LIST OF NEUROSCIENCE TECHNIQUES TO STUDY BRAIN ACTIVITY IN VIVO

After the LLM Screening, it is necessary to merge **both Step 2** and **Step 3** into a single list, again screening for the techniques that fit the established criteria and also looking for duplicates. All the while creating a properly structured list, and also already tagging if they are Invasive [**I**] or non-invasive [**NI**], techniques which are minimally invasive (for instance, require only a contrast injection or isotope) are tagged as [**I***].

New additions while performing the merge of both Step 2 and 3 and checking on selected papers were added to the list, but are pointed at the end as additions and where did they come from (tagged as "**§**").

Note: some items are listed due to their importance but are not counted as they can be seen as advancements or specific approaches within the same technique.

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1. ELECTROMAGNETIC

Microscopic Resolutions

Intracellular or Juxtacellular

1.1. Patch-Clamp [**I**] (1)
https://doi.org/10.1007/978-1-0716-0818-0_1
https://doi.org/10.3390/s21041448
1.2. Sharp Electrode Intracellular Recordings [**I**] (2)
https://doi.org/10.1016/S0165-0270(03)00126-2
1.3. Juxtacellular Recording and Labeling [**I**] (3)
https://doi.org/10.1016/j.jneumeth.2006.02.004
https://doi.org/10.1038/nprot.2014.161

Extracellular

1.4. Tungsten Microelectrodes [**I**] (4)
https://doi.org/10.3389/fnins.2021.691788
1.5. Stereotrodes [**I**] (5)
https://doi.org/10.1016/0165-0270(83)90097-3
https://doi.org/10.1016/j.jneumeth.2013.11.013
1.6. Tetrodes [**I**] (6)
https://doi.org/10.1016/S0165-0270(02)00092-4
1.7. Multielectrode Arrays [**I**]
    1.7.1. Michigan Probes [**I**] (7)
    https://doi.org/10.1109/10.7273
    https://doi.org/10.1016/j.heares.2008.01.010

1.7.2. Utah Arrays [**I**] (8)
https://doi.org/10.1016/S0013-4694(96)95176-0
1.7.3. Floating Microelectrode Arrays [**I**] (9)
https://doi.org/10.1016/j.jneumeth.2006.09.005
1.8. Neuropixels [**I**] (10)
https://doi.org/10.1016/j.conb.2018.01.009
1.9. CMOS-Integrated Neural Probes [**I**] (11)
https://doi.org/10.1126/sciadv.adf9524
https://doi.org/10.1016/j.snr.2024.100206
1.10. Fishbone Nanowire Arrays [**I**] (12)
https://doi.org/10.1002/adma.202504171
1.11. Nitrogen-Vacancy Diamond Sensors [**I**] (13)
https://doi.org/10.1073/pnas.1601513113
https://doi.org/10.1038/s41598-023-39539-y

 # Middle Term Resolutions and Multimodal Approaches
1.12. Flexible Bioelectronic Neural Interfaces [**I**] (14)
https://doi.org/10.1038/s41563-020-0679-7
1.13. Optotetrodes [**I**] (15)
https://doi.org/10.1038/nn.2992
1.14. Transparent Graphene Microelectrodes Arrays [**I**] (16)
https://doi.org/10.1038/s41467-018-04457-5
1.15. Electrical Impedance Tomography [**NI/I**] (17)
https://link.springer.com/article/10.1186/s40779-022-00370-7
https://doi.org/10.1016/j.neuroimage.2019.05.023
https://doi.org/10.1006/nimg.2000.0698

