Introduction to Cross Sectional Anatomy

READING HOSPITAL
SCHOOL OF HEALTH SCIENCES
MEDICAL IMAGING PROGRAM

CROSS SECTIONAL ANATOMY - 2022

1

Traditional Anatomy vs. Cross Sectional Anatomy

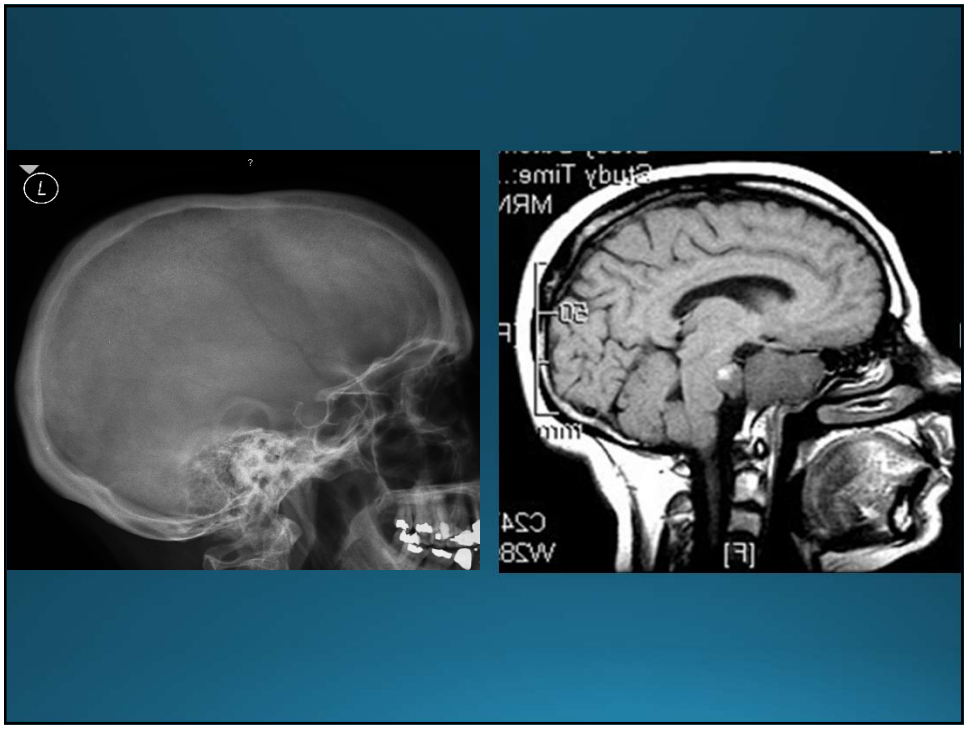
Traditional

- Names and shapes of structures
- 2 Dimension
- Bony anatomy
- Cost effective source of imaging in certain situations

Cross Sectional

- Physical relationship among structures
- 3-D concept
- Evaluation = Soft Tissue Structures

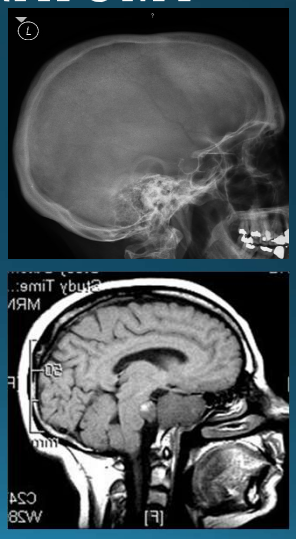
2



3

ADVANTAGES:
CROSS SECTIONAL ANATOMY

- Eliminates overlapping structures
- Helps to differentiate between adjacent structures
- Offers view of anatomy in a variety of planes



