

Neurological

Disease / Medical condition	Biomarker	Imaging Technique	Investigators	Comments	Disease Category
Abscess	Leukocyte accumulation	SPECT	Fischman A	Tc-99m HMPAO improvement over TI-201 and Ga-67	Neurological Inflammatory Musculoskeletal Genitourinary Infectious disease Gastrointestinal
Abscess	Restricted diffusion	Diffusion weighted imaging	Grant E Gonzalez RG Schaefer P		Neurological Inflammatory Infectious disease
Alzheimer's disease	Cerebral blood flow (CBF)	Perfusion weighted imaging / arterial spin labeling	Hoge R		Neurological Metabolic
Alzheimer's disease	Cerebral blood flow (CBF) Cerebral blood volume (CBV) Mean transit time (MTT)	SPECT fMRI	Harris G Gonzalez RG Sorensen AG		Neurological Metabolic
Alzheimer's disease	Directed molecular probes	PET SPECT Optical	Fischman A Weissleder R	Animal modeling Optical with exogenous contrast agents	Neurological Metabolic
Alzheimer's disease	Entorhinal cortex Anterior cingulate size and thickness	MRI	Hyman B	Can distinguish normal from mild AD with 93% accuracy	Neurological Metabolic
Alzheimer's disease	Hippocampal size	MRI quantitative volumetric morphometry	Dale A Hyman B Fischl B Kennedy D	Accurately indicates absence of disease progression in therapeutic trials allows markedly reduced subject numbers	Neurological Metabolic
Alzheimer's disease	Myoinositol N-acetylaspartate (NAA)	MRS	Gonzalez RG Jenkins B		Neurological Metabolic
Alzheimer's disease	Neuritic (senile) plaque	In vivo multiphoton microscopy	Hyman B	Can use histochemical or immunofluorescence for amyloid B	Neurological Metabolic
Alzheimer's disease	Neuronal injury	MRI	Gonzalez RG		Neurological Metabolic
<i>Alzheimer's disease</i>	<i>Oxygen utilization Cerebral blood flow (CBF)</i>	<i>Optical</i>	<i>Boas D Dunn A</i>	<i>Combining of multi-wavelength and laser speckle contrast imaging</i>	<i>Neurological Metabolic</i>
Anorexia	Relative cerebral blood flow (rCBF)	PET	Alpert N Fischman A Rauch SL		Neurological
Asphyxia	Altered vascular and tissue permeability	CT	Gonzalez RG Grant E		Neurological
Asphyxia	Early diffusion changes	Diffusion weighted imaging	Grant E Schaefer P Sorensen AG		Neurological
Asphyxia	Lactate : choline ratio	MRS	Jenkins B		Neurological
Attention deficit hyperactivity disorder (ADHD)	ACCD activation (anterior cingulate cortex division)	fMRI PET	Bush G Fischman A Rosen B		Neurological

Attention deficit hyperactivity disorder (ADHD)	Cortical thickness and asymmetry	MRI (morphometry)	Kennedy D		Neurological
Attention deficit hyperactivity disorder (ADHD)	Dopamine transporter density	SPECT	Fischman A Rauch SL		Neurological
Autism	Frontal language area	MRI	Caviness VS Harris G Kennedy D	Reversal of morphometric asymmetry in frontal language area	Neurological
Autism	Frontal language area	fMRI	Harris G	Abnormal fMRI activation of frontal language areas during semantic language tasks	Neurological
Brain development	Oxygen consumption Cerebral blood flow (CBF)	Optical Imaging	Boas, D Dunn A	Diffuse optical imaging (DOI)	Neurological Metabolic
Brain development / -anencephaly -microcephaly -holoprosencephaly	Cortical thickness, volume and location	MRI morphometry fMRI	Caviness VS Dale A Fischl B Kennedy D		Neurological
Brain function	Cerebral blood flow (CBF)	MRI fMRI PET	Belliveau Kwong K Rosen BR	Response to stimuli	Neurological Metabolic
Brain function / neuronal content	N-acetylaspartate (NAA) Images	MRI chemical shift Echo-planar imaging (EPI)	Gonzalez RG Jenkins B Rosen B		Neurological Metabolic
Brain function / drugs of abuse	rCMRO2 Cerebral blood volume (CBV)	fMRI	Jenkins B Kosofsky B Mandeville JB Rosen B	Response to stimuli	Neurological Metabolic
Brain function / mapping dopaminergic neurotransmitter activity	Relative cerebral blood flow (rCBF) Relative cerebral blood volume (rCBV)	Pharmacologic MRI PET fMRI	Bogdanov M Chen YC Jenkins B Rosen B	Using D-amphetamine and CFT	Neurological Metabolic
Brain injury	Restricted water mobility	Diffusion weighted imaging Apparent diffusion constant	Huisman TA Gonzalez RG Schaefer P Sorensen AG	Cytotoxic edema, vasogenic edema and diffuse axonal injury	Neurological
Brain injury / toxicity and trauma	Focal atrophy	MRI	Caviness VS Kennedy D		Neurological
Carotid dissection	Anatomic disruption of arterial wall	US CT / CTA MRI / MRA Angiography	Gonzalez R Waltman A		Neurological Cardiology / Vascular
Cerebral malaria	Diffuse cerebral edema with thalamic +/- cerebellar hypoattenuation	CT	Gonzalez RG		Neurological Infectious disease
CNS AIDS / fungal and opportunistic infections	Focal brain uptake	PET SPECT	Fischman A		Neurological
CNS AIDS / neuroinflammation neurodegeneration	N-acetylaspartate (NAA) Choline Myoinositol (MI)	MRS	Gonzalez R Schaefer P Schwamm LH		Neurological
CNS neoplasm / primary and secondary	Microvascular blood volume and microvascular density	fMRI MRI	Belliveau Kennedy D Rosen BR		Neurological Oncology / Neoplasm