 # Macroscopic Resolutions
1.16. Electroencephalography [**NI**] (18)
https://doi.org/10.1038/nrn3241
https://doi.org/10.1016/j.ijpsycho.2015.05.004
1.17. Electrocorticogram [**NI**] (19)
https://doi.org/10.1038/nrn3241
1.16.1. Micro Electrocorticogram [**I**] (20)
https://doi.org/10.1038/s41378-023-00597-x
1.18. Magnetoencephalography [**NI**]
https://doi.org/10.1038/nrn3241
https://doi.org/10.3390/brainsci12060788
1.17.1 SQUID (the typical one) [**NI**] (21)
1.17.2. Optically Pumped Magnetometer MEG (OPM-MEG) [**NI**] (22)
https://doi.org/10.1038/s41398-024-03047-y
1.19. Stentrodes [**I**] (23)
https://doi.org/10.1038/nbt.3428
https://doi.org/10.1016/j.jneumeth.2025.110471
https://doi.org/10.1126/science.adh3916
1.20. Stereoelectroencephalography [**I**] (24)
https://doi.org/10.1097/wnp.0000000000000249
https://doi.org/10.1016/j.seizure.2019.01.021

1.21. Deep Brain Stimulation [I] (25)
https://doi.org/10.3389/fpsyt.2023.1080260
https://doi.org/10.1016/j.neurom.2022.01.017
1.22. Neural Dust [I] (26)
https://doi.org/10.1016/j.conb.2017.12.010
https://doi.org/10.3389/fnins.2021.599549

2. MOLECULES SENSING

Microdialysis and Push-Pull Perfusion

2.1. Microdialysis [I] (27)
https://doi.org/10.1021/acsami.2c02740
https://doi.org/10.1039/C4AN01974A
2.2. Push-pull Perfusion [I] (28)
https://doi.org/10.1021/acsami.2c02740
https://pubs.acs.org/doi/10.1021/acs.analchem.8b02468
Note: both 2.1. and 2.2. can be associated with the following techniques
2.3. + High Performance Liquid Chromatography [I] (29)
https://doi.org/10.1021/ac4023605
2.4. + Column Liquid Chromatography [I] (30)
https://doi.org/10.1021/acsami.2c02740
2.5. + Capillary Electrophoresis [I] (31)
https://doi.org/10.1016/j.jneumeth.2004.03.025
2.6. + Mass Spectrometry [I] (32)
https://doi.org/10.1016/j.jpba.2005.07.025
https://doi.org/10.1208/s12248-017-0114-4
2.7. + Electrochemical Workstation [I] (33)
https://doi.org/10.1021/acs.nanolett.2c00289

Carbon Fiber Microelectrodes

2.8. Voltammetry [I] (34)
https://doi.org/10.1021/acsami.2c02740
https://doi.org/10.1016/j.neubiorev.2005.02.003
https://doi.org/10.1523/JNEUROSCI.14-01-00442.1994
    2.8.1. Differential Pulse Voltammetry
    2.8.2. Cyclic Voltammetry
    2.8.3. Fast-Scan Cyclic Voltammetry
    https://doi.org/10.1016/0306-4522(88)90255-2
    https://doi.org/10.1039/C9AN01925A
2.9. Amperometry [I] (35)
https://doi.org/10.1021/acsami.2c02740
    2.9.1. High-Speed Chronoamperometry
    https://doi.org/10.3390/cells11152454
2.10. Liquid-Liquid Interface Microsensors [I] (36)
https://doi.org/10.1021/acssensors.1c00978
https://doi.org/10.1021/ac504151e

Indirect Sensing

2.11. Enzyme-Based sensors [**I**] (37)
https://doi.org/10.1111/j.1471-4159.2006.03673.x
https://doi.org/10.1021/ac403250w
2.12. Aptamer-based sensors [**I**] (38)
https://doi.org/10.1021/acsptsci.4c00579
2.13. Molecularly Imprinted Polymers Sensors [**I**] (39)
https://doi.org/10.1016/j.snb.2011.07.052
https://doi.org/10.1016/j.trac.2018.08.002

 # Other sensing techniques
2.14. Electron Paramagnetic Resonance (EPR) Oximetry [**I**] (40)
https://doi.org/10.1007/s12013-017-0798-1
https://doi.org/10.4103/2045-9912.202911
2.15. Hydrogen Clearance CBF Measurement [**I**] (41)
https://doi.org/10.1038/jcbfm.1986.83

