

Neuroimaging

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Disclosure Statement

- The presenter has no financial or nonfinancial interest in any of the products or services mentioned in the presentation



Neuroimaging

- Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Angiography
- Ultrasonography



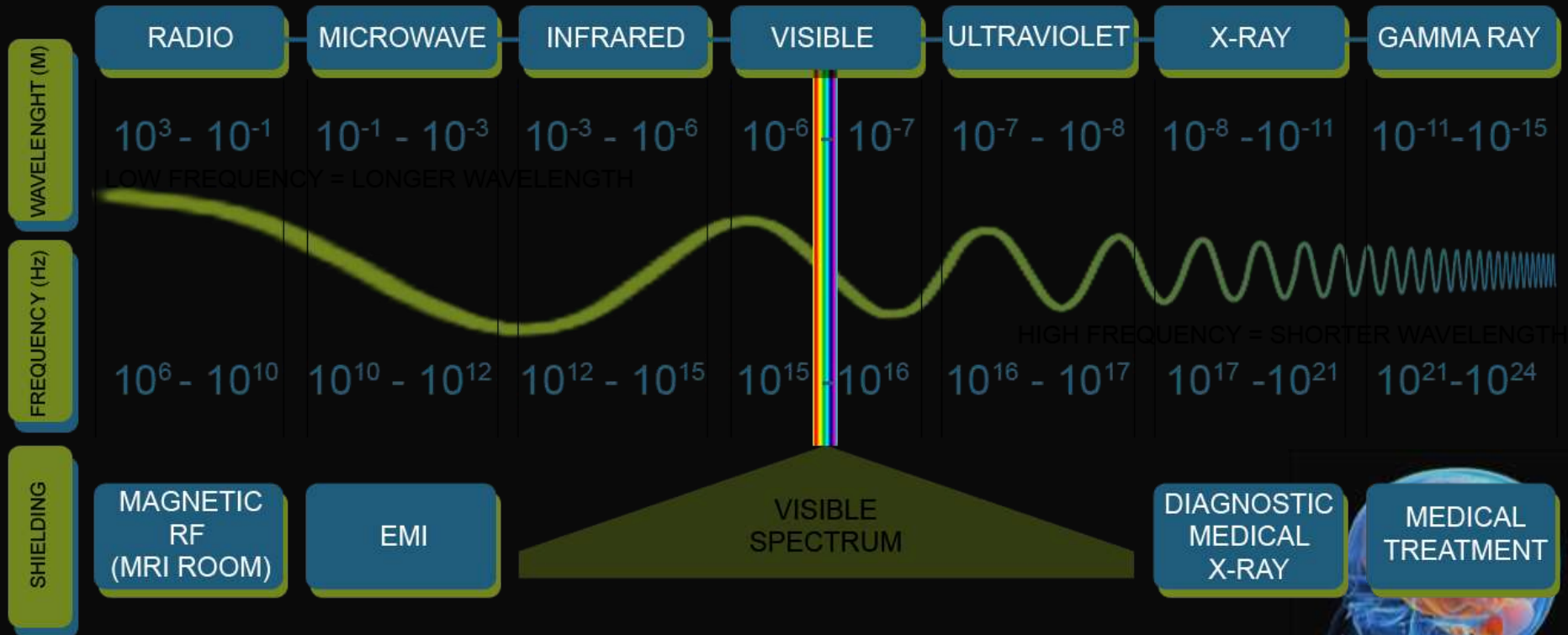
Neuroimaging

- Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Angiography
- Ultrasonography



Electromagnetic Spectrum

ELECTROMAGNETIC SPECTRUM



X-rays

- Wilhelm Röntgen
- German physicist
- Credited as the discoverer of X-rays in 1895



(March 27, 1845 to February 10, 1923)

X-rays

- *Hand mit Ringen* (Hand with Rings): print of Wilhelm Röntgen's first "medical" X-ray, of his wife's hand, taken on 22 December 1895



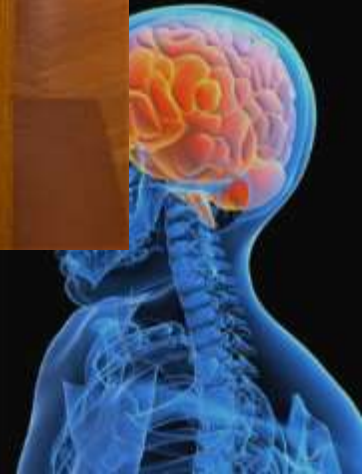
X-rays



- Won the first Nobel Prize in Physics in 1901.
- In honor of his accomplishments, IUPAC named element 111, **Roentgenium**, a very radioactive element with multiple unstable isotopes, after him.



