"How MR Research Can Help Your Program and Improve Your chances for Grant Funding"

E. Mark Haacke, PhD - Director

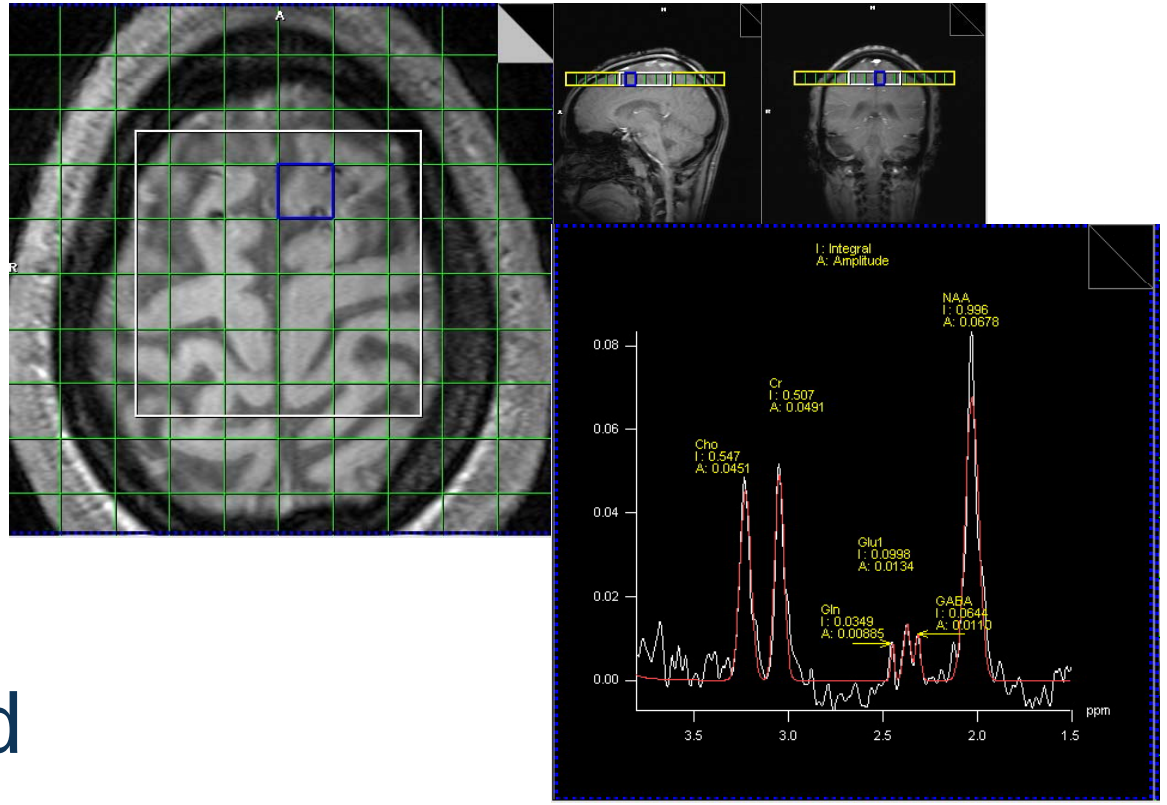
MR Research Facility - Dept. of Radiology, School of Medicine

Wayne State University, Detroit, MI

The Vaitkevicius Magnetic Resonance Research Facility

Magnetic Resonance Research

- Imaging
- Spectroscopy



It provides:

- Structural
- Functional and
- Metabolic Information

Magnetic Resonance Imaging

- Imaging is one of the top ten discoveries in the last 1,000 years.
  - Non – invasive
  - Non – ionizing
  - High resolution images
  - 3D data acquisition
  - Human and animal scanners
  - Future materials imaging

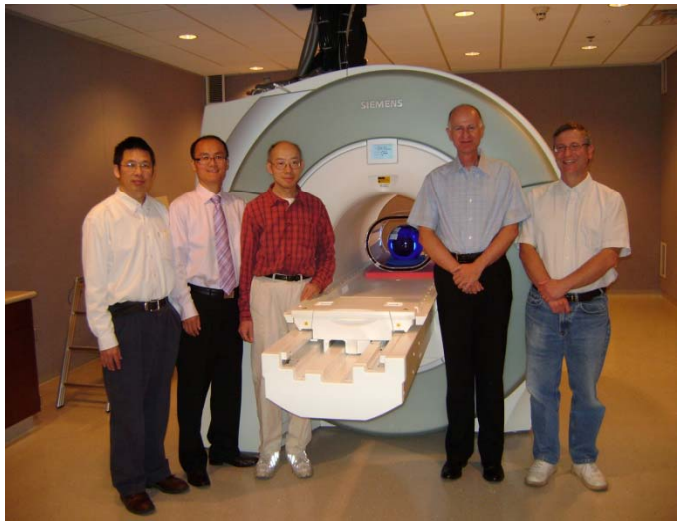
Magnetic Resonance Imaging

- Imaging is one of the top ten discoveries in the last 1,000 years.
  - Developed in 1970's by Lauterbur and Mansfield
  - Umbrella of all imaging modalities today
  - Constantly expanding and rapidly growing
  - From basic physics experiments
  - To numerous clinical applications

MR Research Facility

The Research Human MR Scanner

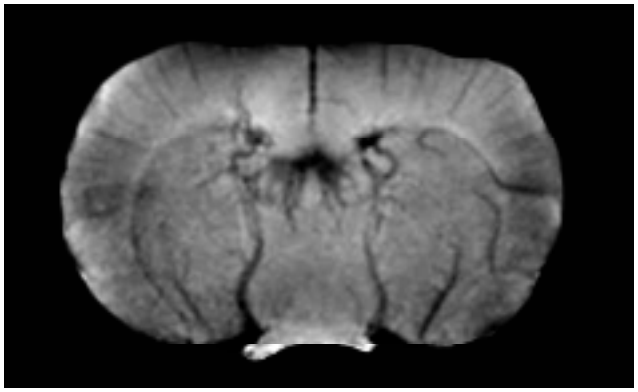
- Located in Harper University Hospital
  - 3T Verio high field human Siemens scanner