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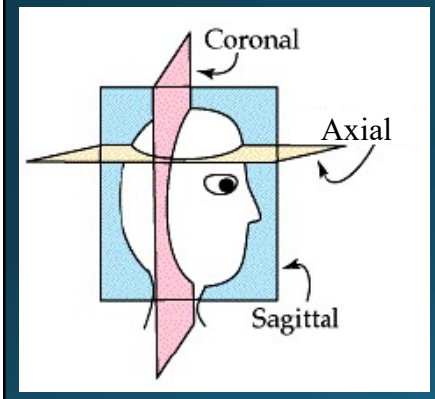
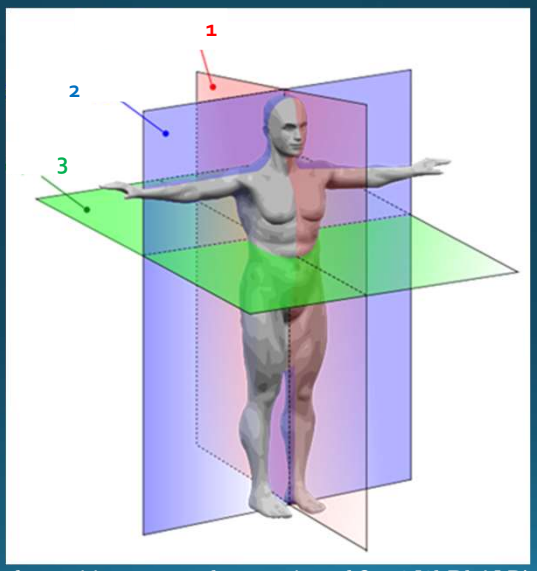
PLANES



- *Sagittal or Median* = *Tech Scans:* Left/Right
- *Axial or Transverse* = *Tech Scans:* Inferior/Superior
- *Coronal or Frontal* = *Tech Scans:* Posterior/Anterior

5

Identify the planes…



https://www.youtube.com/watch?v=2J8bDkALBic

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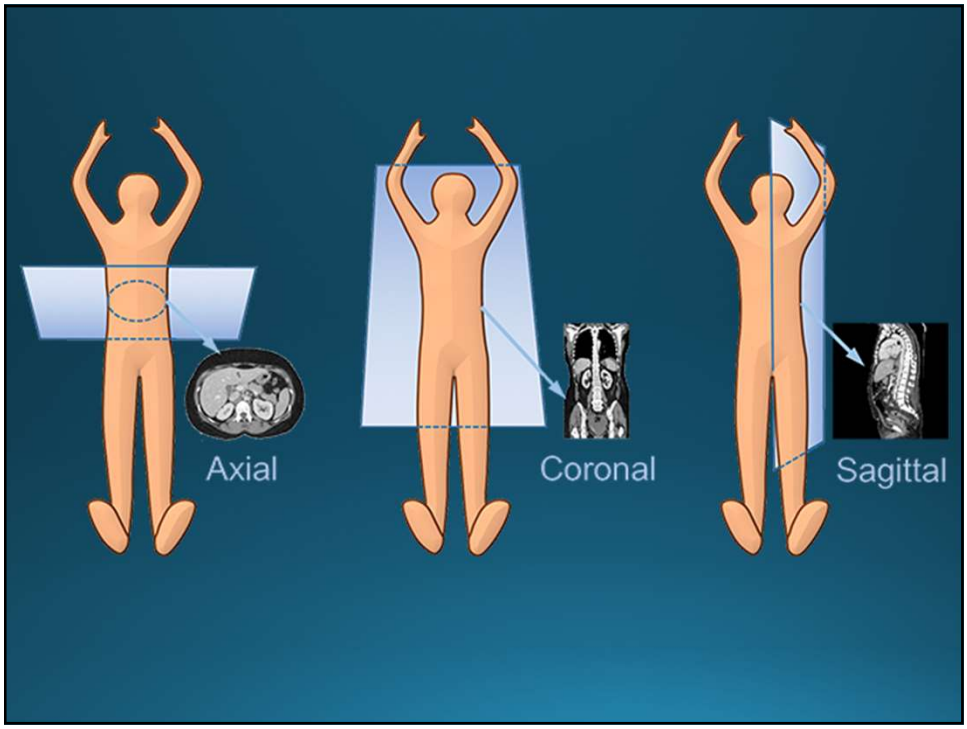