Pedoscope



CT Scanner



CT - Indications

- Orbital and sinus pathology/trauma (except optic nerve)
- Acute cerebral or subarachnoid hemorrhage
- Localization of metallic foreign body



CT Ordering

- Location
 - Orbit
 - Brain
 - Sinuses
- Iodinated Contrast
 - Without contrast
 - With and Without Contrast
- Presumptive Diagnosis



CT Ordering - Contrast



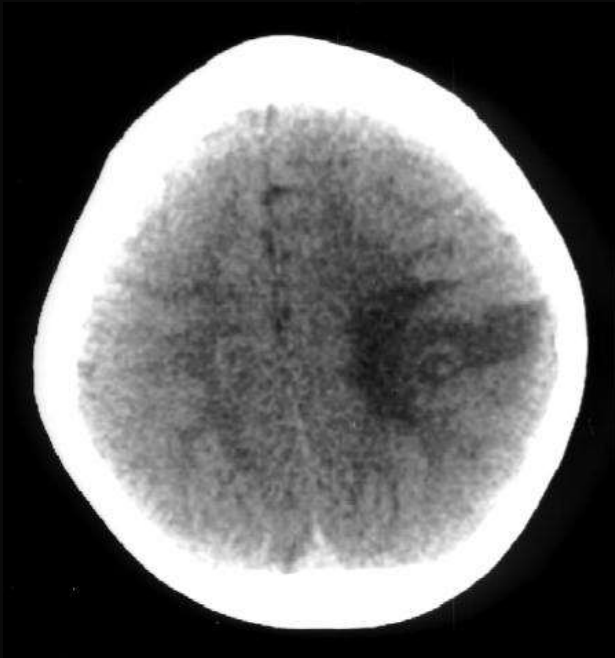
- Iodine Based
- Hard on the kidneys
- Visually translucent, radiographically opaque



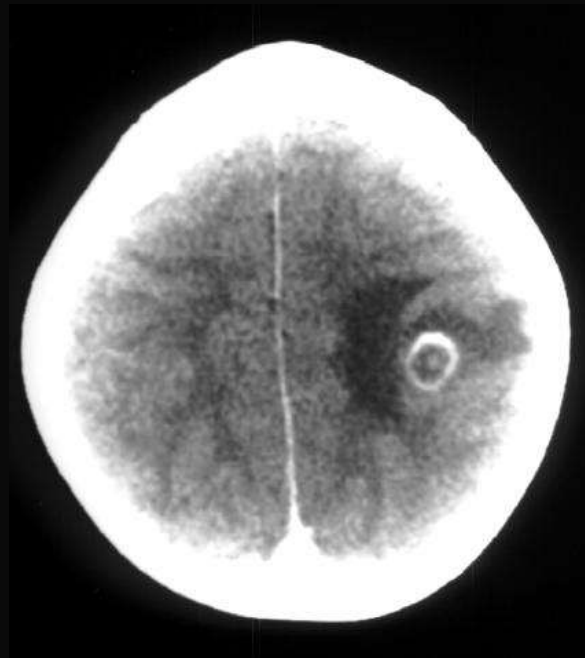
CT Ordering - Contrast

- Enhances Sensitivity and Specificity

Without Contrast



With Contrast



CT Ordering - Contrast

- Lab tests prior to scan if ordering contrast
 - Blood Urea Nitrogen (BUN)
 - Creatinine
 - Glomerular Filtration Rate (GFR)



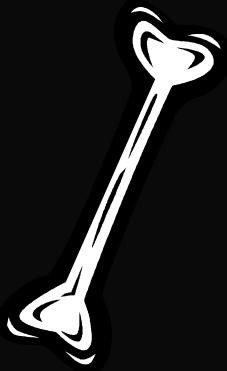
CT Ordering - Contrast

- Contraindications
 - Allergy to iodine
 - Impaired renal function
 - Diabetes – must stop metformin 48 hours prior to scan



CT Ordering - Contrast

- Not indicated (may mask visualization) in:



Bony Injury



Acute Hemorrhage



Localization of Foreign Bodies

BONE

BLOOD

BB



Slice Size



- Images can be provided in as thin as 0.5mm slices. Thin slice rendering is advantageous when trying to detect very small objects (i.e. metallic foreign body, bone fragments in the optic nerve, etc.)