MR Research Facility

The Research Animal MR Scanner

- Located in the Elliman building
  - 7T ClinScan high field animal Bruker scanner



MR Research Facility

The Vaitkevicius MR Center

- Emphasis on Education
  - Attracts MR visionaries and scientists
  - Provides an excellent research learning environment for the MR experimentation
  - Provides guidance to graduate students, research oriented residents as well as young faculty.
  - Supports dozens of projects across campus

MR Research Facility

- The Vaitkevicius MR Center
  - Emphasis on Education and Research
    - The MRRF offers strong training for:
      - Students
      - Post Docs
      - Clinical Fellows
      - Visiting Scholars
      - Young Faculty
    - Clinical and translational research

MR Research Facility

- The Vaitkevicius MR Center
  - Emphasis on Research
    - Develop and apply revolutionary MR methods
    - Apply these methods to detect and monitor disease and its treatment
    - Promote their usage across WSU scientific community and internationally

MR Research Facility

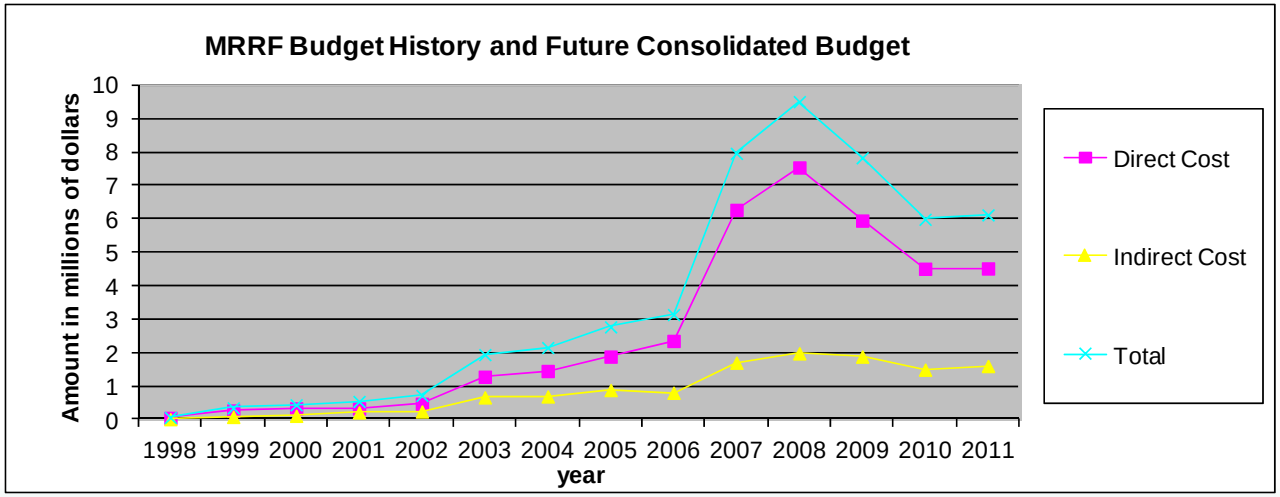
The Vaitkevicius MR Center

- Emphasis on Research
  - Ongoing clinical research include but not limited to:
    - Aging
    - Breast cancer
    - Cardiac Imaging
    - Diabetic retinopathy
    - Multiple sclerosis
    - Stroke
    - Trauma
    - Tumors

MR Research Facility

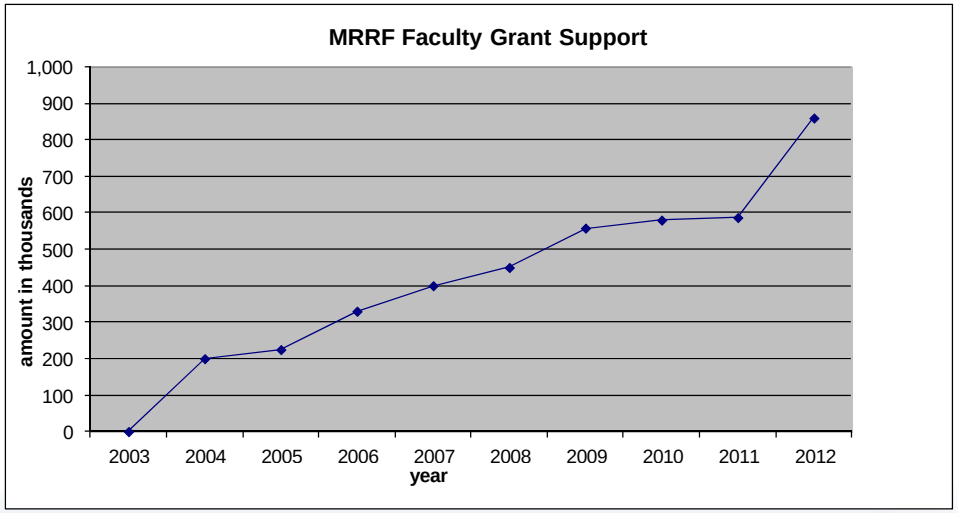
The Vaitkevicius MR Center

- Emphasis on Research
  - In the last 10 years, WSU faculty received more than $30M in funding related to imaging



MR Research Facility

- The Vaitkevicius Magnetic Resonance Center
  - Emphasis on Research
    - In the last 10 years, MRRF research faculty brought more than $5M in imaging funding



PTBIR

- Program for Traumatic Brain Injury Research (PTBIR)
  - Dedicated to campus wide research
    - School of Medicine
    - College of Engineering
    - Detroit Medical Center

PTBIR

- Program for Traumatic Brain Injury Research (PTBIR)
  - Dedicated to campus wide research
    - Basic research
    - Neuroimaging
    - Clinical initiatives

PTBIR

- Program for Traumatic Brain Injury Research
  - Overall goal:
    - Provide unique training environment to prospective neuroscientists
    - Diagnose and predict the outcome of TBI
      - To develop effective treatment approaches to TBI