3. POSITRON EMISSION TOMOGRAPHY
3.1. Total-Body PET Imaging [**I***] (42)
https://doi.org/10.1259/bjr.20220357
https://doi.org/10.2967/jnumed.119.231845
https://doi.org/10.1007/s00259-022-06057-4
3.2. Metabolic Tracing with Short-Lived Isotopes (Dynamic PET) [**I***] (43)
https://doi.org/10.1002/acn3.51546R
https://doi.org/10.1007/s00259-023-06542-4
3.3. μ-opioid Receptor PET ([^{11}C]carfentanil) [**I***] (44)
https://doi.org/10.1007/s00259-024-06746-2
3.4. Dopamine D2/D3 Receptor Occupancy PET [**I***] (45)
https://doi.org/10.1038/s42003-022-03434-5
https://doi.org/10.1177/0271678X231210128
3.5. Cerebral Metabolic Rate of Oxygen (CMRO2) PET [**I***] (46)
https://doi.org/10.1016/j.neuroimage.2020.117136
https://doi.org/10.2967/jnumed.120.260521
3.6. GABA-A Receptor PET ([^{18}F]flumazenil) [**I***] (47)
https://doi.org/10.3390/ph16030417
3.7. Serotonin Transporter PET ([^{11}C]DASB) [**I***] (48)
https://doi.org/10.3390/ijms26010252
3.8. Oxygen-15 Water PET ([^{15}O]H_2O PET) [**I***] (49)
https://doi.org/10.1053/j.semnuclmed.2023.08.002
https://doi.org/10.1016/j.neuroimage.2013.11.044

4. NON-FLUORESCENCE OPTICAL TECHNIQUES

 # Infrared
4.1. Thermal Infrared Imaging / Thermoencephaloscopy [**NI**] (50)
https://doi.org/10.1038/srep17471
https://doi.org/10.1016/S0301-0082(98)00038-0
https://doi.org/10.1111/psyp.12243
4.2. Functional Near-Infrared Spectroscopy [**NI**] (51)

https://doi.org/10.1111/nyas.13948

4.2.1. Time-Domain Near-Infrared Spectroscopy (TD-NIRS) [**NI**] (52)
https://doi.org/10.1038/s41598-024-68555-9
https://doi.org/10.1117/1.JBO.27.7.074710 *
https://doi.org/10.1117/1.NPh.10.1.013504 *

4.2.2. Functional Diffuse Optical Tomography (fDOT) [**NI**] (53)
https://doi.org/10.3390/s25072040 *
https://doi.org/10.1038/s41598-025-85858-7
https://doi.org/10.1117/1.NPh.6.3.035007

4.3. Diffuse Correlation Spectroscopy [**NI**] (54)
https://doi.org/10.1016/j.neuroimage.2013.06.017
https://doi.org/10.1007/s12028-018-0573-1

 # Intrinsic Signals

4.4. Optical Intrinsic Signal [**I**] (55)
https://doi.org/10.1117/1.NPh.10.2.020601
https://doi.org/10.1016/j.xpro.2021.100779 *
https://doi.org/10.1038/324361a0
https://doi.org/10.1146/annurev.ne.08.030185.001403

4.4.1. Hyperspectral Imaging of Intrinsic Signals (56)
https://doi.org/10.1117/1.NPh.2.4.045003
https://doi.org/10.1007/978-3-319-91287-5_3

4.5. Laser Speckle Contrast Imaging [**I**] (57)
https://doi.org/10.1117/1.NPh.10.2.020601
https://doi.org/10.1097/00004647-200103000-00002

4.6. Spatial Frequency Domain Imaging [**I**] (58)
https://doi.org/10.1117/1.NPh.10.2.020601
https://doi.org/10.1117/1.3088140
https://doi.org/10.1117/1.NPh.8.2.025001

4.6.1. Structured Illumination Diffuse Optical Tomography [**NI**] (59)
https://doi.org/10.1117/1.NPh.4.2.021102

4.7. Laser Doppler Flowmetry [**I**] (60)
https://doi.org/10.1111/micc.12884
https://doi.org/10.1002/lpor.202401016 *
https://doi.org/10.1007/s12028-017-0472-x