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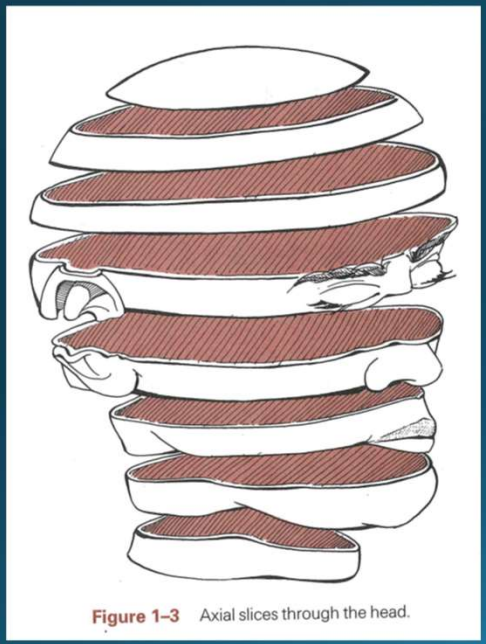

Figure 1–3 Axial slices through the head.

- Slices taken in sequence
- Thickness of slice is dependent on technical settings
  - Thinner slices = more detail
    - Slice thicknesses vary from several mm to 1cm
  - Adjusted by technologist/protocols

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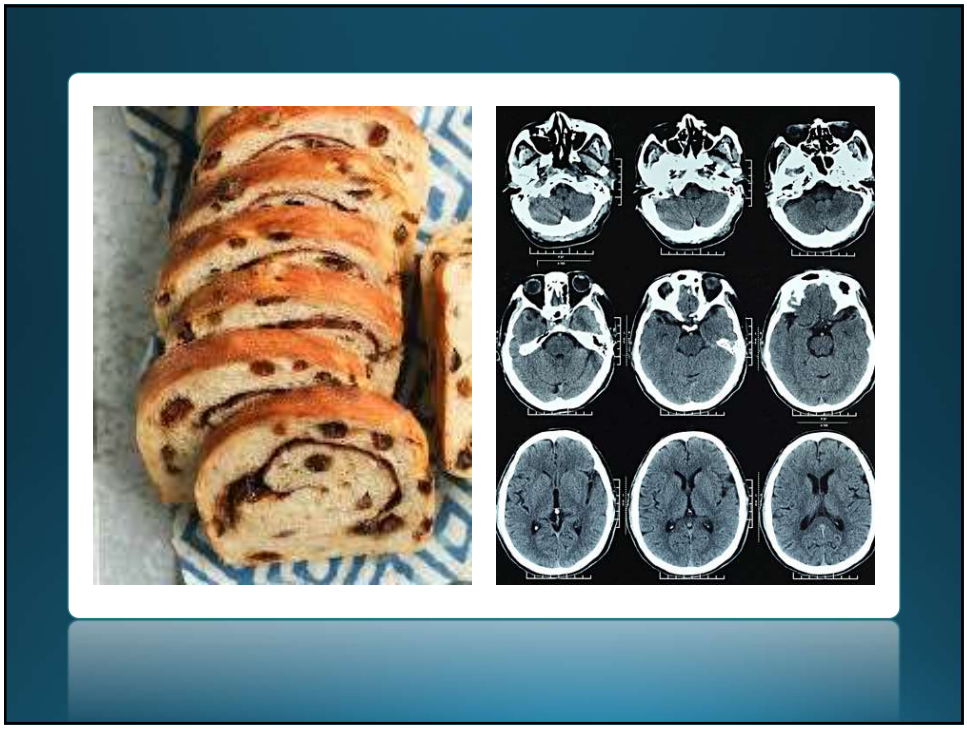

