded in 1986.}}

Voltammetric Methods in Brain Systems

<https://www.springer.com/book/9780896033122>

Carbon Electrode Surface Chemistry
Fast Cyclic Voltammetry (in Brain Slices)
Voltammetry
Amperometry
Microdialysis

Patch-Clamp Analysis

<https://www.springer.com/book/9781588297051>

Patch-Clamp

In Vivo Neuromethods

<https://www.springer.com/book/9780896035119>

In Vivo Brain Microdialysis

Calcium Measurement Methods

<https://www.springer.com/book/9781607614753>

Calcium Imaging
Genetically Encoded Indicators
acetoxymethyl (AM) ester-based Multi Cell Bolus Loading (MCBL)

Imaging and Correlative Physicochemical Techniques

<https://www.springer.com/book/9780896031166>

Measurement of Cerebral Blood Flow using Diffusible Gases *

Measurement of Pial Vessel Hemodynamics ++

Autoradiography and Cerebral Function

Measurement of Regional Cerebral Hemodynamics and Metabolism by Positron Emission

Tomography

NMR Spectroscopy

Visualization Techniques

<https://www.springer.com/book/9781617798962>

Two-Photon Microscopy

Thermal Changes

Perfusion Magnetic Resonance Imaging Quantification in the Brain (Dynamic

Susceptibility-Contrast MRI)

Transcranial Magnetic Stimulation

<https://www.springer.com/book/9781493908783>

Transcranial Magnetic Stimulation

Stimulation and Inhibition of Neurons

<https://www.springer.com/book/9781627032322>

Optogenetics

Visual Evoked Potentials

Photosensitive Molecules for Controlling Biological Function

<https://www.springer.com/book/9781617790300>

Photoswitchable Voltage-Gated Ion Channels

Optical Switch Protein Conjugates

Photoswitchable Ligand-Gated Ion Channels

fMRI Techniques and Protocols

<https://www.springer.com/book/9781603279185>

fMRI / Blood Oxygen Dependent Levels (BOLD)

Molecular Imaging in the Clinical Neurosciences

<https://www.springer.com/book/9781617799884>

Assay of Enzyme Activity, Neuroreceptors/Neurotransporters, Messenger Pathways by
Positron Emission Tomography
Quantification of Cerebral Blood Flow by PET

Microelectrode Biosensors

<https://www.springer.com/book/9781627033695>

Microelectrode Biosensors

Microdialysis Techniques in Neuroscience

<https://www.springer.com/book/9781627031721>

In Vivo Microdialysis (Animal and Human)
Column Liquid Chromatography

Genetically Encoded Functional Indicators

<https://www.springer.com/book/9781627030137>

Genetically Encoded Ca++ Sensitive Bioluminescence Reporter
Two-Photon Calcium Imaging

Neurovascular Coupling Methods

<https://www.springer.com/book/9781493907236>

Intrinsic Optical Imaging Spectroscopy
Optical Coherence Tomography
Photoacoustic Tomography
Laser Speckle Contrast Imaging (LSCI)
Multi-exposure speckle imaging (MESI)
Near Infrared Optical Techniques
Diffuse Optical Tomography (DOT)

Modern Electroencephalographic Assessment Techniques

<https://www.springer.com/book/9781493912971>

Electroencephalography
Intracranial Electroencephalography
Magnetoencephalography

Brain Energy Metabolism

<https://www.springer.com/book/9781493910588>

Tissue Partial Pressure of Oxygen (tpO₂)
Cytosolic Calcium Transients
Near Infrared Spectroscopy

13C Magnetic Resonance Spectroscopy

Neural Tracing Methods

<https://www.springer.com/book/9781493919628>

Single-Cell Electroporation (SCE)
Fluorescent Calcium Indicators Dyes

Optical Imaging of Neocortical Dynamics

<https://link.springer.com/book/10.1007/978-1-62703-785-3>

Calcium-Sensitive Indicators
Voltage-Sensitive Indicators
Genetically Encoded Voltage-sensitive Fluorescent Proteins
Phosphorescence Lifetime

Advanced Patch-Clamp Analysis for Neuroscientists

<https://www.springer.com/book/9781493934096>

Voltage-Clamp Fluorometry
Patch-Clamp Fluorometry

Neurotransmitter Transporters

<https://www.springer.com/book/9781493937639>

High-Speed Chronoamperometry
Single-Photon Emission Computed Tomography (SPECT)

Extracellular Recording Approaches

<https://www.springer.com/book/9781493975488>

Multielectrode Arrays
Tetrodes

Extracellular Recording Approaches

<https://www.springer.com/book/9781493964888>

Push–Pull Superfusion Technique (PPST)

Metals in the Brain

<https://www.springer.com/book/9781493969166>

quantitative MRI (qMRI) for Manganese (Mn) and Iron (Fe)

Use of Nanoparticles in Neuroscience

<https://www.springer.com/book/9781493975822>

Magnetothermal Genetic Stimulation

Multiphoton Microscopy

<https://www.springer.com/book/9781493997015>

Multiphoton FRET-FLIM

Brain Tumors

<https://www.springer.com/book/9781071608555>

Dynamic Susceptibility Contrast (DSC)-MRI

Arterial Spin Labeling (ASL)

Translational Research Methods for Major Depressive Disorder

<https://www.springer.com/book/9781071620823>

Deep Brain Stimulation

Cerebrovascular Reactivity

<https://www.springer.com/book/9781071617625>

Transcranial Doppler

All-Optical Methods to Study Neuronal Function

<https://www.springer.com/book/9781071627631>

3D-Scanless Holographic Optogenetics with Temporal focusing (3D-SHOT)

Stimulated Raman Spectroscopy (sf-SRS)

Electrophysiological Recording Techniques

<https://www.springer.com/book/9781071626306>

High-density EEG

Language Electrified

<https://www.springer.com/book/9781071632628>

Transcranial Direct Current Stimulation (tDCS)

Awake Behaving Mesoscopic Brain Imaging

<https://www.springer.com/book/9781071641194>

mini-mScope Mesoscale Calcium (Ca++)
High-Density Multichannel Fiber Photometry
Neuro-FITM (Transparent microelectrode Array allowing for simultaneous Ca++ imaging)

Molecular Imaging for Brain Diseases

<https://www.springer.com/book/9781071644935>

Magnetic Resonance Spectroscopic Imaging and Thermometry (MRSI-t)
Magnetic Resonance Spectroscopy