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CNS neoplasm / primary and secondary	N-acetylaspartate (NAA) Choline Lactate Phosphocreatine	MRS	Gonzalez R Husiman TA Sorensen AG	Metabolism, tumor viability and response to therapy	Neurological Oncology / Neoplasm
CNS neoplasm / primary and secondary	Tumor angiogenesis	MRI MRS MRA	Davis T Rosen B Wald LL Weissleder R	Measured by dynamic susceptibility contrast (DSC) and monocrySTALLINE iron oxide nanoparticles (MION)	Neurological Oncology / Neoplasm
CNS neoplasm / primary and secondary	Tumor growth rate	MRI	Bogdanov A Marecos E Moore A Weissleder R	Serial studies of tumor volume using uptake of long-circulating dextrin coated iron oxide (LCDIO)	Neurological Oncology / Neoplasm
CNS neoplasm / primary and secondary, presence and viability	Glucose metabolism	PET	Alpert N Choi N Fischman A Kennedy D Rosen B	Non-specific marker with wide variety of applications	Neurological Oncology / Neoplasm
CNS neoplasm / primary and secondary	Lesion volume	CT MRI morphometry	Gonzalez R Harris G Kennedy D Lev Schaefer P Sorensen AG	Anatomic marker of disease presence Response to therapy	Neurological Oncology / Neoplasm
CNS neoplasm / primary and secondary, presence and viability	Oxygen consumption Cerebral blood flow (CBF)	Optical	Boas D Dunn A	Diffuse optical imaging (DOI)	Neurological Oncology / Neoplasm
CNS neoplasm / primary and secondary, presence and viability	Targeted cellular and molecular probes	Optical MRI PET	Kwong KK Weissleder R	Exogenous contrast agents Animal models	Neurological Oncology / Neoplasm
CNS Neoplasm / schwannoma and neurofibromatosis	Tumor growth rate	MRI	Tang Y Weissleder R	Transgenic murine models of neurofibromatosis	Neurological Oncology / Neoplasm
Dementia	Blood oxygen level depletion (BOLD)	fMRI	Rosen B		Neurological
Dementia	Cerebral blood flow (CBF)	MRI / arterial spin labeling	Hoge R		Neurological
Dyskinesia (PNKD)	Dopa decarboxylase activity	PET	Fischman A		Neurological Musculoskeletal
Encephalitis / west Nile virus	Thalamus and substantia nigra hyperintensities	MRI	Gonzalez RG Sorensen AG	Disease confirmation and progression monitoring	Neurological Infectious disease Inflammatory
Epilepsy	Cortical dysplasia	MRI / MEG fMRI	Dale A Grant E Mandeville J Rosen B Stufflebeam SM Wald LL		Neurological
Epilepsy	Hyperperfusion Cerebral blood flow (CBF)	MRI / arterial spin labeling	Hoge R Kwong KK		Neurological
Epilepsy	N-acetylaspartate (NAA) lateralization	MRS	Jenkins BG		Neurological