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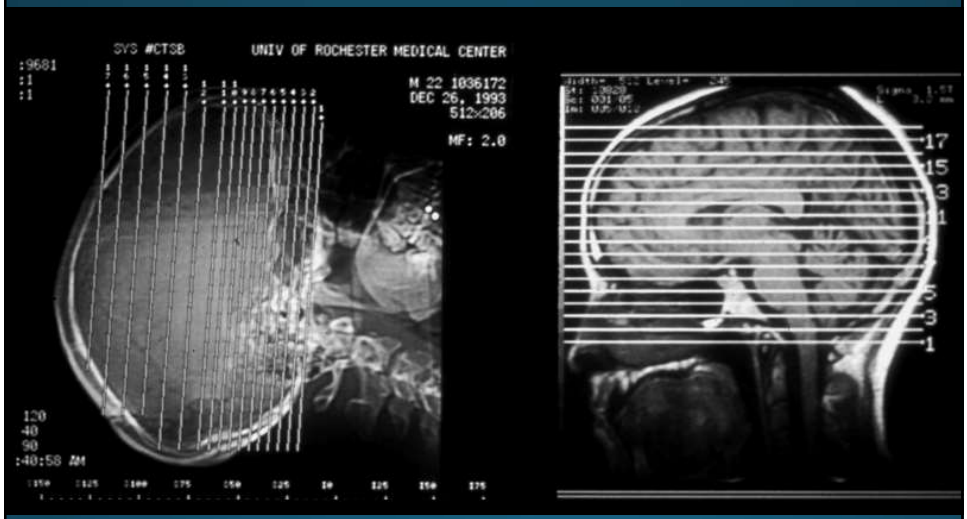
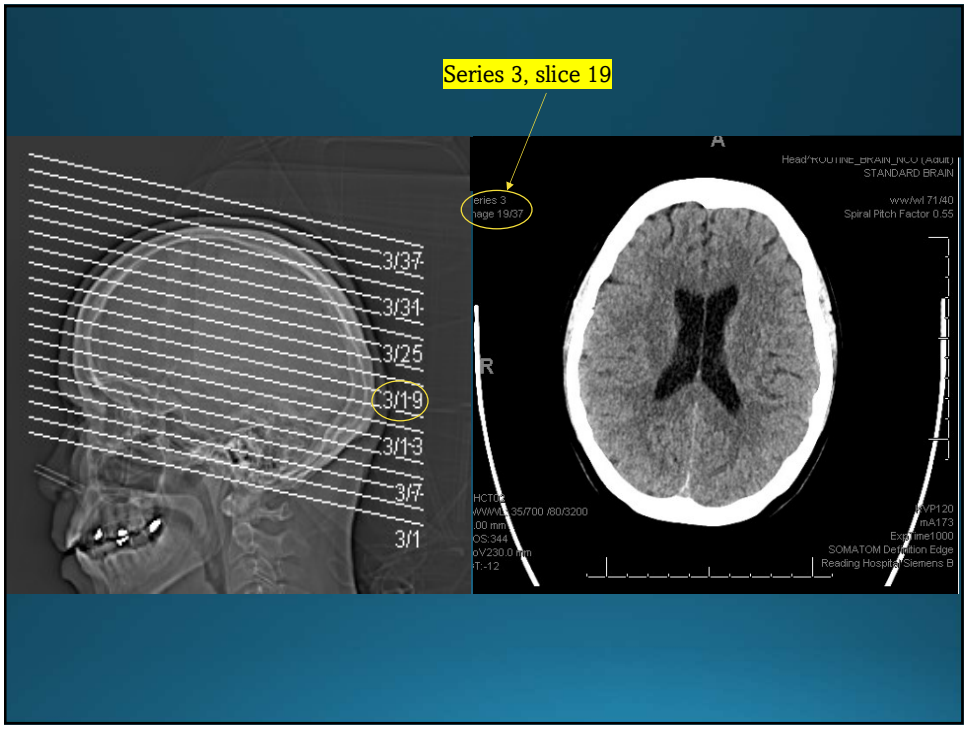
CT MRI



Slices annotated on scout images to provide regional location (Scanogram)