PTBIR

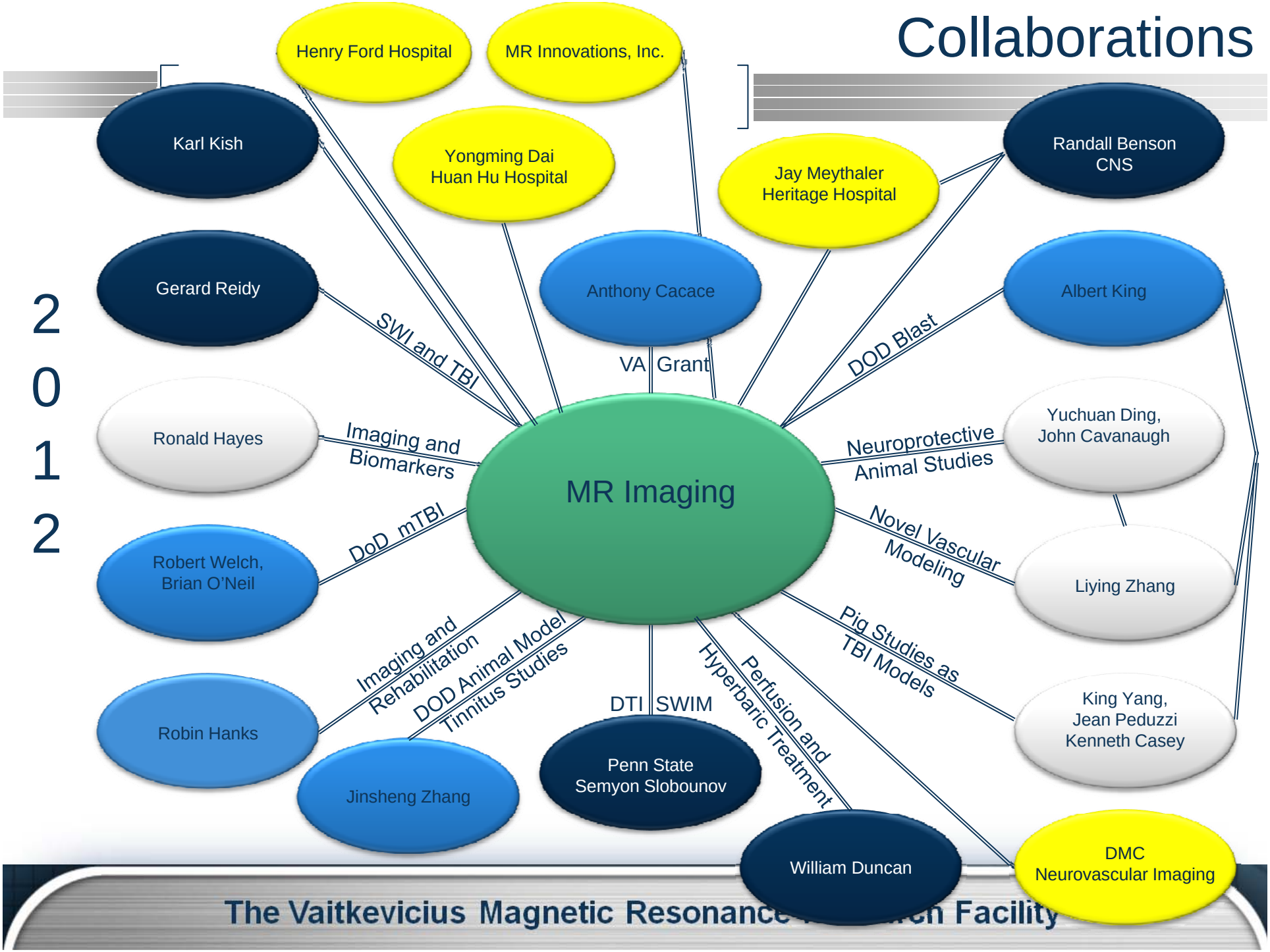
- Program for Traumatic Brain Injury Research
  - Current activities:
    - Seminar Series
      - Held twice a month to host internal and external speakers
    - Annual workshop
      - Held every year in November
        - This year: November 9th, 2012
    - Summer School 2013
      - To be held from June 3rd till June 21st.

PTBIR

Program for Traumatic Brain Injury Research

- Summer school 2013:
  - Primary target: graduate students from Michigan and surrounding states, who are currently enrolled in any biomedical related field and with a focus on TBI, imaging and neurosciences
  - Secondary target: Medical community in general
    - Interested in TBI research
    - Medical students, residents and physicians who are interested in TBI as well as acquiring CME credits (3 days, every Friday)

