

MRI and CT Basis for SCI Imaging Projects

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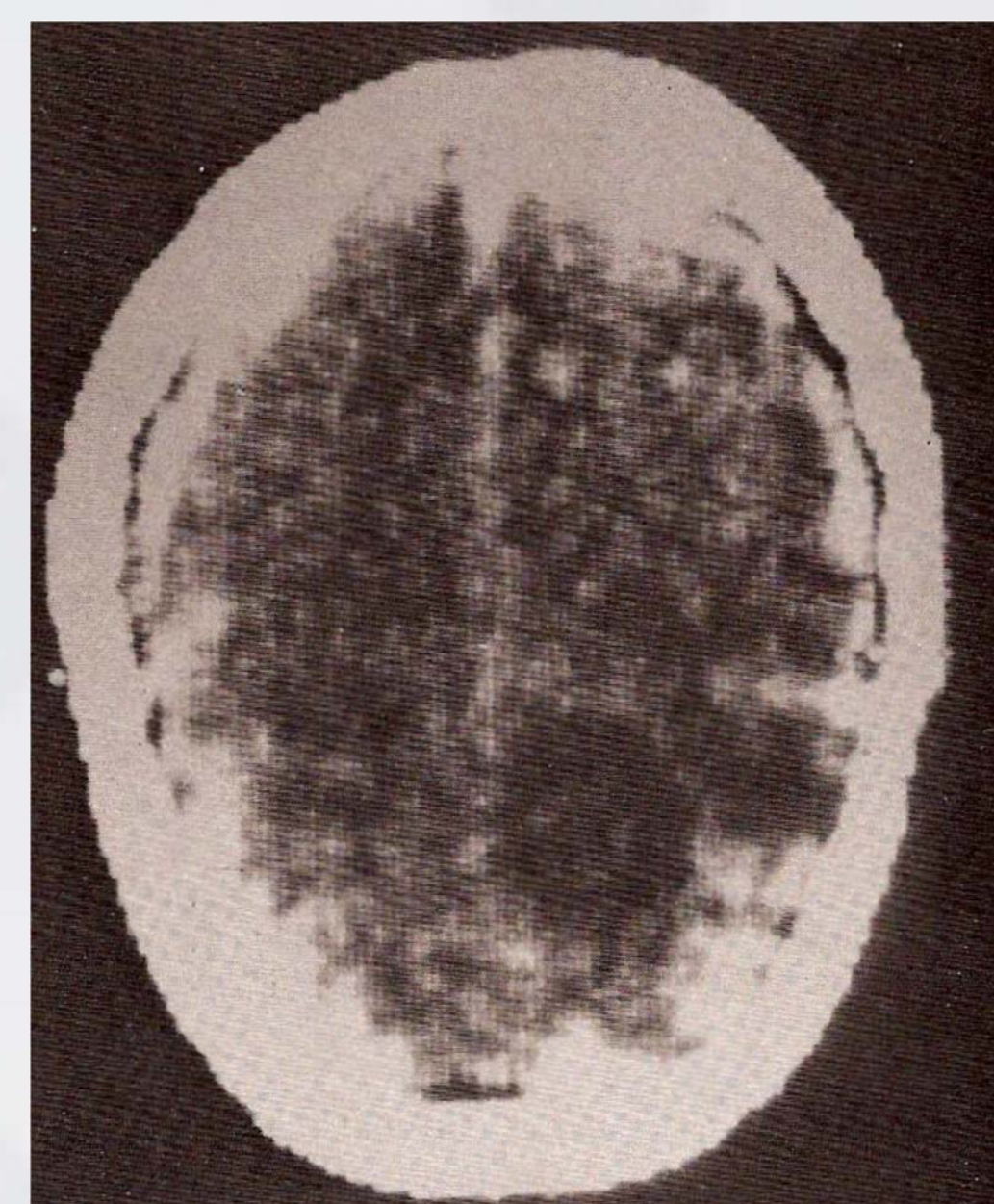
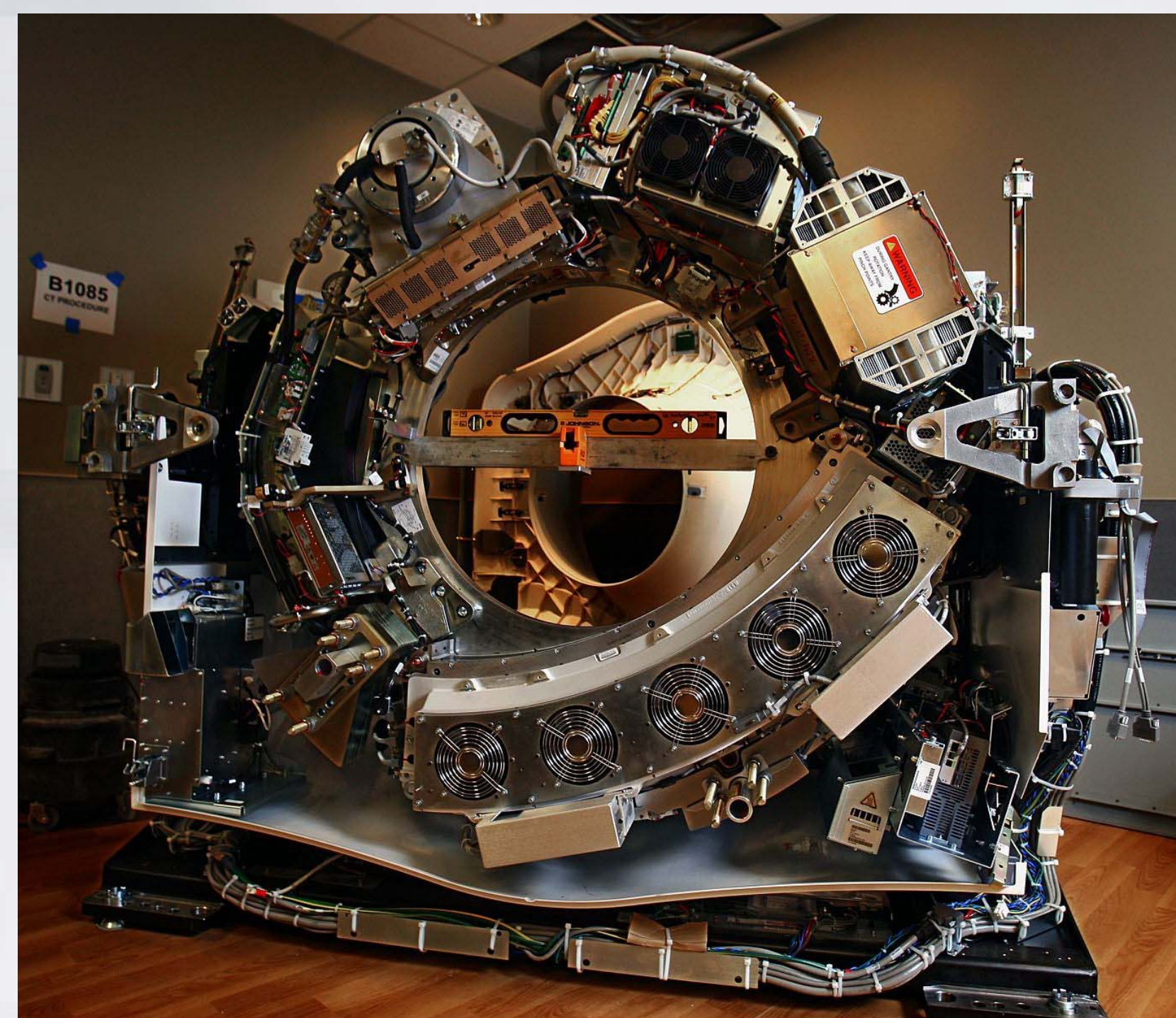
Medical imaging allows for non-invasive visualization of functional and anatomical structures in the body. These images are routinely used for diagnosis, treatment planning, and tracking disease progression.