10


Series 3, slice 19
3/37
3/31
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3/13
3/7
3/1
STANDARD BRAIN
ww/wl 71/40
Spiral Pitch Factor 0.55
SOMATOM Definition Edge
Reading Hospital Siemens B

11


SCOUT
Aug 24 2022
CT BRAIN OR HEAD WO CO
STANDARD BRAIN
ww/wl 80/30
Series 2
Image 1/32
RevolutionTime:1.00
KVP120
mA230
ExpTime1000
LightSpeed VCT
Reading Hospital GE Gateway

12


SIGNA Artist 1.5T
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TR:600
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Image 24/36
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Gap: 1.00
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13


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288X288/2.00 NEX
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Mag = 1.0
MRI BRAIN WO W CONTRAST
SAG T1 FLAIR PROPELLER
Series 5
Image 18/28
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A
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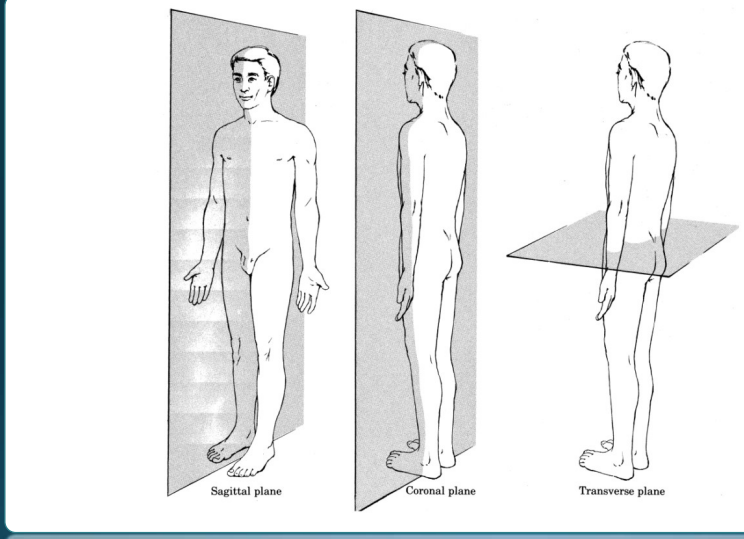
14



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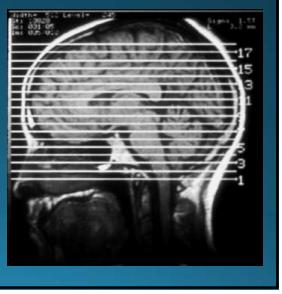
VIEWING IMAGES

- Determining location of slice helps to identify anatomy
  - Scout image correlation
  - Information from bones can be helpful
- Specific arrangement of structures varies from one person to the next
  - Breathing patterns may change location of anatomy



