

Disease/ Medical Condition	Biomarker	Imaging Technique	Investigators	Comments	Disease Category
Adenopathy, lymphoma and metastatic disease	Lesion volume	US CT MRI	Harisinghani M Mueller PR O'Neill MJ Saini S		Oncology / Neoplasm Genitourinary
Adrenal neoplasm	Relative % contrast washout	CT	Boland GW Hahn PF Mueller PR	Differential diagnosis of adrenal masses	Oncology / Neoplasm Genitourinary
Aveolar bronchial cell carcinoma	Pulmonary consolidation	CT MRI	McLoud TC Shepard J		Oncology / Neoplasm Cardiology / Vascular
Benign prostatic hypertrophy	Prostate volume	US CT MRI	Hahn PF Mueller PR O'Neill MJ		Oncology / Neoplasm Genitourinary
Breast neoplasm	Glucose metabolism	PET	Alpert NM Choi NC Fischman AJ		Oncology / Neoplasm
Breast neoplasm	Microcalcifications	Raman Spectroscopy	Feld MS (MIT)	Differential diagnosis of benign from malignant microcalcifications	Oncology / Neoplasm
Breast neoplasm	Microvascular blood volume Microvascular density Angiogenesis	US	O'Neill MJ	Microbubble contrast agents	Oncology / Neoplasm
Breast neoplasm	Presence of contralateral synchronous cancers	MRI	Kopans DB	4 of 17 patients (24%) had contralateral cancer occult to physical exam, mammography and US	Oncology / Neoplasm
Breast neoplasm	Regional blood flow and blood volume Microvessel density (MVD)	MRI	Kopans DB	Magnetic susceptibility-based contrast agent OR GD-DTPA with dynamic echo planar imaging	Oncology / Neoplasm
Breast neoplasm	Tumor associated enzymatic activity	Optical Near infrared spectroscopy	Bremer C Bogdanov A Weissleder R	Expression levels of cathepsin-B activity in animal models of breast cancer	Oncology / Neoplasm
Breast neoplasm	Tumor volume	MRI	Harris G		Oncology / Neoplasm
Cholangio-carcinoma	Liver tissue characterization	MRI	Hahn PF Halpern EF Sahani D	Using combined ferrumoxide / Gd-DTPA	Oncology / Neoplasm Gastrointestinal
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	Microvascular blood volume and microvascular density	fMRI MRI	Belliveau Kennedy D Rosen BR		Neurological Oncology / Neoplasm
CNS neoplasm / primary and secondary	N-acetylaspartate (NAA) Choline Lactate Phosphocreatine	MRS	Gonzalez R Husiman TA Sorensen AG	Metabolism, tumor viability, Response to therapy	Neurological Oncology / Neoplasm

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 Weissleder R	Serial studies of tumor volume using uptake of long-circulating dextrin coated iron oxide (LCDIO) Rodent model	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, presence and viability	Oxygen consumption Cerebral blood flow (CBF)	Optical	Boas D Dunn A	Diffuse Optical imagine (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
Colorectal carcinoma	99mTc labeled monoclonal antibody	SPECT	Fischman AJ	Phase III Clinical Trial with HumaSPECT-Tc	Oncology / Neoplasm Gastrointestinal
Fibrocystic change	Cyst composition / tissue characterization	US CT MRI	Kopans DB		Oncology / Neoplasm
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	Gonzalez RG Sorensen AG 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 R	Via ultra small particulate iron oxide (USPIO)	Neurological Oncology / Neoplasm
Glioma	Vascular volume fraction	Optical NMR	Bogdanov A Kwong KK Weissleder R	Rodent model	Neurological Oncology / Neoplasm
Head and neck neoplasm / primary and secondary	Glucose metabolism	PET	Alpert N Choi N Fischman A	Non-specific marker with wide variety of applications	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