CT





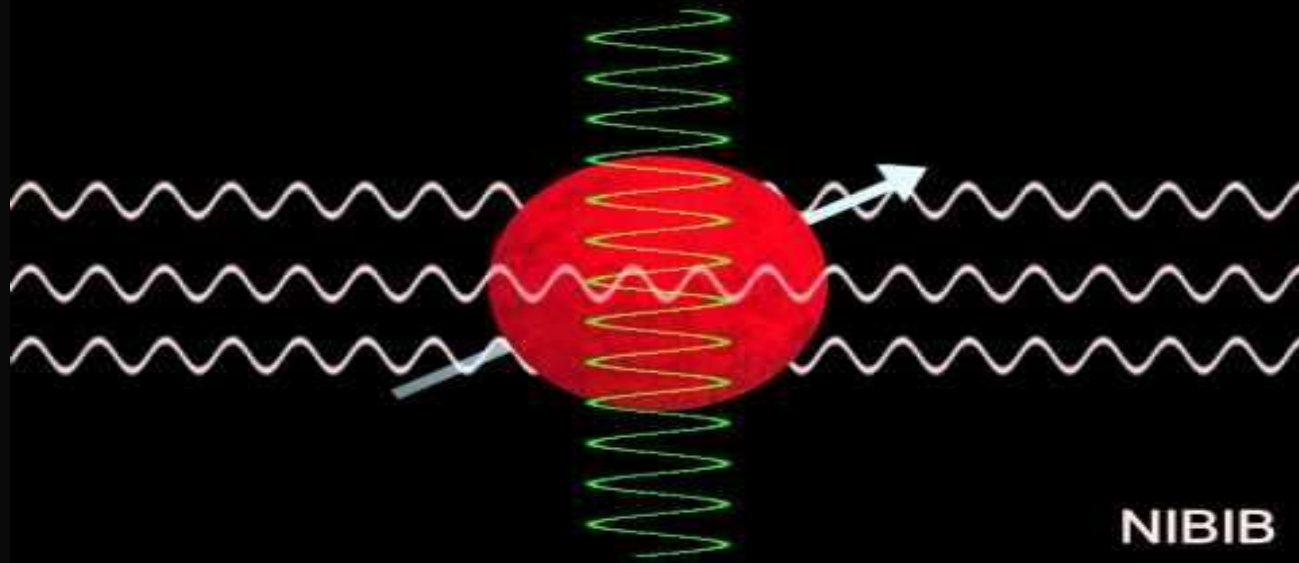
MRI



MRI



MRI: Excitation and Recovery of Spins

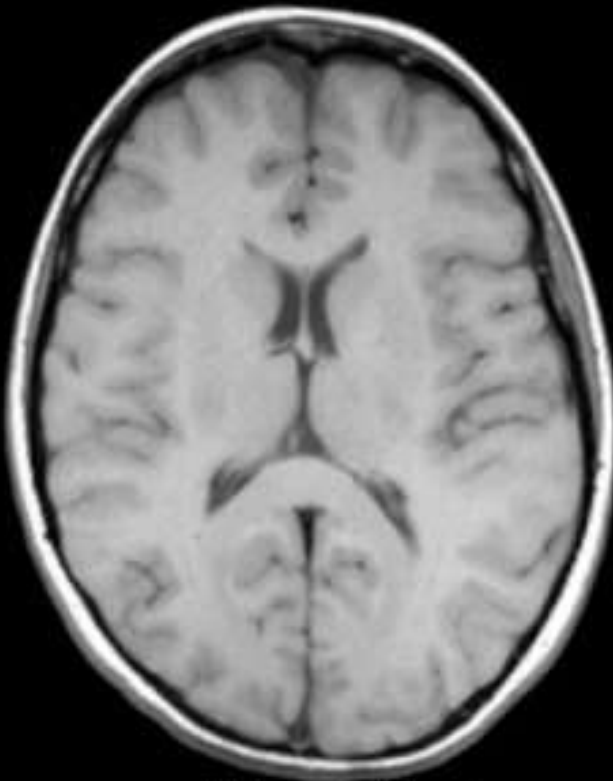


MRI Sequences

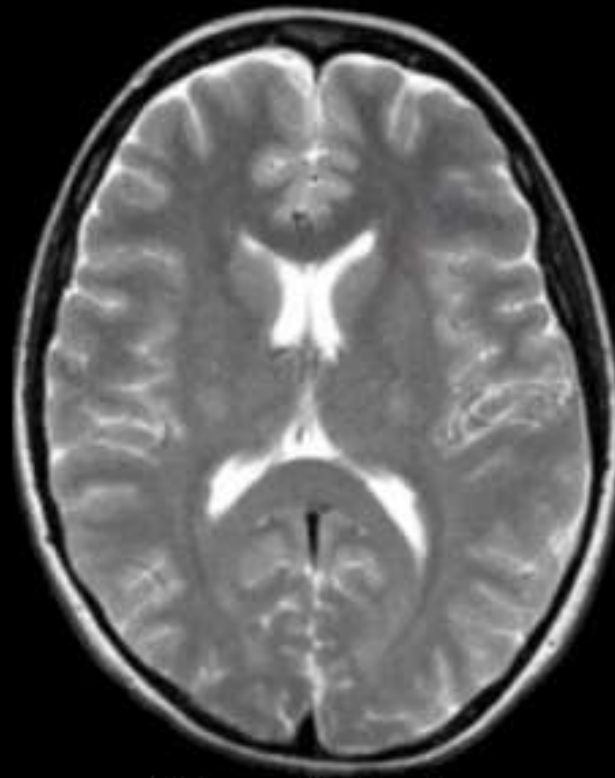
- T1
- T2
- Fluid attenuation inverse recovery (FLAIR)
- Diffusion-weighted imaging (DWI)