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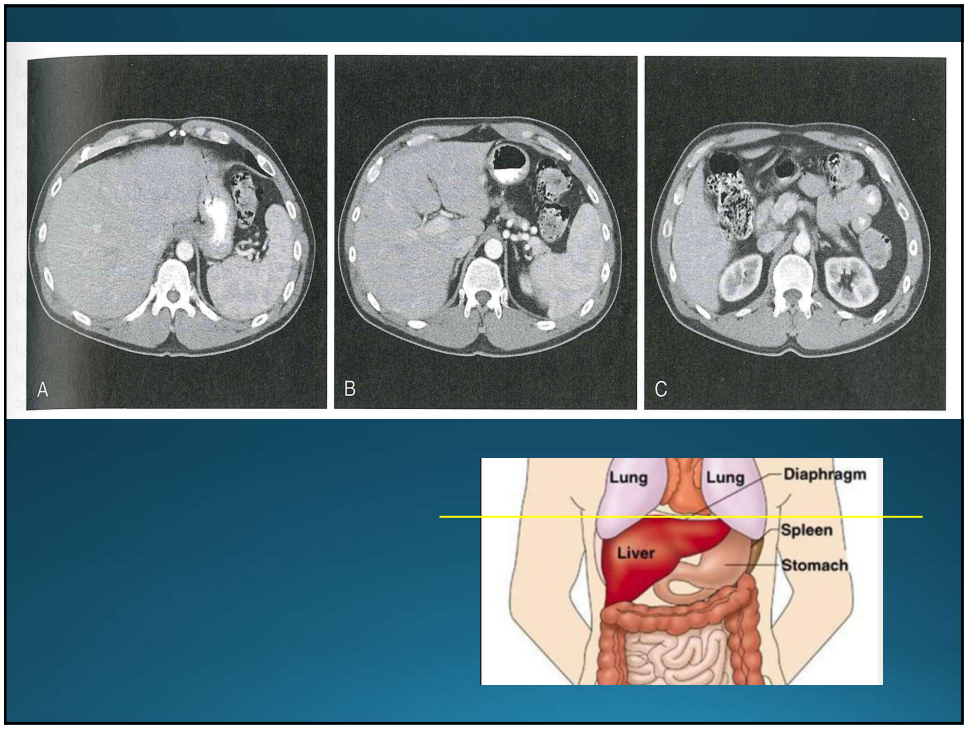
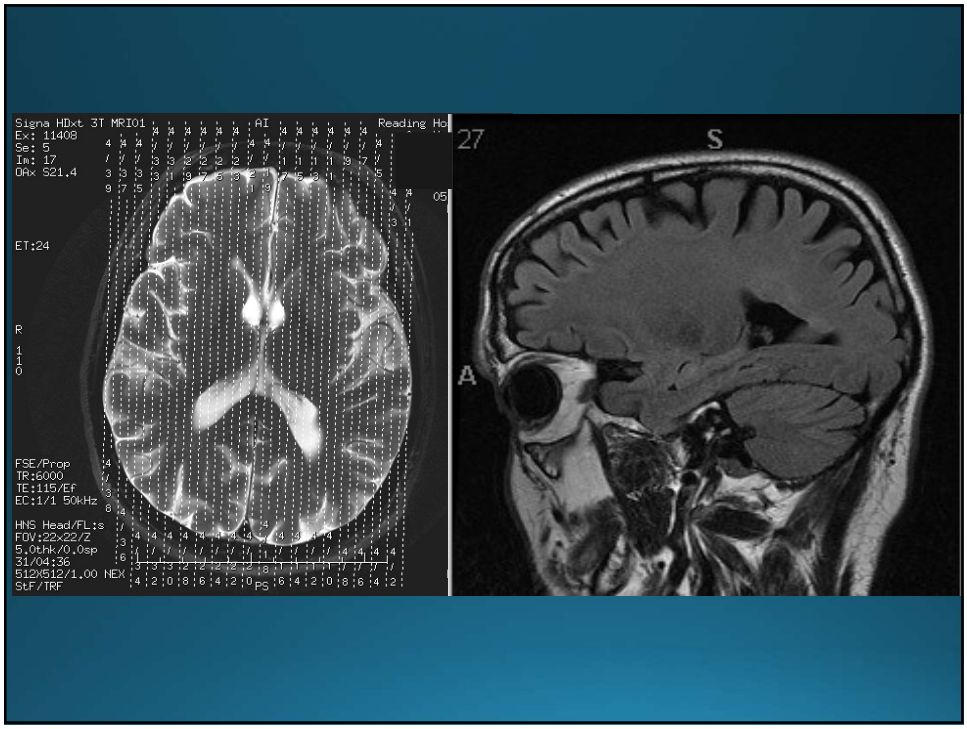

A
B
C
Lung
Lung
Diaphragm
Spleen
Liver
Stomach

17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EC:1/1 50kHz
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FOV:22x22/Z
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512X512/1.00 NEX
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18