Oncology / Neoplasm

Hepatic focal nodular hyperplasia	Liver tissue characterization	MRI	Hahn PF Halpern EF Sahani D	using combined ferrumoxide / Gd-DPTA	Oncology / Neoplasm Gastrointestinal Endocrine
Hepatic focal nodular hyperplasia	Liver tissue characterization	MRI	Hahn PF Harisinghani M Mueller PR Weissleder R	Using ultrasmall super-paramagnetic iron oxide, mangafodipir trisodium	Oncology / Neoplasm Gastrointestinal Endocrine
Hepatic hemangioma	Liver tissue characterization	MRI	Hahn PF Harisinghani M Mueller PF Saini S Weissleder R	Using ultrasmall superpara-magnetic iron oxide OR Gd-based chelates	Oncology / Neoplasm Gastrointestinal
Hepatic neoplasm / primary and secondary	Glucose metabolism	PET	Fischman AJ	Non-specific marker with wide variety of applications	Oncology / Neoplasm Gastrointestinal
Hepatic neoplasm / primary and secondary	Lesion detection	MRI	Hahn PF Harisinghani M Saini S Weissleder R	Increased SNR and CNR with liver specific contrast agent GD-BOPTA and mangafodipir	Oncology / Neoplasm Gastrointestinal
Hepatic neoplasm / primary and secondary	Lesion volume	US CT MRI	Harris G Mueller PR O'Neill MJ Saini S	Anatomic marker of disease presence	Oncology / Neoplasm Gastrointestinal
Hepatic neoplasm / primary and secondary	Vascular architecture	Multidetector CT angiography (MDCTA)	Hahn PF Mueller PR Saini S Sahani D	Presurgical treatment planning	Oncology / Neoplasm Gastrointestinal
Hepatocellular Carcinoma	Liver tissue characterization	MRI	Hahn PF Harisinghani M Mueller PR Weissleder R	Using ultrasmall superpara-magnetic iron oxide, mangafodipir trisodium	Oncology / Neoplasm Gastrointestinal
Hepatocellular carcinoma	Liver tissue characterization	MRI	Hahn PF Halpern EF Harisinghani M Sahani D,	Using combined ferrumoxide / Gd-DPTA	Oncology / Neoplasm Gastrointestinal
Hodgkin's disease	N-acetylaspartate (NAA)	MRS	Jenkins B Kennedy D Rosas D Rosen BR		Oncology / Neoplasm
Lung neoplasm / non small cell carcinoma	Glucose metabolism	PET	Choi NC Fischman AJ Weissleder R	Pilot trial in NSCLC showed good inverse correlation between MR post radiation and outcomes	Oncology / Neoplasm
Lung neoplasm / primary and secondary	Lesion volume	CT MRI	Hunter GJ	Anatomic marker of disease presence	Oncology / Neoplasm
Lung neoplasm / primary and secondary	Mediastinal nodal status	PET MRI CT	Fischman AJ McLoud TC Weissleder R	Physiologic imaging with FDG or iron oxide particles in NSCLC	Oncology / Neoplasm
Lymphangio-carcinomatosis	Increased pulmonary interstitial markings	CT	McLoud TC Mueller PR Shepard J Weissleder R		Oncology / Neoplasm
Lymphatic extension of pelvic malignancy (gynecological oncology)	Abnormal lymphatic uptake of tracer	MRI	Hahn PF Harisinghani M Mueller PR Saini S Weissleder R	MR Lymphangiography using ultrasmall superpara-magnetic iron oxide (ferumoxtran-10)	Oncology / Neoplasm Inflammatory