Collaborations

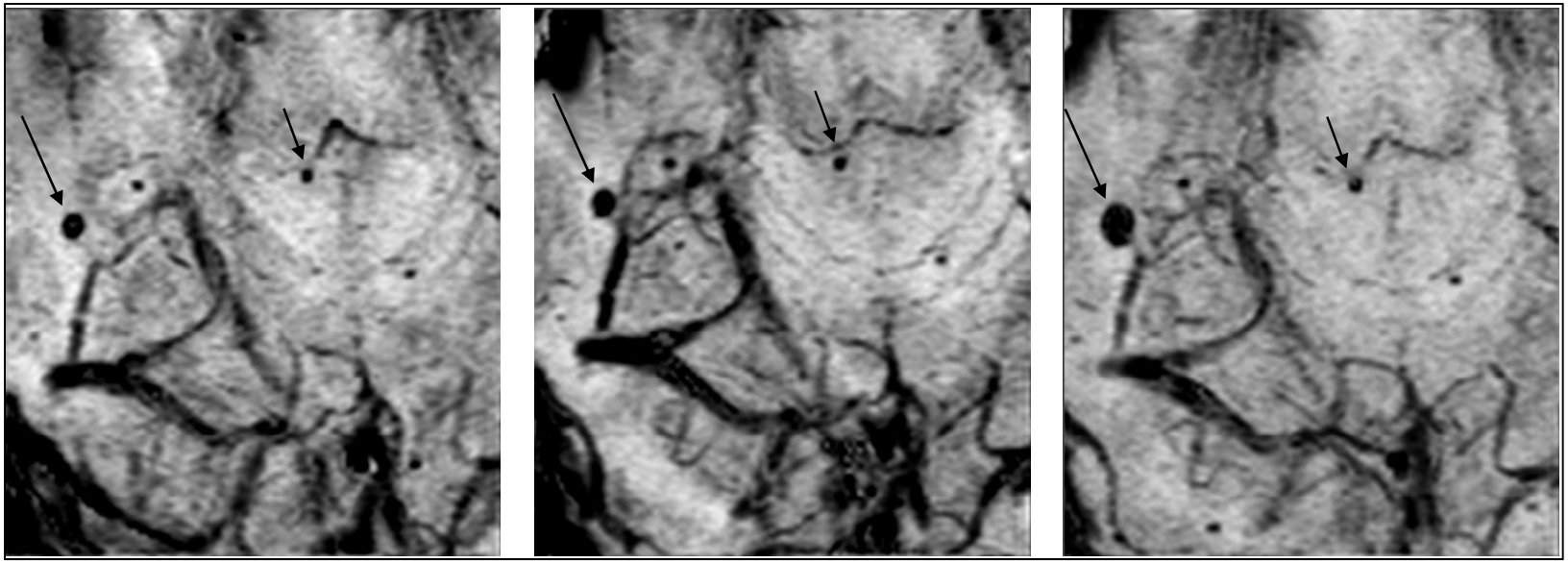


Research projects

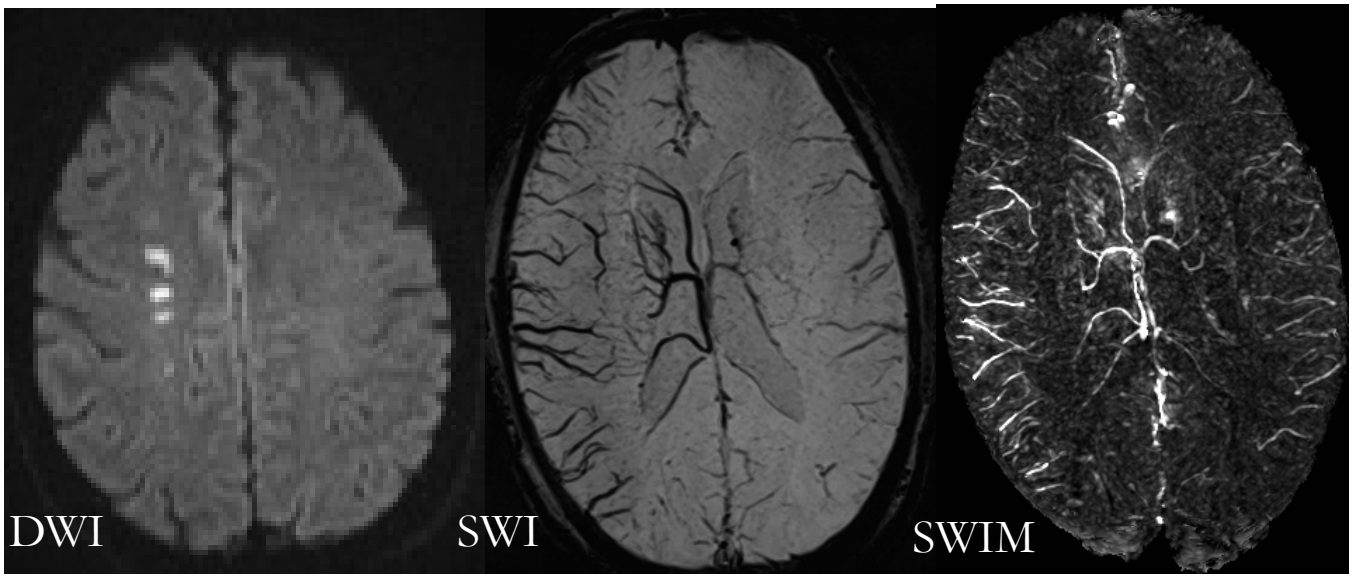
- Neurodegenerative disease:
  - Multiple sclerosis, Parkinson's, Epilepsy, ADHD and OCD etc
- Cardiovascular disease:
  - Cardiac function
  - Atherosclerosis etc.
- Macular degeneration
- and many others

Vascular Dementia

- WSU researchers have made major advances using MRI that have the potential to help improve health care and enhance funding in:
  - Detection of microbleeds



Stroke:
Measuring oxygen saturation:
Can we monitor the health of tissue post trauma?