- Fat-suppression/saturation



T1 and T2



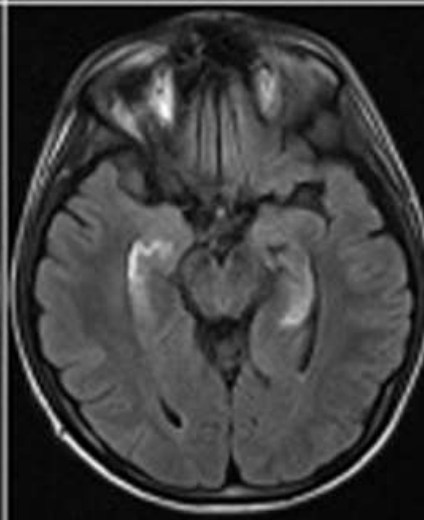
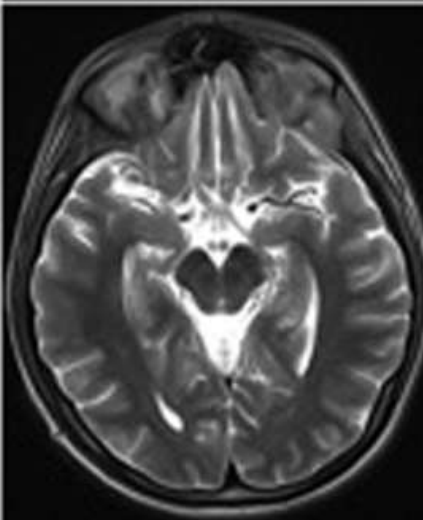
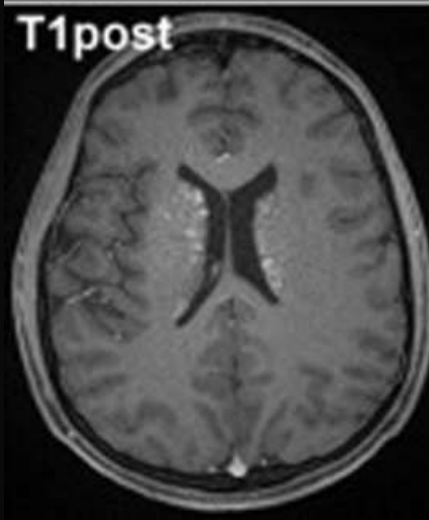
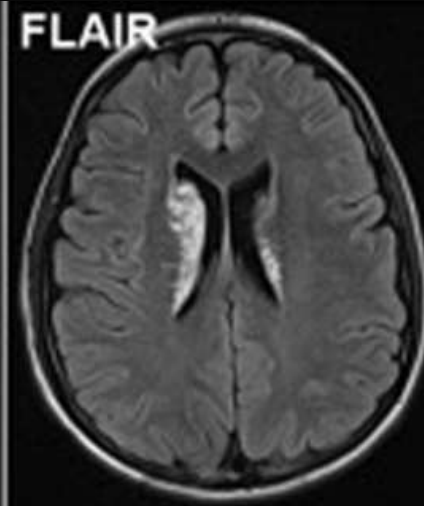
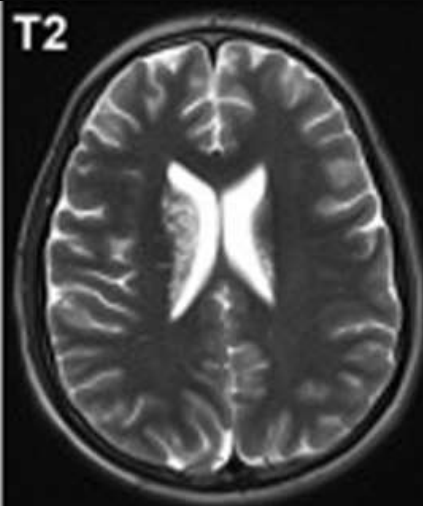
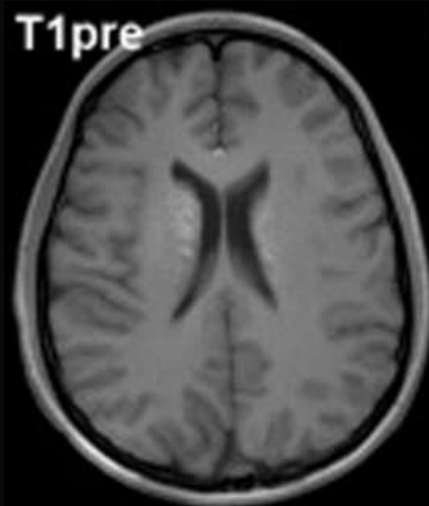
T1-weighted