Signa HDxt 3T MRI01
Ex: 11408
Se: 4
Im: 20
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TR:9502
TE:127/Ef
EC:1/1 62.5kHz
TI:2250
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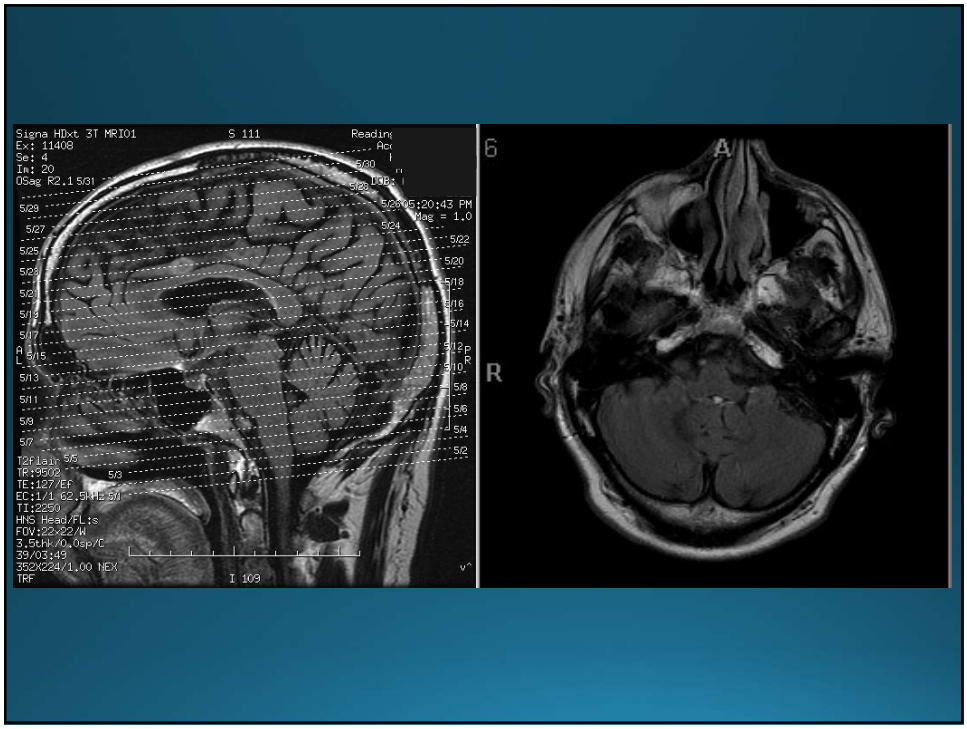
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TE:127/Ef
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TI:2250
HNS Head/FL:s
FOV:22x22/W
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352X224/1.00 NEX
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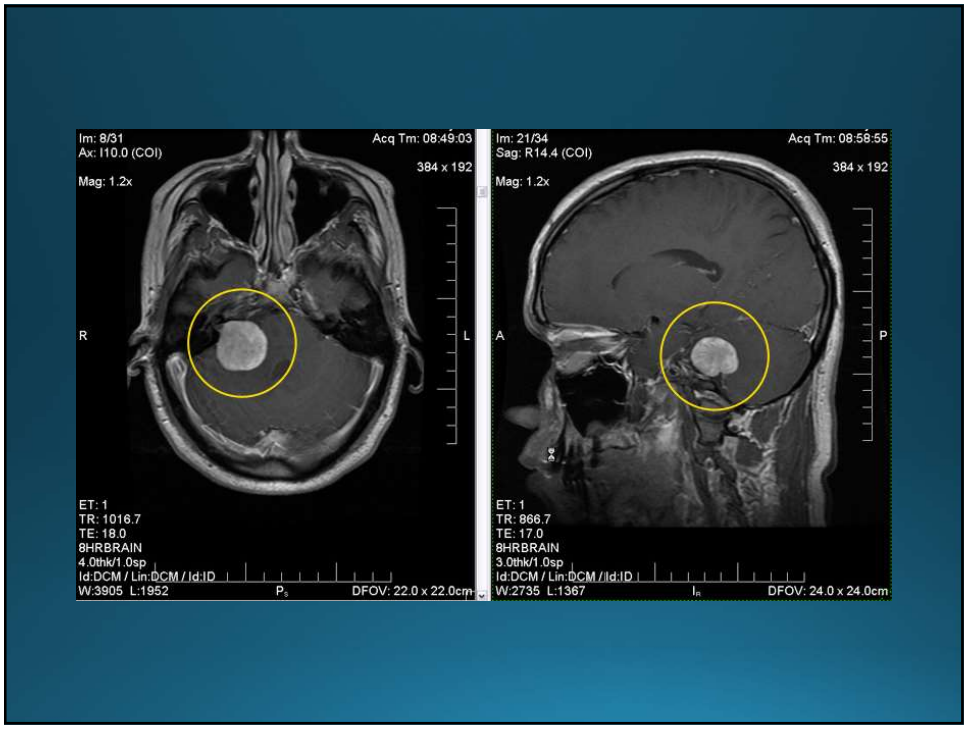
Im: 8/31
Ax: I10.0 (COI)
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TR: 1016.7
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DFOV: 22.0 x 22.0cm