Oncology / Neoplasm

Neoplasm / primary and secondary	Anti-tumor antibody	Optical	Ntziachristos V Weissleder R	Targeted Fluorochromes	Oncology / Neoplasm
Neoplasm / primary and secondary	Apoptosis Caspase-1 Caspase-3	Optical	Ntziachristos V Weissleder R	Active, stable Fluorochromes	Oncology / Neoplasm
Neoplasm / primary and secondary	Apoptosis Phosphatidylserine	Optical	Ntziachristos V Weissleder R	Active, stable Fluorochromes	Oncology / Neoplasm
Neoplasm / primary and secondary	Cathepsin D	Optical	Ntziachristos V Weissleder R	Active, stable Fluorochromes	Oncology / Neoplasm
Neoplasm / primary and secondary	Change in local tissue density or contrast enhancement	CT MRI	Palmer WE Rosenthal DI	Multicenter Trail with 367 patients - CT and MRI equally reliable for diagnosis	Musculoskeletal Oncology / Neoplasm
Neoplasm / primary and secondary	Directed molecular probes	MRI PET Optical	Fischman AJ Hunter GJ Weissleder R		Oncology / Neoplasm
Neoplasm / primary and secondary	Enzymatic activity	Optical	Weissleder R	Rodent model	Oncology / Neoplasm
Neoplasm / primary and secondary	Fluorescent proteins / exogenous	Macroscopic fluorescence reflective imagine (FRI) Fluorescence molecular tomography (FMT)	Ntziachristos V Weissleder R	Green fluorescence proteins (GFPs) Ds Red Hc Red	Oncology / Neoplasm
Neoplasm / primary and secondary	Folate receptor	Optical	Ntziachristos V Weissleder R	Targeted Fluorochromes	Oncology / Neoplasm
Neoplasm / primary and secondary	Glucose transporter	Optical	Ntziachristos V Weissleder R	Targeted Fluorochromes	Oncology / Neoplasm
Neoplasm / primary and secondary	Human transferrin receptor	MRI	Weissleder R	Receptor binding probe linking transferrin and monocrystalline iron oxide (Tf-MION)	Oncology / Neoplasm
Neoplasm / primary and secondary	Local uptake of specific tumor avid radiotracers	Nuclear medicine	Fischman AJ		Musculoskeletal Oncology / Neoplasm
Neoplasm / primary and secondary	Matrix metalloproteinase-2 MMP-9 MMP-13	Optical	Ntziachristos V Weissleder R	Active, stable Fluorochromes	Oncology / Neoplasm
Neoplasm / primary and secondary	Pharmacokinetics Biodistribution Non-tumor uptake	SPECT PET MRS	Fischman AJ Jenkins B	Additional use for determining in vivo heterogeneity of tumor uptake	Oncology / Neoplasm
Neoplasm / primary and secondary	Soft tissue inflammation	Nuclear medicine MRI	Fischman AJ Palmer WE Rosenthal DI		Oncology / Neoplasm
Neoplasm / primary and secondary	Somatostatin receptor	Optical	Ntziachristos V Weissleder R	Targeted Fluorochromes	Oncology / Neoplasm
Neoplasm / primary and secondary	Tumor angiogenesis	MRI Dynamic susceptibility contrast (DSC) / monocrystalline iron oxide nanoparticles (MION)	Bogdanov A Bremer C Rosen BR Weissleder R	High resolution MR using long circulating iron oxide contrast agents Rodent model	Oncology / Neoplasm
Neoplasm / primary and secondary	Tumor angiogenesis Macromolecular contrast extravasate	MRI SPECT	Bogdanov A Weissleder R	Animal model using pegylated DOTA derivatized graft copolymers	Oncology / Neoplasm