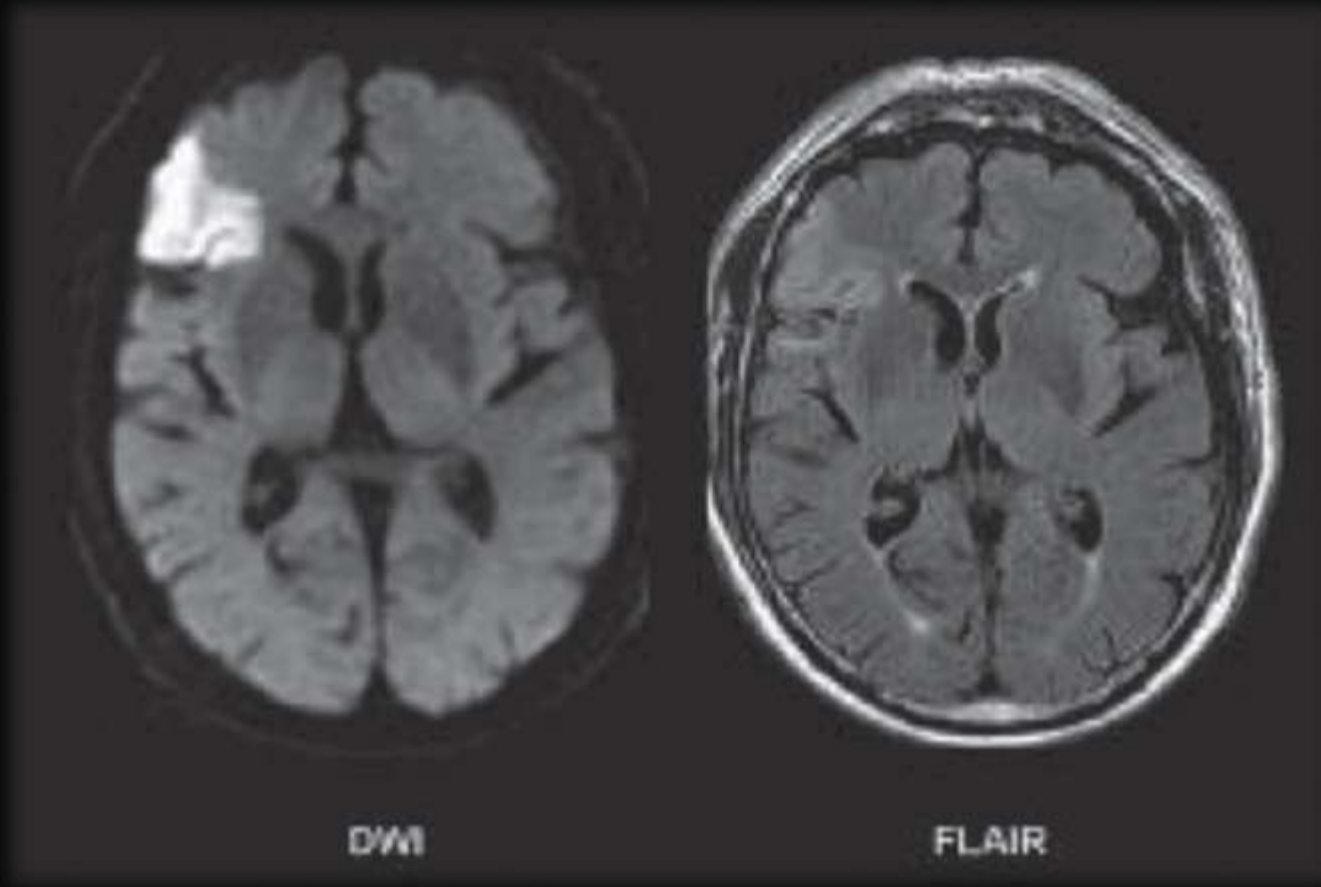
T2-weighted



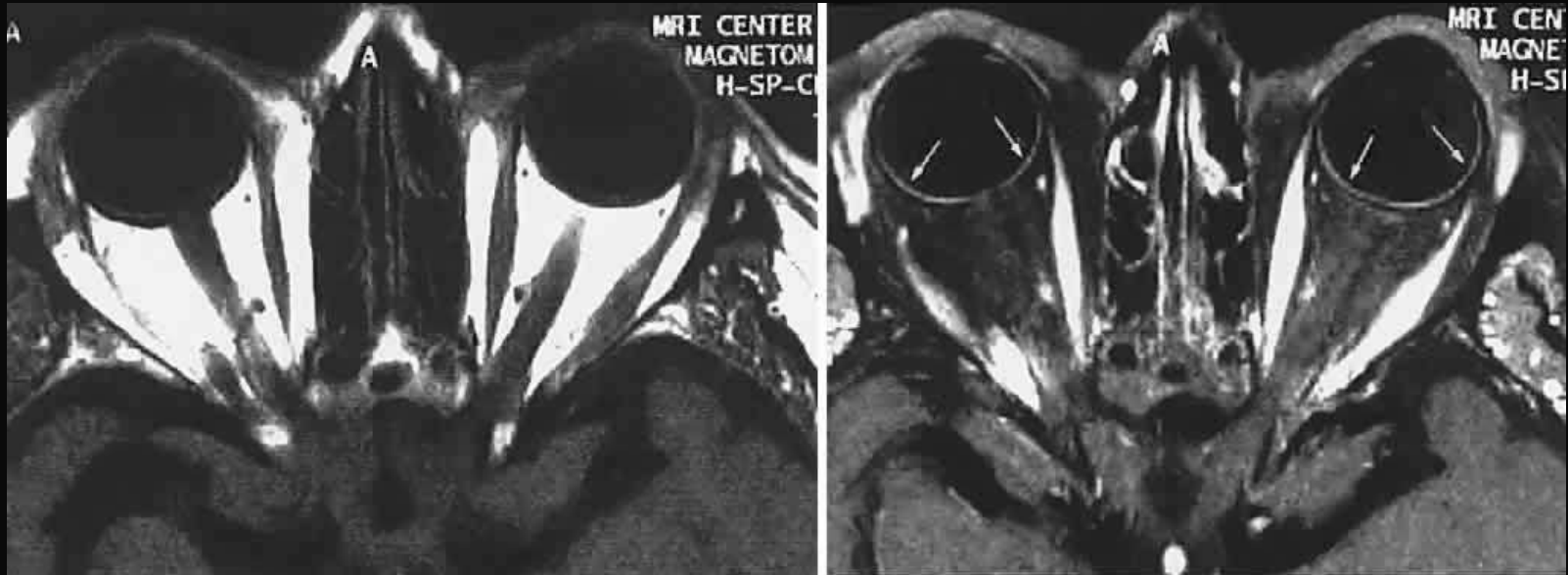
FLAIR



DWI

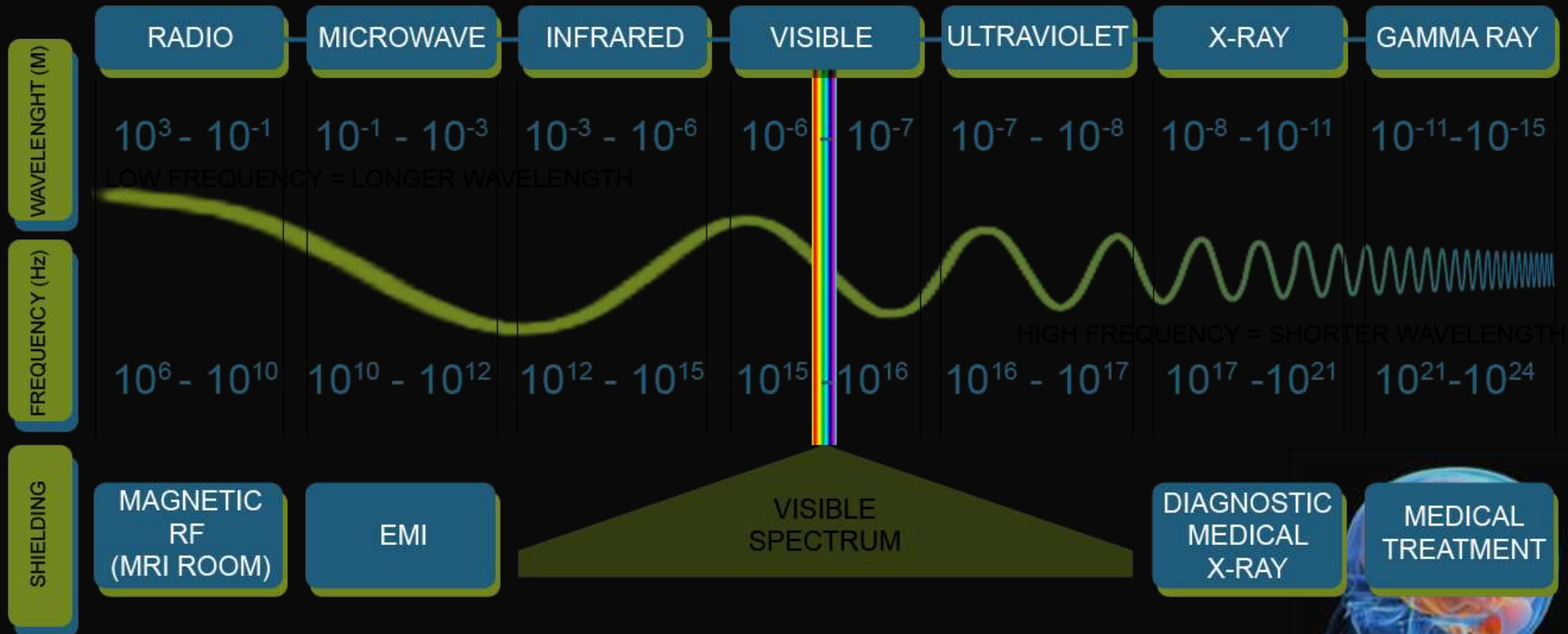


Fat Suppression



Electromagnetic Spectrum

ELECTROMAGNETIC SPECTRUM



MRI Indications

- Technique of choice for visual pathway
 - Optic nerve and optic nerve sheath
 - Pituitary tumors
 - Cavernous sinus pathology



MRI Ordering

- Location
 - Orbit
 - Brain
 - Sinuses
- Gadolinium Contrast
 - Without contrast
 - With and Without Contrast
- Presumptive Diagnosis



MRI Ordering - Contrast

- Lab tests prior to scan if ordering contrast:
 - Glomerular Filtration Rate (GFR)
- Concern of nephrogenic systemic fibrosis