4.8. Optical Coherence Tomography [**I/NI**] (61)
https://doi.org/10.1126/science.1957169
https://doi.org/10.1016/j.jneumeth.2008.11.026

4.8.1. Speckle-Modulated Optical Coherence Tomography (OCT) [**I**] (62)
https://doi.org/10.1038/ncomms15845
https://doi.org/10.1063/5.0278271
https://doi.org/10.1093/cercor/bhac388

4.8.2. Doppler Optical Coherence Tomography (D-OCT) [**I**] (63)
https://doi.org/10.1364/BOE.5.003217
https://doi.org/10.1021/acsphotonics.4c00856

4.8.3. Visible Light Optical Coherence Tomography (vis-OCT) [**I**] (64)

https://doi.org/10.1364/BOE.6.003941
https://doi.org/10.1364/BOE.6.001429
https://doi.org/10.1117/1.JBO.22.12.121707

5. ULTRASOUND AND PHOTOACOUSTICS

Ultrasound (Purely)

5.1. Transcranial Doppler [**NI**] (65)
https://doi.org/10.33549/physiolres.935413
https://doi.org/10.1186/s41984-021-00114-0
https://doi.org/10.1159/000103113

5.2. Functional Ultrasound (fUS) Imaging [**NI/I**] (66)
https://doi.org/10.1016/j.cobme.2021.100286
https://doi.org/10.1146/annurev-neuro-111020-100706
https://doi.org/10.1016/j.neuroscience.2021.03.005
https://doi.org/10.1038/nmeth.1641

5.2.1. Microbubble-Enhanced fUS (Contrast-Enhanced fUS) [**I**] (67)
https://doi.org/10.1016/j.neuroimage.2015.09.037
https://doi.org/10.1016/j.cobme.2021.100286

5.2.2. Functional Ultrasound Microscopy (68)
https://doi.org/10.1038/s41592-022-01549-5

Photoacoustic

5.3. Photoacoustic Imaging (PAI) [**I/NI**] (69)
https://doi.org/10.1016/j.pacs.2019.05.001
https://doi.org/10.1063/1.2195024
https://doi.org/10.3109/13813450312331337649

5.3.1. Photoacoustic Computed Tomography (PACT) [**I/NI**] (70)
https://doi.org/10.1038/nbt839
https://doi.org/10.1002/jbio.201700024
https://doi.org/10.1364/BOE.423707

5.3.2. Functional Photoacoustic Microscopy (fPAM) [**I**] (71)
https://doi.org/10.1038/s41377-022-00836-2
https://doi.org/10.1016/j.neuroimage.2021.118260

5.4 Voltage-Sensitive Photoacoustic Imaging [**I**] (72)
https://doi.org/10.1002/lpor.202400165

6. MAGNETIC RESONANCE IMAGING

Hemodynamic

6.1. Blood Oxygen Dependent Levels (BOLD) [**NI**] (73)
https://doi.org/10.1073/pnas.87.24.9868
https://doi.org/10.1038/jcbfm.2012.23
https://doi.org/10.1016/j.tins.2024.12.010
https://doi.org/10.1002/nbm.70076
https://doi.org/10.1523/JNEUROSCI.23-10-03963.2003

