TATRC Programs in Image-Guided Therapy

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TATRC: Our Community and its Needs

TRICARE

Tricare
(Active, Retired, Beneficiaries)

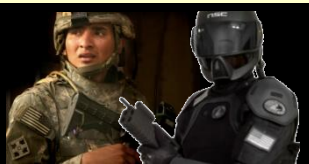
Healthcare
(Cancers, Circulatory Disease)

Prevention, Detection, Diagnosis and Treatment

Trauma Care
(PTSD/TBI, Bleeding, Amputations, Burns)

Soldier Performance
(Psychological/Physiological)

Combat Casualty Care
"Boots on the ground"



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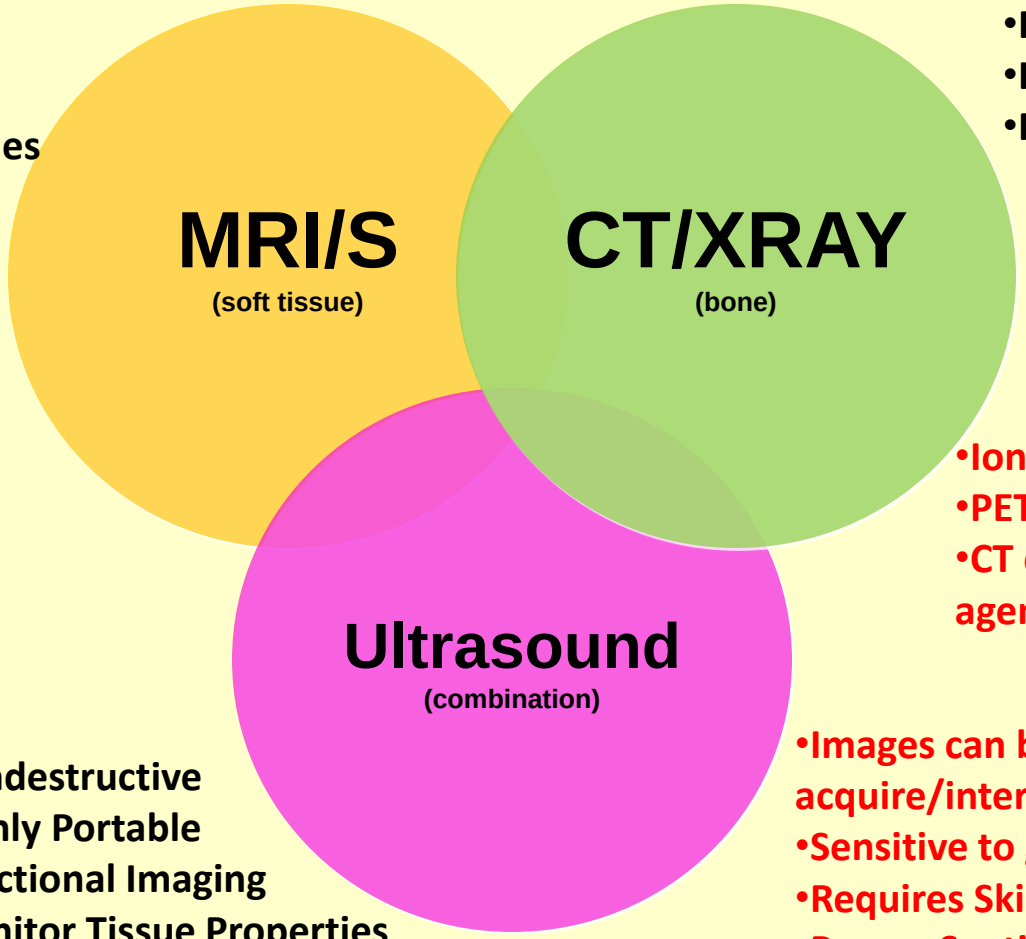
Conventional Technologies: Detection and Diagnosis



- Nondestructive
- Functional Imaging
- High Resolution
- Penetrates All Tissues

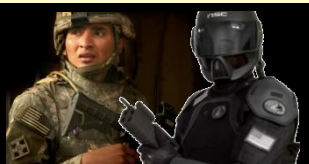
- Functional Imaging (PET)
- High Resolution
- Penetrates All Tissues

- Ferromagnetic interference
- Not Portable
- Limited to 3T for humans

- Ionizing Radiation
- PET requires radiotracers
- CT can require contrast agents

- Nondestructive
- Highly Portable
- Functional Imaging
- Monitor Tissue Properties