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Epilepsy	Seizure focus	MEG / EEG	Halgren E Stufflebeam SM		Neurological
Glioma	Blood-tumor barrier permeability (BTP)	MRI fMRI	Gonzalez RG Kwong KK Sorensen AG Weissleder R		Neurological Oncology / Neoplasm
Glioma	Cerebral blood volume (CBV) Cerebral blood flow (CBF)	MRI fMRI	Rosen B		Neurological Oncology / Neoplasm
Glioma	Glucose uptake	PET	Fischman A Kennedy D Rosen B		Neurological Oncology / Neoplasm
Glioma	Tumor angiogenesis	MRI MRS MRA	Davis T Rosen B Wald LL Weissleder R	measured by dynamic susceptibility contrast (DSC) and monocrySTALLINE iron oxide nanoparticles (MION)	Neurological Oncology / Neoplasm
Glioma	Tumor margin	MRI	Weissleder	via ultra small particulate iron oxide (USPIO)	Neurological Oncology / Neoplasm
Glioma	Vascular volume fraction	Optical	Weissleder		Neurological Oncology / Neoplasm
Head and neck neoplasm / primary and secondary	Lesion volume	CT MRI	Gonzalez R Lev MH Schaefer P Schwamm Sorensen AG	Anatomic marker of disease presence	Neurological Oncology / Neoplasm
Head and neck neoplasm / primary and secondary, presence and viability	Glucose metabolism	PET	Alpert N Choi N Fischman A	Non-specific marker with wide variety of applications	Neurological Oncology / Neoplasm
Hepatic encephalopathy	Glucose N-acetylaspartate (NAA) Choline Myoinositol (MI) Lactate	MRS	Grant E Jenkins BG Schaefer P		Neurological
Huntington's disease	Basal ganglia / putamen volume	MRI	Harris G		Neurological
Huntington's disease	Cortical thickness	fMRI MRI morphometry	Dale A Fischl B Harris G Kennedy D Rosas D		Neurological
Huntington's disease	Directed molecular probes	MRI PET Optical	Fischman A Weissleder R		Neurological
Huntington's disease	N-acetylaspartate (NAA) Choline : creatine ratio Lactate	MRS	Jenkins BG Rosen B		Neurological
Hypertension	Relative cerebral blood volume (rCBV)	Dynamic susceptibility contrast MRI	Hunter G Rosen B	Using Gd-DTPA following L-arginine infusion	Neurological Cardiology / Vascular
Infectious disease / -empyema -herpes virus -CJD	Restricted diffusion	Diffusion weighted imaging	Grant, E Schaefer P		Neurological Infectious disease

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Infectious disease / cerebral malaria	Diffuse cerebral edema with thalamic +/- cerebellar hypoattenuation	CT	Gonzalez RG		Neurological Infectious disease
Intracranial arterial dissection	Anatomic disruption of arterial wall	CTA MRA Angiography	Gonzalez R Lev MH Waltman A		Neurological Cardiology / Vascular
Migraine	Cerebral blood flow (CBF)	Laser speckle contrast imaging Diffuse optical topography	Boas D Bolay Dunn A		Neurological
Migraine	Cerebral blood flow (CBF) Cerebral blood volume (CBV) Mean Transit time (MTT)	Diffusion / perfusion weighted imaging fMRI	Grant E Schaefer P Sorensen AG Rosen BR		Neurological
Migraine	Cortical spreading depression (CSD)	Blood oxygen level dependent (BOLD) fMRI	Hadjikhani N Rosen BR Sorensen AG	Signal changes measured during visual aura	Neurological
Migraine	Restricted diffusion	Optical	Boas D Dunn A		Neurological
Multiple sclerosis	Choline / sodium (NA) ratio Creatine / sodium (NA) ratio	MRS	Jenkins B Gonzalez RG		Neurological Inflammatory
Multiple sclerosis	Comparative brainstem analysis MS plaque demyelination	MRI	Jenkins B Rosen B Stufflebeam SM		Neurological Inflammatory
Multiple sclerosis	Decreased N-acetylaspartate (NAA)	MRS	Jenkins B Gonzalez RG		Neurological Inflammatory
Multiple sclerosis	Thalamic neuronal loss	MRI fMRI MRS	Gonzalez RG Fischl B Kuperberg G		Neurological Inflammatory
Multiple sclerosis	Tissue characterization Cortical thickness	fMRI MRI morphometry	Fischl B Kuperberg G		Neurological Inflammatory
Neurodegenerative disorders	Apparent diffusion constant (ADC) Blood oxygen level depletion	fMRI MRI / diffusion weighted imaging	Jenkins BG Kennedy D Rosas HD Rosen B		Neurological
Obsessive compulsive disorder	Cortical activation during provoked conditions	fMRI PET SPECT	Fischman A Rauch SL Rosen BR		Neurological
Obsessive compulsive disorder	Cortical thickness	MRI (morphometry)	Kennedy D		Neurological
Obsessive compulsive disorder	Whole brain morphometry	MRI (morphometry)	Kennedy D Rosen BR	Findings include sig. less total white-matter and greater cortex and opercular volumes	Neurological
Pain	Cortical activity	fMRI PET SPECT MEG	Fischman A Halgren E Rosen B Sorensen AG Stuffelbeam SM		Neurological Musculoskeletal