6.1.1. Functional Connectivity MRI (fcMRI) [**NI**]

https://doi.org/10.1016/j.neuroimage.2023.120249
https://doi.org/10.1038/s42003-023-05629-w
6.1.2. Resting-State fMRI (rs-fMRI) [**NI**]
https://doi.org/10.1002/jmri.28894
6.2. Arterial Spin Labeling [**NI**] (74)
https://doi.org/10.1002/mrm.1910230106 (first)
https://doi.org/10.1002/mrm.29381 *
https://doi.org/10.1073/pnas.89.1.212
6.2.1. Continuous Arterial Spin Labeling (CASL) [**NI**]
https://doi.org/10.3389/fradi.2022.929533
6.2.2. Pulsed Arterial Spin Labeling (PASL) [**NI**]
https://doi.org/10.3389/fradi.2022.929533
6.3. Vascular-Space-Occupancy (VASO) [**NI**] (75)
https://doi.org/10.1002/mrm.10519
https://doi.org/10.1016/j.neuroimage.2021.118868
6.3.1. VASO and Perfusion (VAPER) [**NI**] (76)
https://doi.org/10.1016/j.neuroimage.2019.116358
https://doi.org/10.1162/imag_a_00140
6.4. Laminar fMRI [**NI**]
https://doi.org/10.1016/j.neuroimage.2017.02.063
https://doi.org/10.1093/psyrad/kkae027
https://doi.org/10.1016/j.cobme.2021.100288
https://doi.org/10.1016/j.neuroimage.2017.07.004
6.5. Exogenous Labeling [**I**]
https://doi.org/10.3348/kjr.2014.15.5.554
6.5.1. Dynamic Susceptibility Contrast (DSC)-MRI [**NI/I**] (77)
https://doi.org/10.1038/jcbfm.2010.4
https://doi.org/10.1007/s10334-009-0190-2
https://doi.org/10.1038/s41598-024-58086-8 [**NI**]
6.5.2. Dynamic Contrast-Enhanced (DCE)-MR [**I**] (78)
http://www.ajnr.org/content/27/7/1467
https://doi.org/10.2174/1874440001105010090
https://doi.org/10.7554/eLife.89611.4
6.6. Susceptibility-Weighted Imaging (SWI) [**NI**] (79)
https://doi.org/10.1016/j.neuroimage.2012.01.020
https://doi.org/10.1016/j.neuroimage.2007.11.046
6.7. Intravoxel Incoherent Motion (IVIM) MRI [**NI**] (80)
https://doi.org/10.1371/journal.pone.0117706
https://doi.org/10.1002/nbm.3780
https://doi.org/10.1016/j.neuroimage.2017.12.062
6.8. Phase-Contrast MRI [**NI**] (81)
https://doi.org/10.1148/rg.2020190039
https://doi.org/10.1186/s40809-016-0019-0
6.8.1. Displacement Spectrum (DiSpect) Imaging (82)
https://doi.org/10.1002/mrm.28882

 # Non Hemodynamic
6.9. Functional Magnetic Resonance Spectroscopy [**NI**] (83)

https://doi.org/10.1016/j.neuroimage.2023.120194
https://doi.org/10.1177/0271678X221076570
https://doi.org/10.1002/nbm.4314

6.9.1. ^{31}P MRS [**NI**]
https://doi.org/10.1002/nbm.70043

6.9.2. ^{13}C MRS [**I**]
https://doi.org/10.1007/s11064-022-03538-8
https://doi.org/10.1038/s41598-019-38981-1

6.10. Functional Quantitative Susceptibility Mapping (fQSM) [**NI**] (84)
https://doi.org/10.1016/j.neuroimage.2021.117924

6.11. ^{23}Na Sodium MRI [**NI**] (85)
https://doi.org/10.1016/j.neuroimage.2018.09.071
https://archive.ismrm.org/2025/2503_bFbEoFQ1W.html

6.12. Hyperpolarized ^{13}C Metabolic MRI [**I**] (86)
https://doi.org/10.1073/pnas.1613345114
https://doi.org/10.1016/j.neuroimage.2022.119284

6.13. Chemical Exchange Saturation Transfer (CEST) fMRI [**NI**] (87)
https://doi.org/10.1038/s41598-019-40986-9
https://doi.org/10.1002/jmri.27850

6.14. Magnetic Resonance Elastography (MRE) [**NI**] (88)
https://doi.org/10.3389/fbioe.2021.666456
https://archive.ismrm.org/2014/0871.html

6.15. Apparent Diffusion Coefficient fMRI [**NI**] (89)
https://doi.org/10.1038/s42003-025-07889-0
https://doi.org/10.1038/s41467-025-60357-5
https://doi.org/10.3389/fnhum.2013.00817