- Images can be hard to acquire/interpret
- Sensitive to gas/bone
- Requires Skin Contact
- Poorer Spatial Resolution



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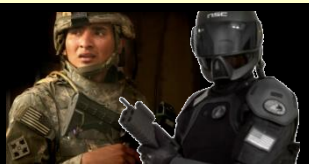
Medical Imaging Technologies: Roadblocks for Trauma Care

In the Combat Support Hospital:

- One tool "to do it all"
- Ease of use
- Morbidity of combat-related injuries
- Portability, Maintainability, Reliability

Limitations of Imaging Techniques:

- What more can we do with current technologies using photons, particles and sound waves?
- Where are the standards and models? (acquisition-related, post-processing, instrumentational,…TISSUE)
- How do we get a tool with sub-millimeter spatial resolution and deep-tissue penetration?



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Optical Imaging:

Pathologies:

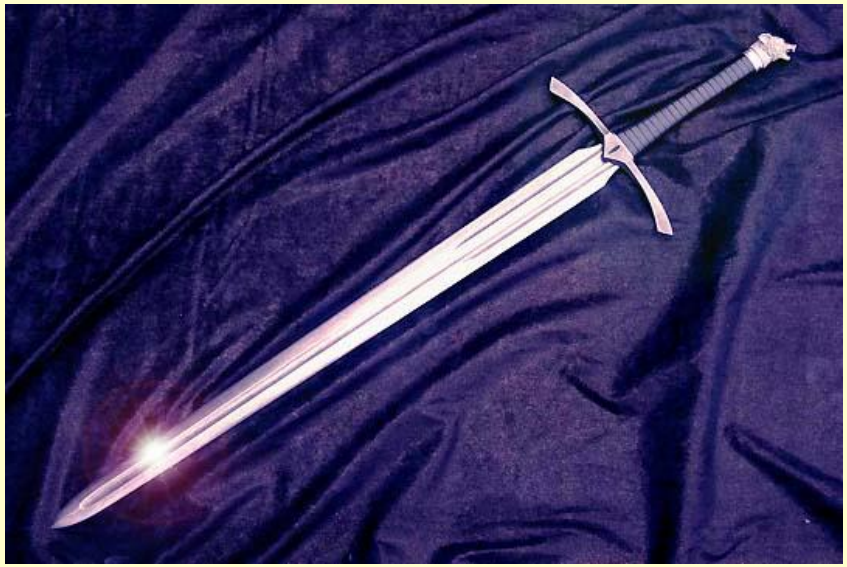
- Burn (Monstrey et al.)
- Wound (Singer et al.)
- Neuroimaging (Arenth et al.)
- Infection (Naumann et al.)
- Bone (Camacho et al.)

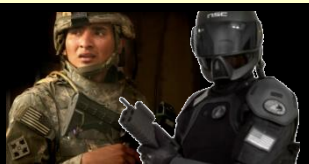
Limits of Current Studies:

- Tissue modeling in terms of photonic properties
- Developing a consensus amongst established researchers for image acquisition parameters and experimental conditions for each pathology

Efforts @ TATRC:

- Terahertz imaging of burn
- Hyperspectral imaging for detection and treatment of skin cancers
- SBIR/STTR topics





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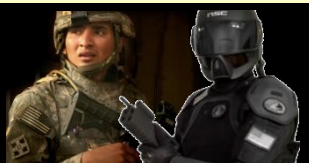
Neurotrauma: The Military Challenges

- **Co-existence of TBI and PTSD; but no clear association**

- **Links of mTBI to other diseases such as PD (Bower 2003) and AD (Plassman 2000)**