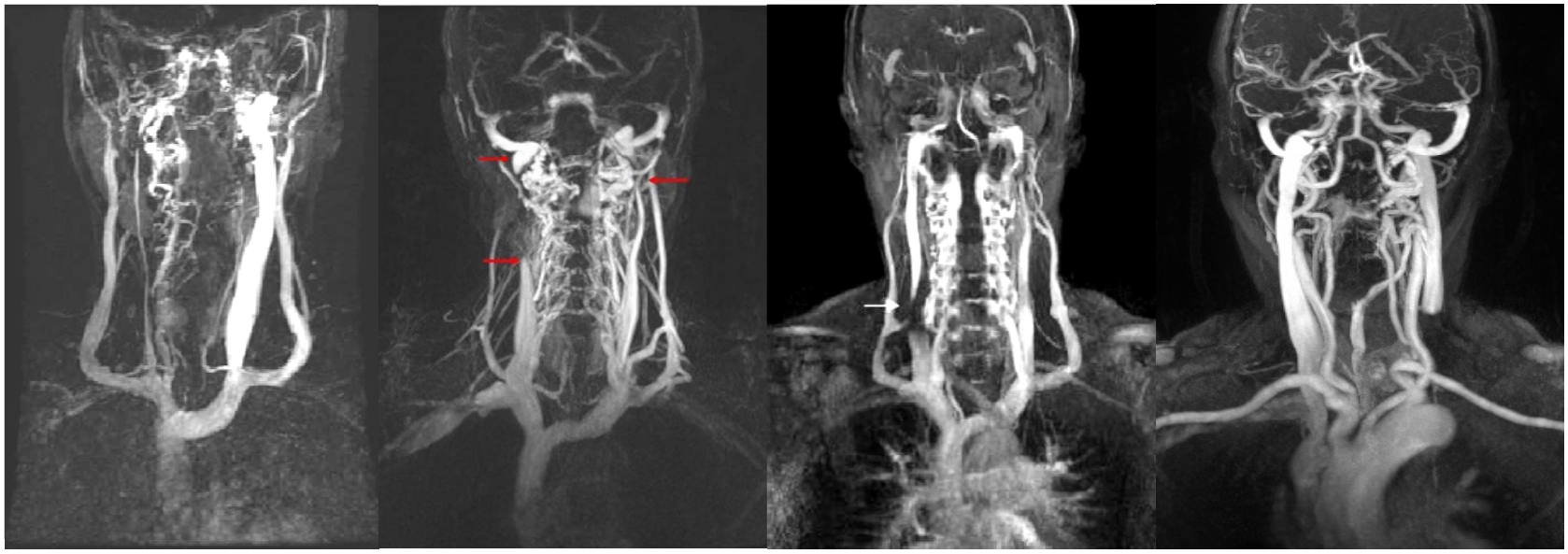


A 57 year old male patient with left limb weakness was scanned 144 hours after onset of stroke.

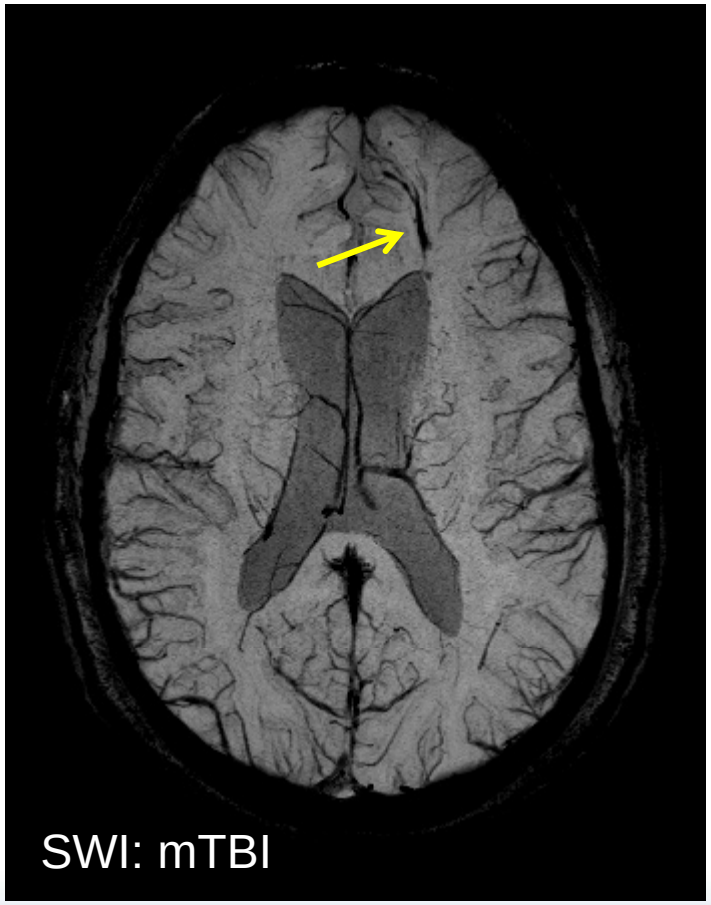
Recall that TBI can be like having multiple strokes.

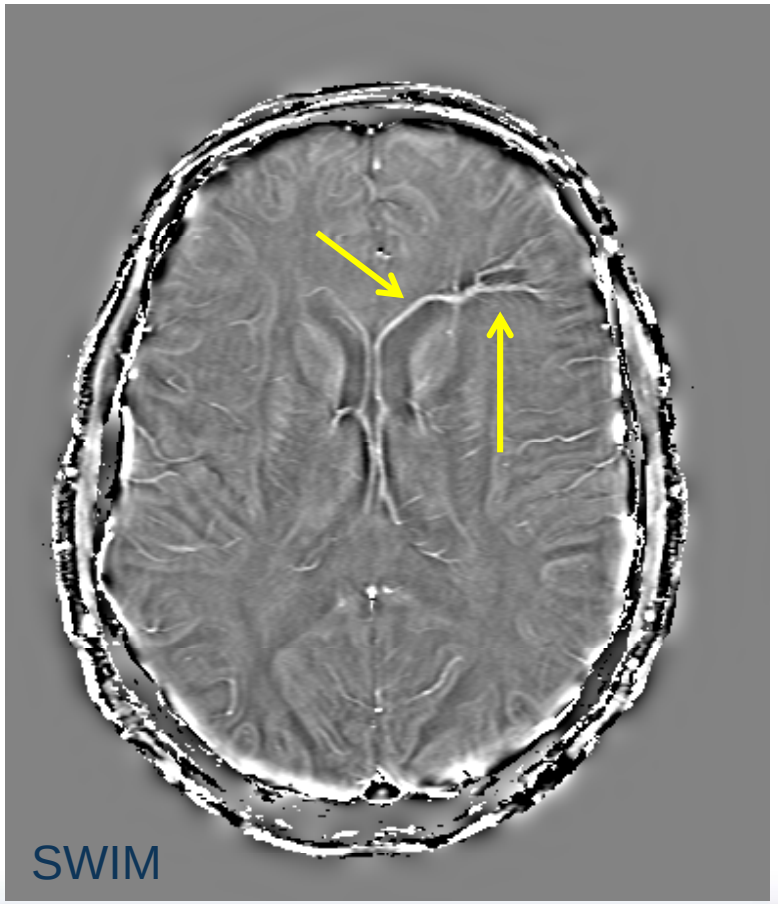
Vascular MS

- WSU researchers have made major advances using MRI that have the potential to help improve health care and enhance funding in:
  - establishing anatomical and functional biomarkers in the study of multiple sclerosis.