6.16. Molecular fMRI [**I**] (90)
https://doi.org/10.1016/j.jneumeth.2021.109372

7. LABELED OPTICAL TECHNIQUES

 # Indicators and Sensors
https://doi.org/10.1146/annurev-anchem-061522-044819

7.1. Calcium Indicators [**I**]
https://doi.org/10.1111/j.1476-5381.2010.00988.x
https://doi.org/10.1016/j.cell.2021.12.007

7.1.1. Calcium Indicator Dyes (Ratiometric / Nonratiometric) [**I**] (91)
https://doi.org/10.1073/pnas.1507110112
https://doi.org/10.1016/S0143-4160(98)90085-9

7.1.2. Genetically Encoded Calcium Indicators (GECIs) [**I**] (92)
https://doi.org/10.1016/j.neures.2020.05.013 (GCaMP variants)

7.2. Voltage Indicators [**I**]
https://doi.org/10.3390/colorants3040025 (General)

7.2.1. Voltage-Sensitive Dye Imaging (VSDI) (Ratiometric / Nonratiometric) [**I**] (93)
https://doi.org/10.1016/j.cclet.2020.12.060
https://doi.org/10.1002/lpor.202400165

7.2.2. Genetically Encoded Voltage Indicators (GEVIs) [**I**] (94)
https://doi.org/10.1007/978-981-15-8763-4_12

7.6.2. Genetically Encoded Lactate Sensors **[I]**
https://doi.org/10.1038/s41467-025-64484-x
7.6.3. Genetically Encoded Nitric Oxide Sensors (geNOps) **[I]**
https://doi.org/10.1016/j.celrep.2023.113514

 # Microscopy Modalities

7.7. One-Photon Imaging (Miniscope / Widefield) **[I]** (99)
https://doi.org/10.1016/j.conb.2011.12.002
https://doi.org/10.1016/j.cell.2022.02.017
7.8. Two-Photon Microscopy **[I]** (100)
https://doi.org/10.1016/j.conb.2011.12.002
https://doi.org/10.1016/j.cell.2022.02.017
7.9. Three-Photon Microscopy **[I]** (101)
https://doi.org/10.1038/s41583-025-00937-y
https://doi.org/10.1038/s42003-025-08079-8
7.10. Fiber Photometry **[I]** (102)
https://doi.org/10.1080/15476278.2025.2489667
7.11. Mesoscopic Calcium Imaging (Widefield, not Miniscope) **[I]** (103)
https://doi.org/10.3390/biology11111601
https://doi.org/10.3389/fnins.2023.1210199
https://doi.org/10.1371/journal.pone.0185759
7.12. Light-Sheet Fluorescence Microscopy (LSFM) **[I]** (104)
https://doi.org/10.1038/nmeth.2434
https://doi.org/10.1016/j.jneumeth.2018.07.011
https://doi.org/10.1016/j.conb.2018.03.007
https://doi.org/10.1146/annurev-neuro-070918-050357
7.13. Swept Confocally-Aligned Planar Excitation (SCAPE) Microscopy **[I]** (105)
https://doi.org/10.1038/nphoton.2014.323
https://doi.org/10.1038/s41587-020-0628-7
7.14. Adaptive Optics for In Vivo Neural Imaging **[I]** (106)
https://doi.org/10.3389/fnins.2022.880859
https://doi.org/10.3389/fnins.2023.1188614
7.15. Oblique Plane Microscopy (OPM) **[I]** (107)
https://doi.org/10.1038/s41467-023-43741-x
7.16. Multifocal/Multibeam Two-Photon Microscopy **[I]** (108)
https://doi.org/10.1364/BOE.9.003678
https://doi.org/10.3389/fncel.2019.00039
https://doi.org/10.1364/BOE.514826
7.17. Line-Scanning Temporal Focusing Microscopy (mosTF) **[I]** (109)
https://doi.org/10.1038/s41598-024-57208-6
https://doi.org/10.1364/BOE.9.005654
7.18. Light Field Microscopy **[I]** (110)
https://doi.org/10.1016/j.jneumeth.2021.109083
7.19. Fluorescence Lifetime Imaging Microscopy (FLIM) **[I]** (111)
https://doi.org/10.1364/OPTICA.426870
https://doi.org/10.1038/s41598-020-77737-0
7.20. Total Internal Reflection Fluorescence (TIRF) Microscopy **[I]** (112)
https://doi.org/10.1021/acsnano.3c04489