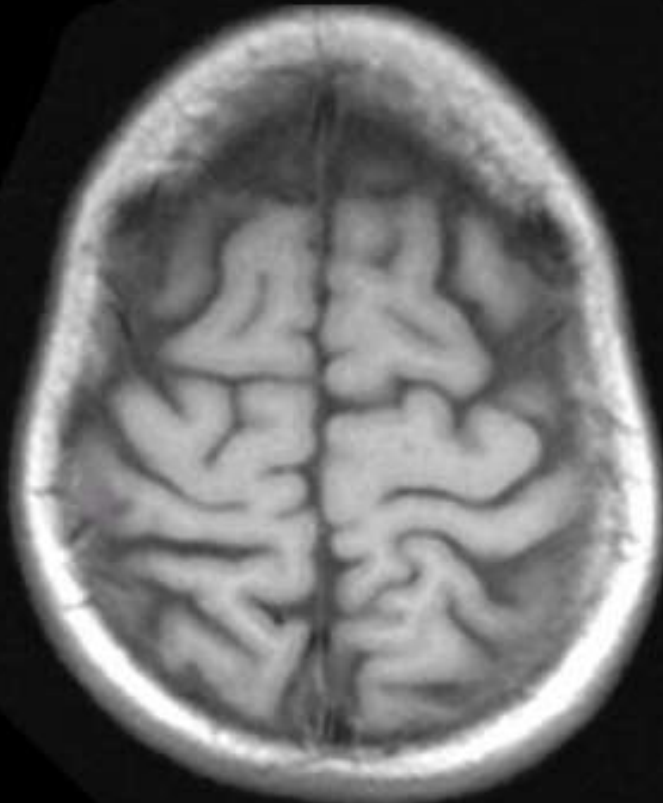


MRI Ordering - Contrast

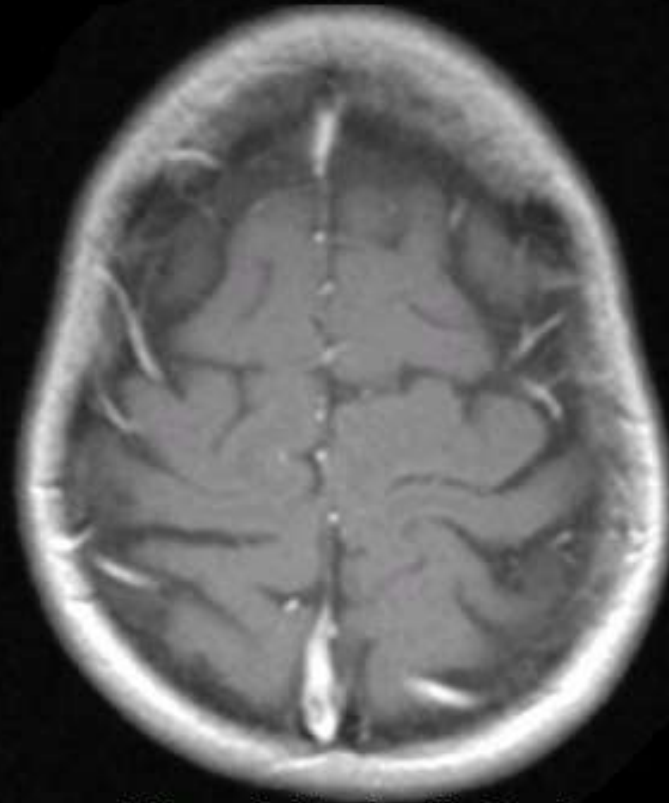
- Gadolinium based - acquires magnetic moment when placed in an electromagnetic field
- Administered intravenously and remains intravascular unless there is a breakdown of the blood-brain barrier
- Only visualized on T1 weighted images. Enhancing lesions such as tumors and areas of inflammation will appear bright



Contrast



T1-weighted



T1-weighted with Gad



Table Limits



National Imaging Price Variances

Service	Region	High	Low	Variance	
				\$	%
MRI of Brain	Southeast	\$3,600	\$825	\$2,775	336%
MRI of Brain	Northeast	\$3,500	\$1,540	\$1,960	127%
MRI of Lumbar Spine	Southeast	\$2,500	\$560	\$1,940	346%
MRI of Brain	Southwest	\$2,200	\$425	\$1,775	418%
PET Scan of Base of Skull to Thigh	Southwest	\$3,000	\$1,240	\$1,760	142%
MRI of Lower Extremity	Southeast	\$2,400	\$800	\$1,600	200%
CT Scan of Pelvis with Contrast	Southwest	\$1,800	\$230	\$1,570	683%
MRI of Lower Extremity	Northeast	\$2,200	\$710	\$1,490	210%
CT Scan of Abdomen with Contrast	Southwest	\$1,800	\$320	\$1,480	463%
MRI of Lumbar Spine	Northeast	\$2,250	\$790	\$1,460	185%



CT vs MRI

CT



MRI