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Parkinson's disease	Cerebral blood volume (CBV) Cerebral blood flow (CBF)	MRI / Arterial spin labeling	Hoge R		Neurological
Parkinson's disease	Directed molecular probes	PET Optical	Weissleder R		Neurological
Parkinson's disease	Dopamine binding potential Dopamine transporter (DAT) density	SPECT (using I-123 altropane)	Fischman A Halpern E Sahani D		Neurological
Parkinson's disease	Dopaminergic neurotransmitter activity	fMRI PET	Fishman A Livni E Rosen B	Pet using 11C-CRT	Neurological
Parkinson's disease	N-acetylaspartate (NAA) levels over time	MRS	Gonzales RG Jenkins BG		Neurological
Schizophrenia	Cerebral blood flow (CBF) Neural activation of dorsolateral pre-frontal cortex, hippocampus and cerebellum	PET	Alpert N Fischman A Heckers S Rauch SL Schaefer P	Regional activation during cognitive paradigms	Neurological
Schizophrenia	Cortical thickness	MRI (morphometry)	Fischl B Harris G Kennedy D Kuperberg G		Neurological
Schizophrenia	Specific regional uptake, target selection and functional activation	fMRI	Kuperberg G Manoach D Stufflebeam SM Rosen B	Regional activation during cognitive paradigms	Neurological
Stroke	Apparent diffusion constant (ADC) Relative cerebral blood flow index (rCBF)	Diffusion weighted imaging fMRI MRI (morphometry)	Kennedy D Lo E Rosen B		Neurological Cardiology / Vascular
Stroke	Cerebral blood flow (CBF) Cerebral blood volume (CBV) Mean transit time (MTT) Flow heterogeneity (FH)	MRI (combined Arterial spin labeling and Dynamic susceptibility contrast) CAPTIVE	Harris G Hoge R Ostergaard L Rosen B Sorensen AG Wald LL	MTT helps to stratify patients in clinical trials MR perfusion territory imaging	Neurological Cardiology / Vascular
Stroke	Intravascular thrombus	CT / CTA MRI / MRA Angiography	Caviness VS Gonzalez RG Schaefer P Sorensen AG		Neurological Cardiology / Vascular
Stroke	Neuronal activation CMRO2	Arterial spin labeling MRI O2 15 PET Xenon Enhanced CT	Wald LL		Neurological Cardiology / Vascular
Stroke	Neuronal activation CMRO2	fMRI Diffuse optical topography (Near infrared spectroscopy)	Boas D Mandeville JB Strangman G	NIRS agrees well with fMRI, useful in longitudinal studies	Neurological Cardiology / Vascular

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Stroke	Oxygen consumption Cerebral blood flow (CBF)	Optical Imaging	Boas D Dunn A Lo E		Neurological Cardiology / Vascular
Stroke / ischemic	Cerebral blood flow (CBF) Relative cerebral blood volume (rCBV) Water EF	CAPTIVE MRI	Bogdanov A Jenkins B Kwong K Weissleder R		Neurological Cardiology / Vascular
Stroke / ischemic	Vascular occlusion Ischemic brain tissue	Diffusion / perfusion weighted imaging MRI CT perfusion CTA	Gonzalez R Harris G Sorensen AG		Neurological Cardiology / Vascular
Stroke / recovery	Cortical activation during sensorimotor tasks	fMRI	Schaechter J Rosen BR		Neurological Cardiology / Vascular
Visual process disorders	Neuronal activation	fMRI	Mandeville JB Rosen B Tootell RBH		Neurological
Vulnerable plaque	Atherosclerotic plaque temperature	Thermography	Brady T Lev M Waltman A		Neurological Cardiology/ Vascular Inflammatory
Vulnerable plaque	Macrophage content Fibrous cap thickness Plaque Type	Optical coherence topography	Weissleder R		Neurological Cardiology / Vascular Inflammatory
Vulnerable plaque	Subendothelial lipid pool	Optical coherence topography Near infrared spectroscopy	Brady T Muller J		Neurological Cardiology / Vascular
Vulnerable plaque	Targeted microbubble contrast agents	Contrast enhanced US	O'Neill MJ Waltman A		Neurological Cardiology / Vascular Inflammatory
Vulnerable plaque	Thickness and composition of plaque	Intravascular US IVUS	Brady T Lev M O'Neill MJ Waltman A		Neurological Cardiology / Vascular Inflammatory