“We want to help you come all the way home” – BG Sutton 2009



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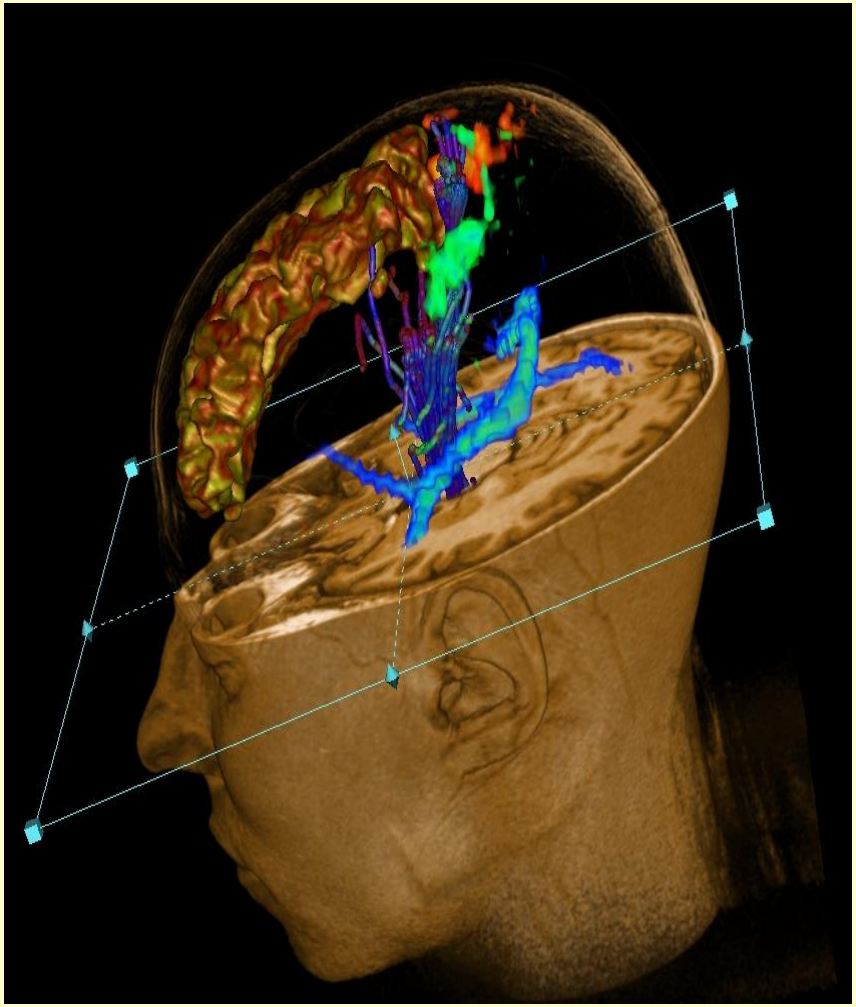
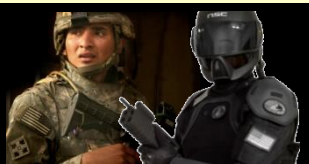
From Symptoms to Classification; Standardization:

- Dr. Vannier of the University of Chicago is focused on developing acquisition and post-processing standards for DTI

- TATRC has worked with the DVBIC, Siemens and the American College of Radiology to develop new visualization software that uses an XIP format for image processing with anatomical data for a telemedicine application (Right: DTI/MRI/Anatomically co-registered image from a thumb tapping experiment)





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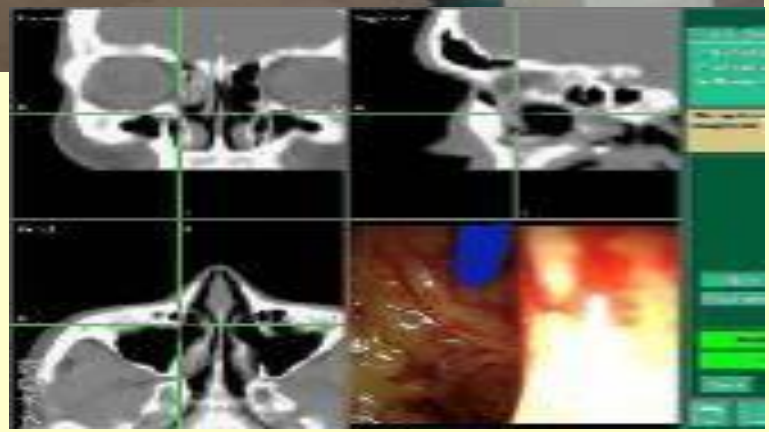
Medical Imaging Technologies: Cancers



TATRC Imaging Roadmap 2015:

PORTABLE IMAGING AND IMAGE GUIDED THERAPIES

- Portable X-Ray
- Ultrasound
- Portable EEG
- Advanced surgical camera

HIGH PERFORMANCE RADIOLOGY

- Higher sensitivity CT and PET designs
- Higher sensitivity MR Coils/instrumentation
- Radiological and anatomical standards
- Better small molecule tracers

ADVANCED SURGICAL CAMERA

- Incorporate new materials
- Algorithm development (post-processing)
- Spectral libraries based on anatomy/pathology
- Deep tissue models of targeted pathologies

COMPUTER ASSISTANCE IN DIAGNOSIS

- Treatment planning and simulation (controls: patient movement, procedure to procedure, patient to patient)
- Development of open software platforms for image registration/segmentation

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Questions:

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