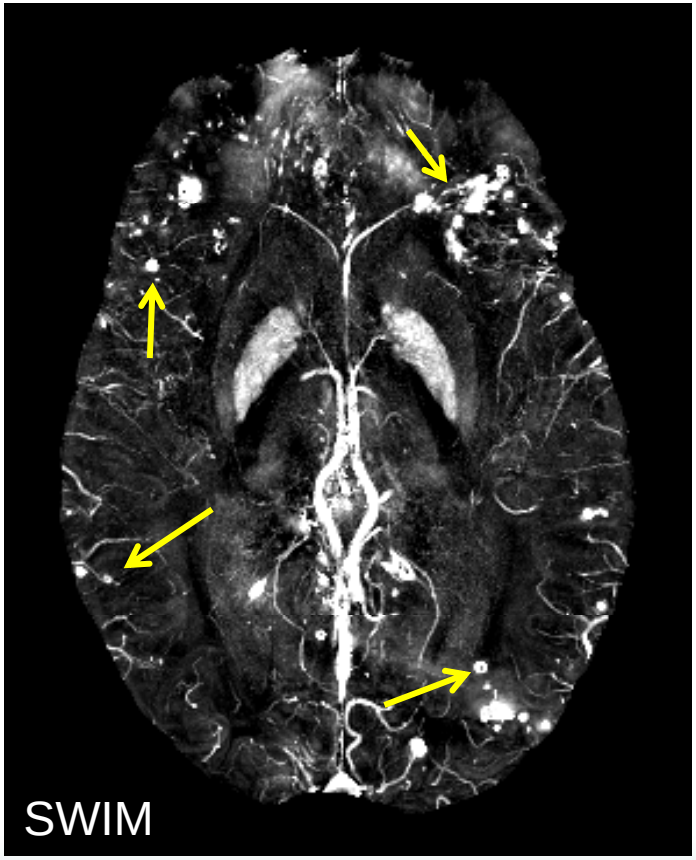


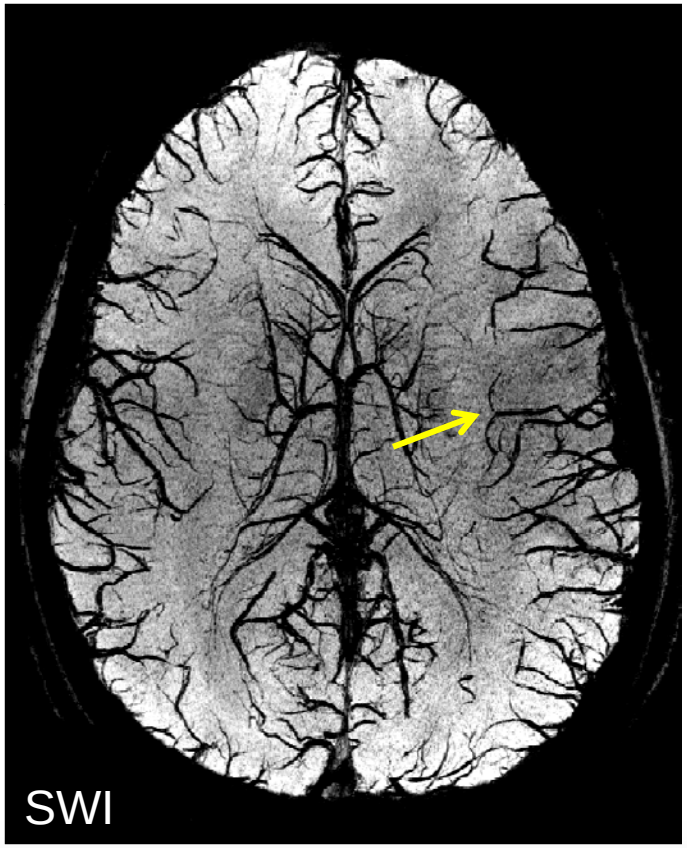
Breakthroughs in TBI Research: The role of medullary vein damage in mild TBI



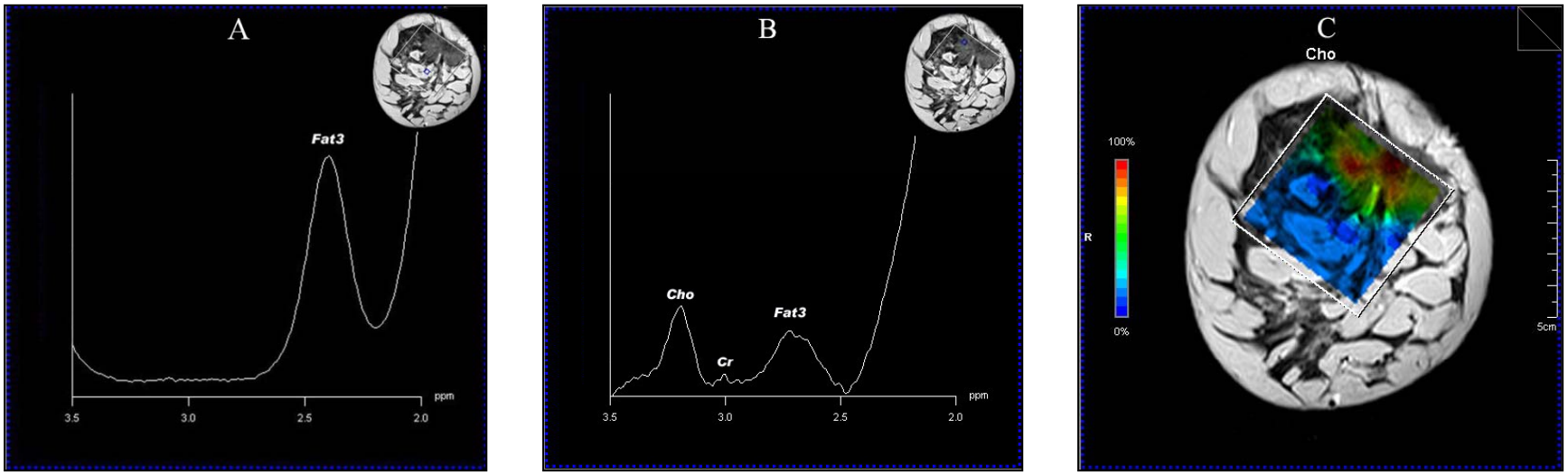


Breakthroughs in TBI Research: Monitoring oxygen utilization and iron deposition: Applications to TBI and PD