Computed Tomography (CT):

CT forms an image by applying complex mathematics to many X-ray images taken at different angles.

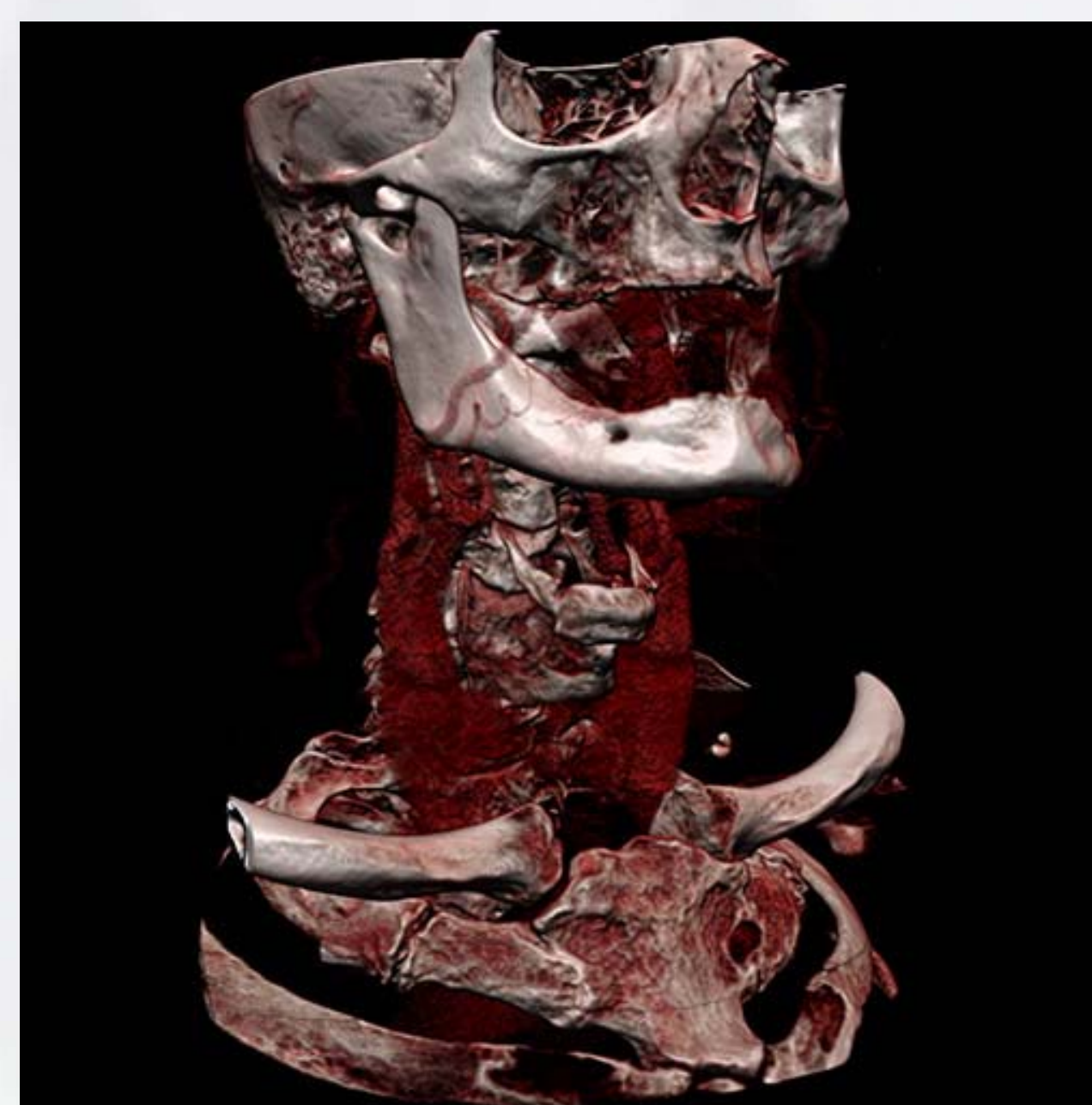
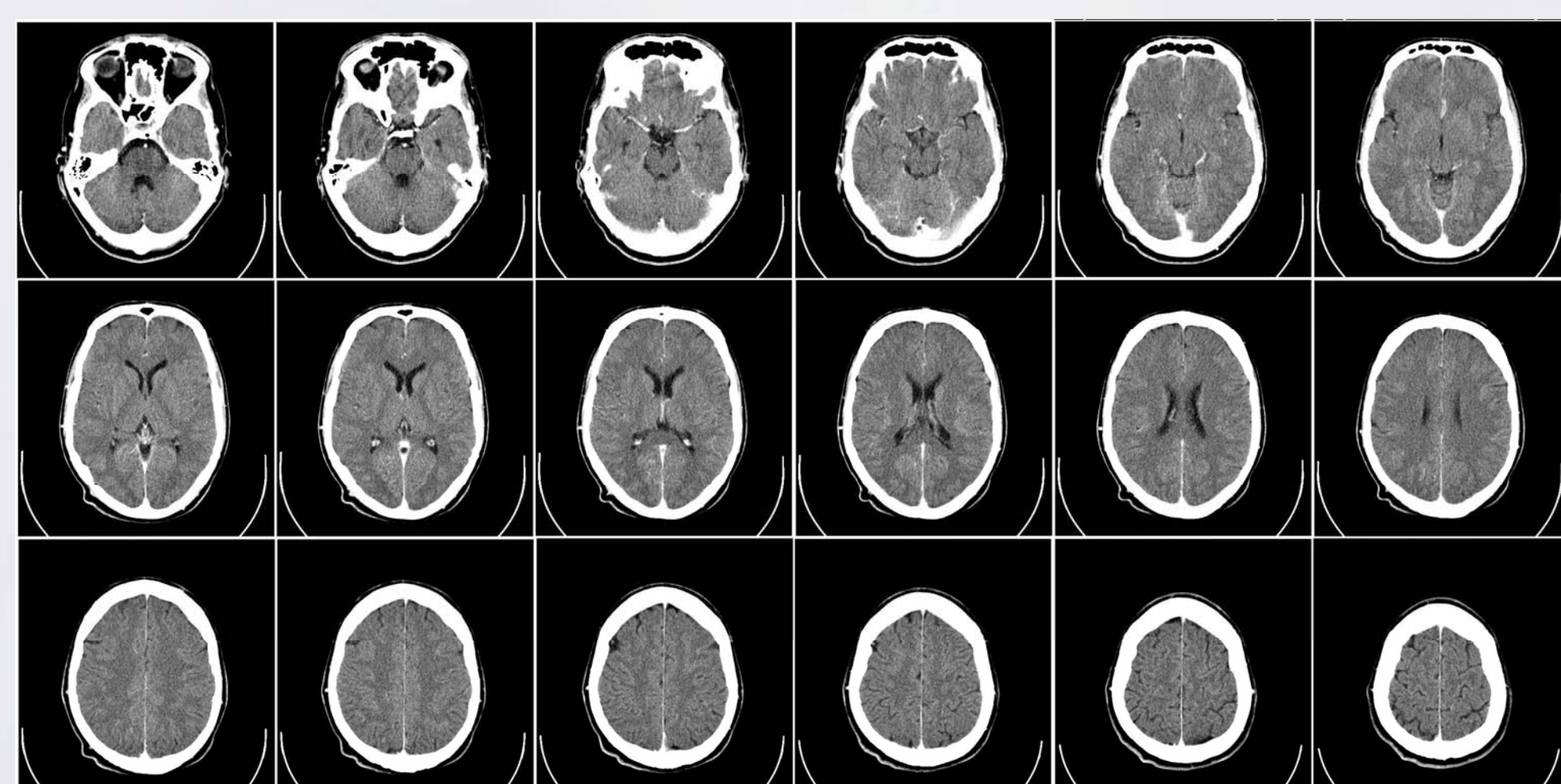
History:

The technique is based on the the mathematical work of Johann Radon. Godfrey Hounsfield commercialized this reconstruction ability for studying brain tumors.



Modern Techniques:

CT has greatly increased in speed through the years. Modern computing allows for 3D visualization.



Advantages of CT	Drawbacks of CT
Short Scan Time	High Dosage of Ionizing Radiation
Great Bone Contrast	Poor Soft Tissue Contrast
Large Field of View	Long Reconstruction Times
Quantitative Measure of Density	Limited Patient Applicability

Magnetic Resonance Imaging (MRI):

MRI uses a strong magnetic field to excite water molecules. These molecules emit a radio-frequency signal as they return to a non-excited state.

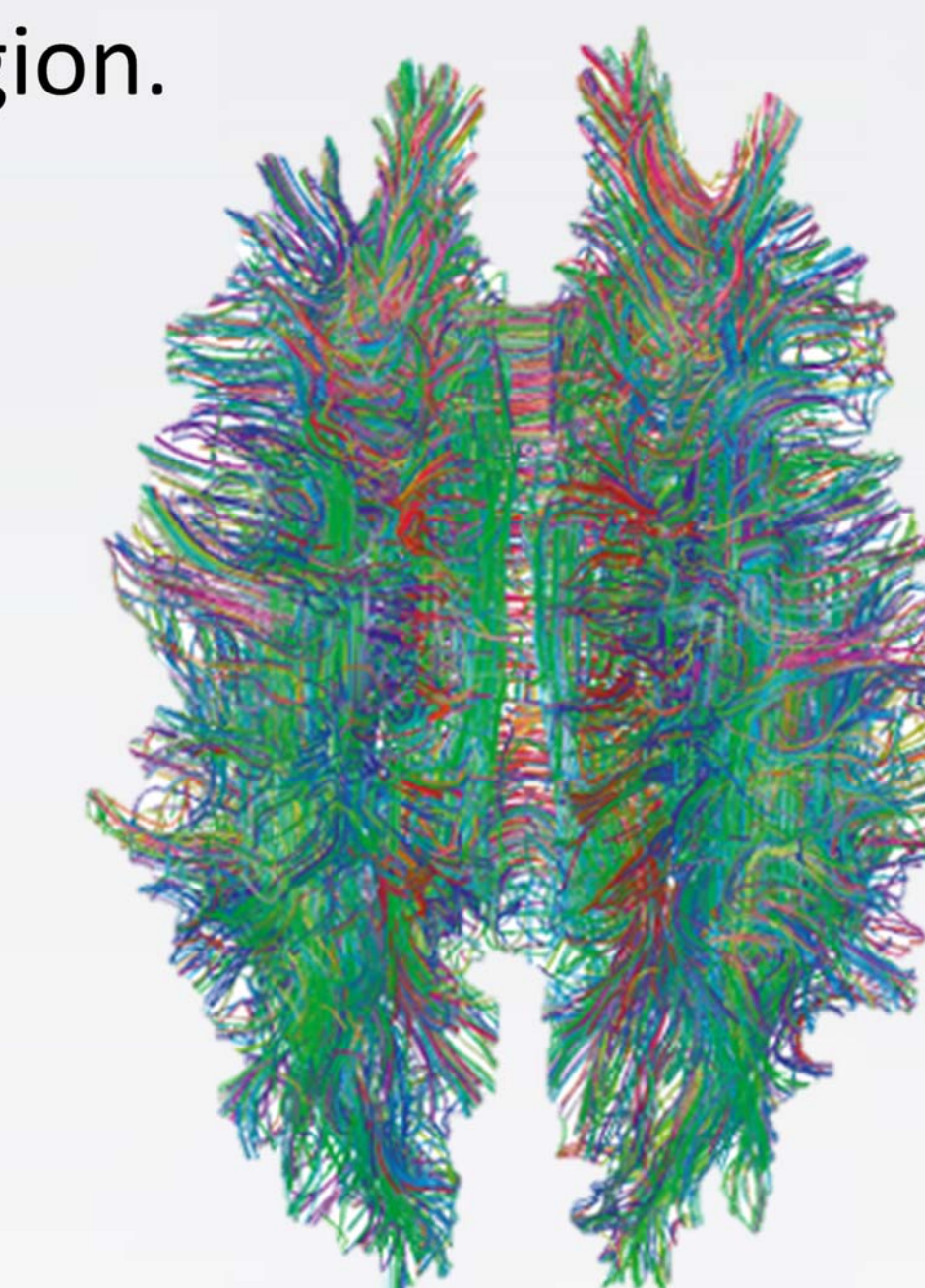
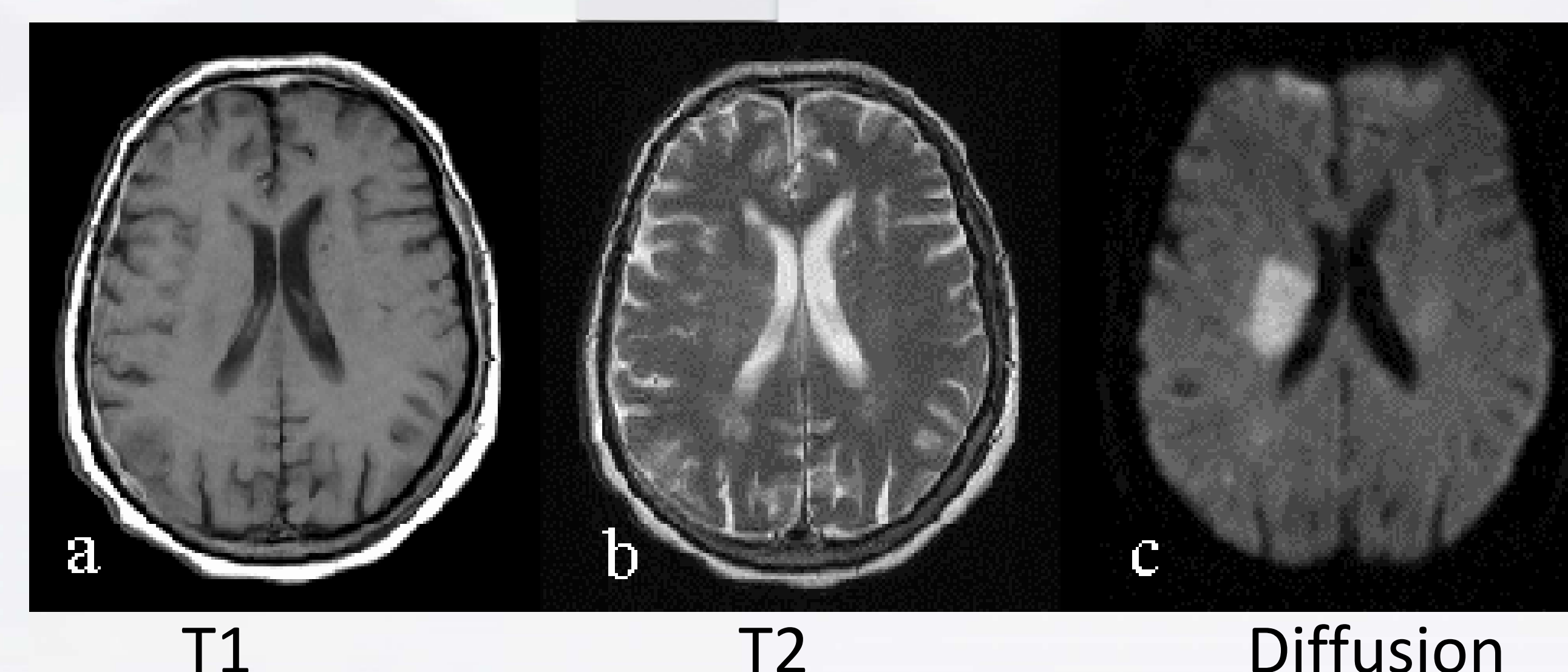
History:

Lauterbur and Mansfield invented MRI by introducing spatially-varying magnetic fields to a common chemical analysis technique.



Modern Techniques:

MRI is extremely versatile. The same hemorrhage is nearly invisible in (a) and (b); however, (c) clearly shows the impacted region.



Advantages of MRI	Drawbacks of MRI
Great Soft Tissue Contrast	Poor Contrast Otherwise
Versatility of Contrast	Poor Resolution
Non-ionizing Radiation	Long Scan Time and Noisy
Measures functional properties	High Strength Magnet