7.21. Random Access Microscopy **[I]** (113)
https://doi.org/10.1038/nmeth.4033
https://iopscience.iop.org/article/10.1088/2515-7647/ad2e0d
7.22. Multispectral Optoacoustic Tomography (MSOT) **[I]** (114)
https://doi.org/10.1016/j.pacs.2021.100285
7.23.Bioluminescent Voltage Imaging (e.g., LOTUS-V) **[I]** (115)
https://doi.org/10.1038/s41598-019-43897-x
https://doi.org/10.1117/1.nph.11.2.024203
7.24 Digital Holographic Microscopy **[I]** (116)
https://doi.org/10.1038/s41467-023-36889-z
https://doi.org/10.1016/j.conb.2018.03.006

8. INTERFERENCE TECHNIQUES
https://doi.org/10.3389/fnbeh.2021.820017

 # Electrical Stimulation
8.1. Cortical Stimulation **[I]** (117)
https://doi.org/10.1016/j.yebeh.2009.03.001 (1870)
8.2. Microstimulation **[I]** (118)
https://doi.org/10.1038/s41551-024-01299-z
https://doi.org/10.1002/adhm.202100119
    8.2.1 Supracortical Microstimulation **[I]**
    https://doi.org/10.1146/annurev-bioeng-103023-072855
8.3. Temporal Interference Simulation [**NI**] (119)
https://doi.org/10.3389/fnhum.2023.1266753
https://doi.org/10.1016/j.cell.2017.05.024
https://doi.org/10.1109/EMBC46164.2021.9629968
8.4. Transcranial Electrical Stimulation [**NI**]
https://doi.org/10.3390/biomedicines10102333
https://doi.org/10.1371/journal.pbio.3001973
    8.4.1. Transcranial Direct Current Stimulation (tDCS) [**NI**] (120)
    https://doi.org/10.3389/fnhum.2025.1640565
    8.4.2. Transcranial Alternating Current Stimulation (tACS) [**NI**] (121)
    https://doi.org/10.3389/fnhum.2025.1640565
    8.4.3. Transcranial Random Noise Stimulation (RNS) [**NI**] (122)
    https://doi.org/10.1038/s41598-019-51553-7
    https://doi.org/10.3389/fncel.2017.00162
8.5. Transcranial Magnetic Stimulation [**NI**] (123)
https://doi.org/10.1007/s12264-021-00781-x
https://doi.org/10.1146/annurev-psych-081120-013144
    8.5.1. Deep Transcranial Magnetic Stimulation (dTMS) [**NI**] (124)
    https://doi.org/10.5498/wjp.v13.i9.607
    https://doi.org/10.1016/j.jneumeth.2021.109261
    https://doi.org/10.1016/j.jneumeth.2020.108709
    https://doi.org/10.1523/ENEURO.0163-17.2018
8.6. Peripheric Nerve Stimulation **[I]**
    8.6.1. Galvanic Vestibular Stimulation (GVS) **[I]** (125)

https://doi.org/10.1126/science.aaq1144
https://doi.org/10.1016/j.biomaterials.2017.07.017

