LIST OF NEUROSCIENCE TECHNIQUES TO STUDY BRAIN ACTIVITY IN VIVO

SEED 1 + SEED 2 cleaned and organized, excluding repetitions or same techniques with different terms

SEED 1_Guide to Research Techniques in Neuroscience

@book{carter_guide_2022, address = {San Diego}, edition = {3rd ed}, title = {Guide to {Research} {Techniques} in {Neuroscience}}, isbn = {978-0-12-818646-6 978-0-323-91561-8}, language = {en}, publisher = {Elsevier Science \& Technology}, author = {Carter, Matt and Essner, Rachel and Goldstein, Nitsan and Iyer, Manasi}, year = {2022}}

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.}}

[I] = Invasive [NI] = Non-Invasive

Magnetic Resonance & Computed Tomography (CT) Imaging Techniques

Functional Magnetic Resonance Imaging *[NI]*

1. Blood Oxygen Dependente Levels (BOLD) *[NI]*
2. quantitative MRI (qMRI) for Manganese (Mn) and Iron (Fe) *[NI]*
3. Dynamic Susceptibility Contrast (DSC)-MRI *[NI]*
4. Arterial Spin Labeling (ASL) *[NI]*
5. Nuclear Magnetic Resonance Spectroscopy *[NI]*
    13C Magnetic Resonance Spectroscopy
6. Positron Emission Tomography (PET) *[NI]*
    Assay of Enzyme Activity, Neuroreceptors/Neurotransporters, Messenger Pathways
    Quantification of Cerebral Blood Flow
7. Single-Photon Emission Computerized Tomography *[NI]*
8. Cerebral Blood Flow with Stable Xenon CT *[NI]*

Ultrasound

9.Transcranial Doppler *[NI]*

EEG & MEG

10. Electroencephalography *[NI]*
    High-density EEG
11. Magnetoencephalography *[NI]*

INVASIVE ELECTRICAL RECORDINGS

12. Deep Brain Stimulation *[I]*
13. Single Electrodes *[I]*
14. Multielectrode Array *[I]*

CELLULAR RECORDINGS / PATCH-CLAMP

15. Patch-Clamp Techniques *[I]*
    - Voltage-Clamp Fluorometry *[I]*
    - Patch-Clamp Fluorometry *[I]*

MICROSCOPY / MICROENDOSCOPY

16. One-Photon Microscopy *[I]*
    - GRIN LENSES
    - Miniscopes
    - mini-mScope Mesoscale Calcium (Ca++)
17. Two-Photon Microscopy *[I]*
18. Fiber Photometry *[I]*
19. High-Density Multichannel Fiber Photometry *[I]*
20. Neuro-FITM *[I]*

NEUROSENSING / ELECTROCHEMICAL

21. Microdialysis *[I]*
22. Column Liquid Chromatography *[I]*
23. Push–Pull Superfusion Technique (PPST) *[I]*

Carbon Electrode Surface Chemistry *[I]*

24. Voltammetry *[I]*
    - Fast-Scan Cyclic (FSC)
25. Amperometry *[I]*
    - High-Speed Chronoamperometry

FLUORESCENT ACTIVITY INDICATORS

DYES AND ENCODING

26. Voltage-sensitive dye imaging (VSDI) (Ratiometric / Nonratiometric) *[I]*
27. Calcium Indicator Dyes (Ratiometric / Nonratiometric) *[I]*
    - Fluorescent Calcium Indicators Dyes
    - acetoxymethyl (AM) ester-based Multi Cell Bolus Loading (MCBL)
28. Genetically Encoded Voltage Indicators (GEVIs) *[I]*
    - Genetically Encoded Ca++ Indicators (GECIs)
        - Sensitive Bioluminescence Reporter
29. pH-sensitive Fluorescent Proteins *[I]*

FLUORESCENCE READOUT TECHNIQUES

30. Fluorescence/Föster Resonance Energy Transfer (FRET) *[I]*
31. Bimolecular Fluorescence Complementation (BiFC) *[I]*
32. Fluorescence Recovery After Photobleaching (FRAP) *[I]*
33. Photoactivation/Photoconversion *[I]*
34. Phosphorescence Lifetime (PLIM) *[I]*
35. Multiphoton FRET-FLIM *[I]*

OPTICAL APPROACHES

36. Diffuse Optical Imaging *[NI]*

37. Near Infrared Spectroscopy *[NI]*

 # INTERFERENCE

ELECTRICAL/MAGNETIC
38. Transcranial Magnetic Stimulation *[NI]*
39. Transcranial Direct Current Stimulation (tDCS) *[NI]*
40. Microstimulation *[I]*
41. Electrolytic lesions *[I]*

EXCLUSIVELY GENETIC
42. Transgenes from other species *[I]*
43. Designer receptors exclusively activated by designer drugs (DREADDs: hM3Dq, hM4Di) *[I]*
44. RNA Interference (RNAi) *[I]*
45. Morpholinos *[I]*
46. Dominant Negatives *[I]*
47. Single-Cell Electroporation (SCE) **(Is an Interference Technique)** *[I]*

OPTOGENETICS AND GENETICALLY MEDIATED DERIVATIVES
48. Optogenetics *[I]*
    - Channelrhodopsin-2 (ChR2)
    - Halorhodopsin (NpHR)
    - Archaerhodopsin (Arch)
    - Anion-conducting channelrhodopsins (ACRs)
    - Photoswitchable Voltage-Gated Ion Channels
    - Photoswitchable Ligand-Gated Ion Channels
    - Optical Switch Protein Conjugates
49. Magnetothermal Genetic Stimulation *[I]*

ULTRASOUND
50. Ultrasonic Neuromodulation *[NI]*

Excluded after further evaluation
Technique / Reasoning / Notes

1. Autoradiography / https://doi.org/10.1007/s00441-014-2093-4 / Not In Vivo

2. Measurement of Pial Vessel Hemodynamics / https://doi.org/10.1080/01616412.1987.11739803 / Restrict used and specifics studies related just to response to other hemodynamic parameters, and soon afterwards substituted by Ultrasound techniques

3. Thermal Changes / https://doi.org/10.1007/978-1-61779-897-9_12 / Whole-body, no Brain specificity
4. Organized and Nested several within **FLUORESCENT ACTIVITY INDICATORS,** DYES and ENCODING to end with duplicity and ambiguity, and then their READOUTS techniques.
5. Also Organized and Nested Optogenetics Tools, to not overexpress slightly different techniques