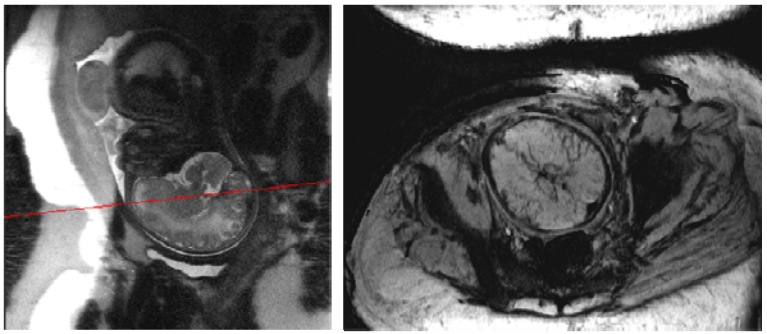
Breakthroughs in TBI Research: Breast Cancer Detection using MRI



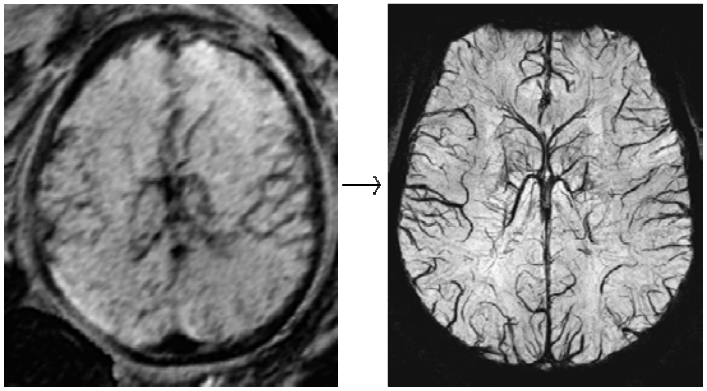
The images above illustrates the heterogeneous distribution of choline (Cho), creatine (Cr), and taurine (Tau) across a lesion using high spatial resolution spectroscopy at 3T. (A) Spectrum from a control area without detectable Cho. (B) Shows clearly elevated Cho. (C) A color-coded Cho image overlaid on the corresponding MR breast image, illustrating two “hot” tumor areas highlighted as increased choline in red. This result indicates a potentially active tumor from which the radiologist could draw important diagnostic conclusions for the future treatment of the patient.

Fetal imaging

- WSU researchers have made major advances using MRI that have the potential to help improve health care and enhance funding in:
  - Perinatal Research



Pilot scan on the left, effective transverse SWI on the right: 37 weeks 1 day

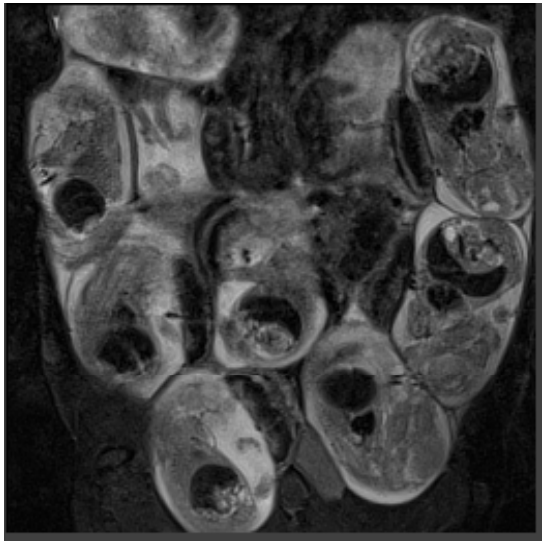


SWI Venography in the Fetus
0.7 x 1.4 mm² in-plane with slice thickness 3 mm

SWI venography in Adults
0.5 x 0.5 mm² in-plane with slice thickness 0.5 mm

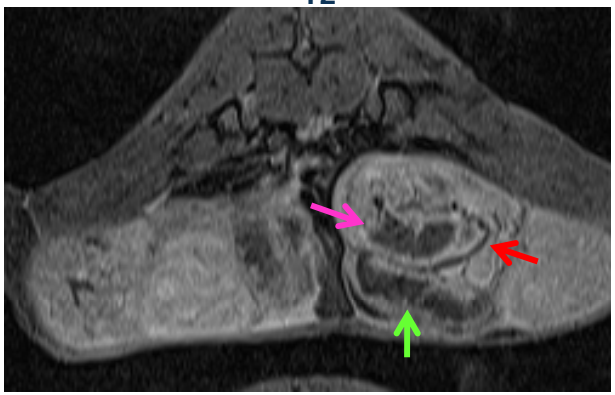
Fetal imaging – In Animals

- WSU researchers have made major advances using MRI that have the potential to help improve health care and enhance funding in:
  - Perinatal Research – investigating pre-eclampsia condition in Animal Model (mice)