 # Other Interference Techniques
8.12. Cortical Cooling [**I**] (136)
https://doi.org/10.3389/fnsys.2011.00053
https://doi.org/10.1016/0006-8993(77)90734-X
8.13. Lidocaine Inactivation [**I**] (137)
https://doi.org/10.1016/S0165-0270(97)02229-2
8.14. Muscimol Inactivation [**I**] (138)
https://doi.org/10.1016/j.jneumeth.2008.01.033
8.15. Transcranial Focused Ultrasound [**NI**] (139)
https://doi.org/10.3389/fnhum.2021.749162
https://doi.org/10.1371/journal.pone.0288654
https://doi.org/10.1007/s13534-024-00369-0
  8.15.1. Focused Ultrasound Blood–Brain Barrier Opening (FUS-BBBO) [**NI**] (140)
  https://doi.org/10.1002%2Fmds.101
  https://doi.org/10.1148/radiol.14140245
  https://doi.org/10.1093/brain/awab460
  https://doi.org/10.1038/s41598-018-25904-9
8.16. Optoacoustic Neuromodulation [**I**] (141)
https://doi.org/10.1038/s41467-020-14706-1
8.17. Infrared Neural Stimulation [**NI/I**] (142)
https://doi.org/10.1073/pnas.2015685118
https://doi.org/10.1038/s41598-021-89163-x
https://doi.org/10.1016/j.brs.2023.01.1678
8.18. Transcranial Photobiomodulation (tPBM) [**NI**] (143)
https://doi.org/10.1038/s41598-019-42693-x
https://doi.org/10.1126/sciadv.abq3211
https://doi.org/10.1364/BOE.402047
8.19 Photothermal Neuromodulation (non-genetic) [**I**] (144)
https://doi.org/10.1002/admi.202400873
https://doi.org/10.1021/acsnano.4c01037
8.20. Iontronic microfluidic probes / microfluidic interconnection [**I**] (145)
https://doi.org/10.1038/s41378-021-00295-6
https://doi.org/10.1002/smll.202410906
8.21. Neuromodulation via Magnetic Nanodiscs [**I**] (146)
https://doi.org/10.1038/s41565-024-01798-9
https://doi.org/10.3389/fnhum.2025.1489940
8.22. Terahertz Neural Control [**NI**] (147)
https://doi.org/10.7554/eLife.97444.3
DOI: 10.4103/NRR.NRR-D-23-00872

9. Miscellaneous Techniques
(or they are a mix/interface of the above or not encompassed by the above classification)
9.1. Thermal Diffusion Flowmetry [**I**] (148)
https://doi.org/10.1089/neu.2018.6309
9.2. Magnetic Particle Imaging (MPI) [**I**] (149)

https://doi.org/10.18416%2FIJMPI.2020.2009009
https://doi.org/10.1016/j.neuroimage.2018.05.004
9.3. Near-Infrared Fluorescence Imaging of Hemodynamics **[I]** (150)
https://doi.org/10.1371/journal.pone.0048383
9.4. Second Harmonic Generation (SHG) Microscopy **[I]** (151)
https://doi.org/10.1073/pnas.1004748107 *(pivotal, not brain)*
https://doi.org/10.1021/acsphotonics.9b01749 (brain dynamics)

ADDITIONS:
1. Diffuse Correlation Spectroscopy
from https://doi.org/10.1111/micc.12884
2. Laminar Functional Magnetic Resonance Imaging
from https://doi.org/10.1093/psyrad/kkae027
3. Phase-Contrast Based Approaches MRI
from https://doi.org/10.1002/mrm.28882
4. Thermal Diffusion Flowmetry
https://doi.org/10.1089/neu.2018.6309
from https://doi.org/10.1111/micc.12884

EXCLUDED after recheck:
1. Deep Label-Free Microscopy (DLFM)
https://doi.org/10.1038/nm.3495 (after rechecking its time frames)
2. Microvascular Volumetric Pulsatility Mapping
https://doi.org/10.1038/s44161-025-00722-1
https://doi.org/10.3389/fnagi.2025.1486775
https://doi.org/10.1177/0271678X20980652
(the literature does not show functional studies to the moment)
3. Magnetic Resonance Fingerprinting (MRF)
https://doi.org/10.1002/jmri.29812 (It is not a technique per se, but more a “pipeline” optimization method. EXTREMELY interesting and useful, but here excluded)