Oncology / Neoplasm

Neoplasm / primary and secondary	Tumor growth rate	MRI SPECT Dual tracer NMR	Bogdanov A Kwong K Weissleder R	SPECT via uptake of long-circulating dextrin coated iron oxide (LCDIO) Rodent model	Oncology / Neoplasm
Neoplasm / primary and secondary	Tumor mass	Optical	Weissleder R		Oncology / Neoplasm
Neoplasm / primary and secondary	Tumoral proteinase	Optical Near infrared spectroscopy	Bogdanov A Mahmood U Weissleder R	Rodent model	Oncology / Neoplasm
Osseous neoplasm / primary and secondary	Glucose metabolism	PET	Fischman AJ		Oncology / Neoplasm
Osseous neoplasm / primary and secondary	Osteoblastic activity	Nuclear medicine	Fischman AJ		Oncology / Neoplasm
Osseous neoplasm / primary and secondary	Tissue characterization	CT MRI	Rosenthal DI		Oncology / Neoplasm
Ovarian neoplasm / presence and viability	Glucose metabolism	PET	Fischman AJ	Non-specific marker with wide variety of applications	Oncology / Neoplasm Genitourinary
Ovarian neoplasm / presence and viability	ROC curve analysis of 13 CT radiographic parameters	CT	O'Neill MJ	Predictive model of relative success of surgical cytoreduction	Oncology / Neoplasm Genitourinary
Pancreatic adrenal carcinoma	Degree of circumferential vessel involvement	Multidetector CT / CTA	Boland GW Mueller PR Saini S		Oncology / Neoplasm Gastrointestinal
Pancreatic carcinoma	18 F-fluorodeoxy-glucose	PET	Fischman AJ		Oncology / Neoplasm Gastrointestinal
Pancreatic carcinoma	Vascular involvement Portal Venous invasion	MRA	Halpern EF Saini S Waltman AC	Better predictor than conventional angiography	Oncology / Neoplasm Gastrointestinal
Pancreatic mass	Contrast enhanced tissue characterization	MR cholangio-pancreatography	Prasad S Sahani D Saini S		Oncology / Neoplasm Gastrointestinal
Prostate cancer	Prostate volume	US CT MRI	Hahn PF Mueller PR O'Neill MJ		Oncology / Neoplasm Genitourinary
Prostate cancer	Prostate-specific antigens (PSA)	Optical	Ntziachristos V Weissleder R	Active, stable Fluorochromes	Oncology / Neoplasm
Prostate cancer	Spermine levels	MRS magic angle spinning	Cheng LL Gonzalez RG	Proposed endogenous inhibitor of prostate CA growth	Oncology / Neoplasm Genitourinary
Pulmonary neoplasm	Permeability surface area product	PET MRI	Fischman AJ McLoud TC		Oncology / Neoplasm
Pulmonary neoplasm / presence and viability	Glucose metabolism	PET	Fischman AJ	Non-specific marker with wide variety of applications	Oncology / Neoplasm
Rectal carcinoma / advanced Staging	Infiltration of tunica muscularis Presence of positive nodes	MRI Multidetector CT US	Hahn P Saini S O'Neill MJ Mueller P		Gastrointestinal Oncology / Neoplasm
Rectal carcinoma / Recurrent	Perirectal fat involvement Spiculated lymph node	MRI	Hahn P Prasad S Saini S	Predictor of high probability of local recurrence	Gastrointestinal Oncology / Neoplasm
Renal neoplasm / primary and secondary	Cyst composition / tissue characterization	US CT MRI	Mueller PR		Oncology / Neoplasm Genitourinary
Renal neoplasm / primary and secondary	Glucose metabolism	PET	Fischman AJ		Oncology / Neoplasm Genitourinary

## Oncology / Neoplasm

Renal neoplasm / primary and secondary	Lesion volume	US CT MRI	Mueller PR O'Neill MJ Saini S	Anatomic marker of disease presence	Oncology / Neoplasm Genitourinary
Sarcoma	Vascular volume fraction	Optical	Weissleder R		Oncology / Neoplasm
Simple renal cysts	Cyst composition / tissue characterization Soft tissue inflammation	US CT MRI	Mueller PR		Oncology / Neoplasm Genitourinary
Soft tissue neoplasm / primary and secondary	Glucose metabolism	PET	Fischman AJ	Non-specific marker with wide variety of applications	Oncology / Neoplasm Musculoskeletal
Splenic cysts	Splenic tissue characterization	MRI	Hahn PF Harisinghani M Mueller PR Weissleder R	Using ultrasmall superpara-magnetic iron oxide	Oncology / Neoplasm Gastrointestinal
Splenic neoplasm	Splenic tissue characterization	MRI	Hahn PF Harisinghani M Mueller PR Weissleder R	Using ultrasmall superpara-magnetic iron oxide	Oncology / Neoplasm Gastrointestinal
Synovial cell sarcoma	Cyst composition / tissue characterization	US CT MRI	Rosenthal DI		Oncology / Neoplasm Musculoskeletal
Synovial chondromatosis	Periarticular erosion	Plain radiographs	Palmer WE Rosenthal DI		Oncology / Neoplasm Musculoskeletal
Thyroid carcinoma	Cystic nodal metastases	US	Hahn PF Harisinghani M Mueller PR O'Neill MJ		Oncology / Neoplasm Endocrine