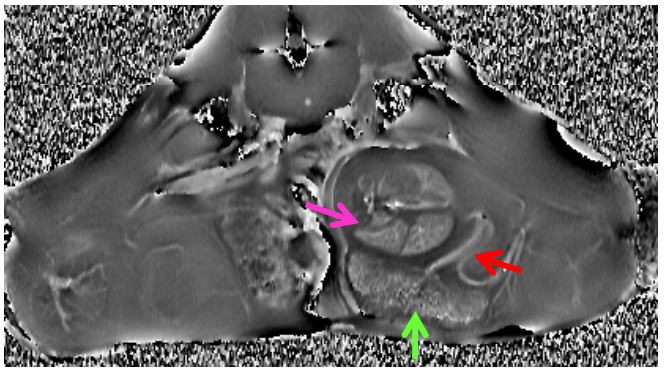


Coronal View of the multiple fetuses in mice pregnancy

T2



SWI Phase

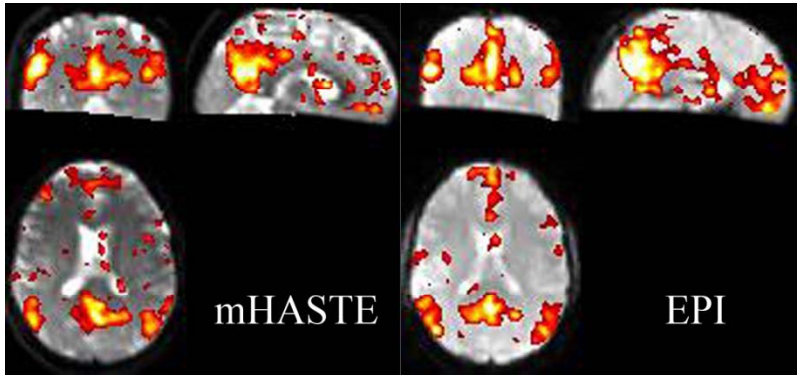


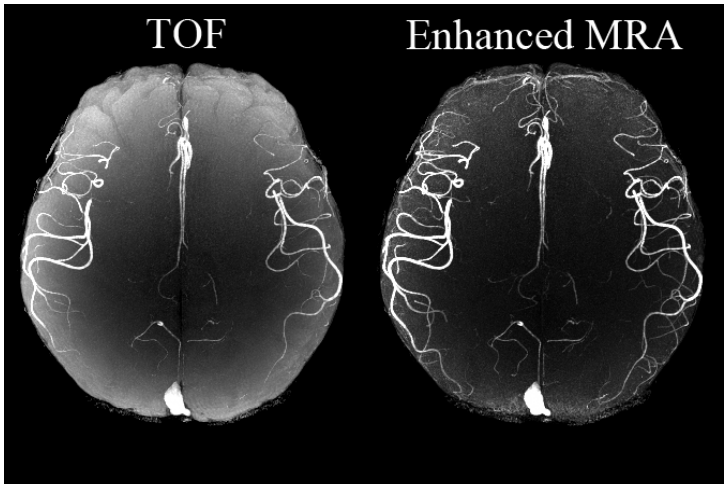
T2 and SWI phase images of the axial view of a fetus. Placenta and corresponding umbilical cord is clearly visualized in SWI-phase. Various lobes of the fetal lung are also seen.

Umbilical Cord
Placenta
Fetal Lung

Functional MRI

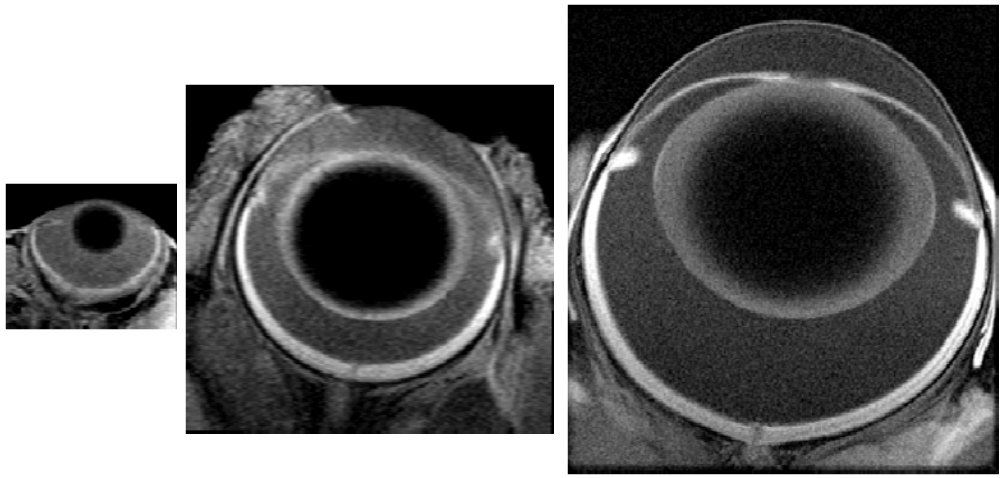
- WSU researchers have made major advances using MRI that have the potential to help improve health care and enhance funding in:
  - Functional MRI and MR angiography





Diabetic retinopathy

- New functional MRI surrogates of treatment efficacy in visual and hearing perception and their correlation with performance
  - Diabetic retinopathy
  - Tinnitus
- Novel functional MRI for measuring tumor proliferation



Zebrafish Mouse Rat

fMRI in psychiatry

The BRAIN Division

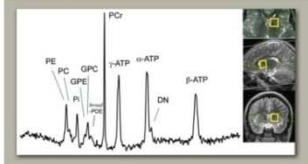
Strategic Approach to Neuimaging Research

PEDIATRIC DISORDERS

The BRAIN division is involved in studying different pediatric disorders including:

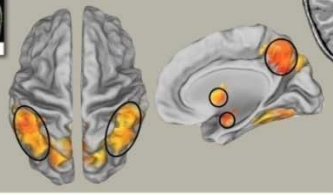
- Attention deficit hyperactivity disorder (ADHD)
- Anxiety disorders
- Mood disorders
- Schizophrenia
- At risk populations
- Fetal alcohol spectrum disorders (FASD)

NEUROIMAGING TOOLS - MRS, fMRI, MRI AND DTI



MRS can identify biochemical markers.

fMRI can examine function.



MRI and DTI can pinpoint morphological markers.

BASIC NEUROSCIENCE RESEARCH

Using these neuroimaging methods, the primary goals are to:

- Chart development biochemically and functionally in the brain.
- Map functional networks associated with behavior and cognition.
- Assess how these different networks integrate as the brain matures.

CLINICAL RESEARCH

Applying basic neuroscience research to clinical research can help to:

- Identify when in age and where in the brain alterations occur.
- Implement early treatment intervention.
- Better targeted treatment intervention.
- Monitor overtime treatment response.

Future plans

- To expand the applications and utility of magnetic resonance research at Wayne State University and to help you whenever possible improve your chances for grant funding in the future.


Thank You
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www.tbi.wayne.edu
The Vaitkevicius Magnetic Resonance Research Facility