Im: 21/34
Sag: R14.4 (COI)
Mag: 1.2x
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8HRBRAIN
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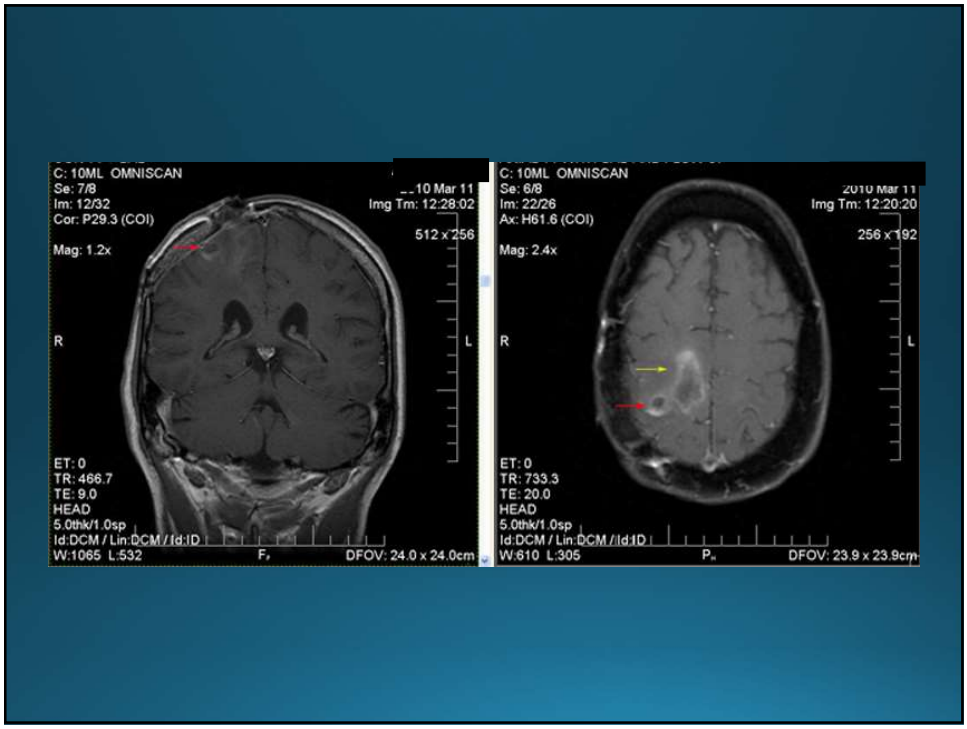
W:2735 L:1367
DFOV: 24.0 x 24.0cm

21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ET: 0
TR: 466.7
TE: 9.0
HEAD
5.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:1065 L:532
DFOV: 24.0 x 24.0cm
C: 10ML OMNISCAN
Se: 6/8
Im: 22/26
Ax: H61.6 (COI)
Mag: 2.4x
Img Tm: 12:20:20
256 x 192
R
L
ET: 0
TR: 733.3
TE: 20.0
HEAD
5.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:610 L:305
DFOV: 23.9 x 23.9cm

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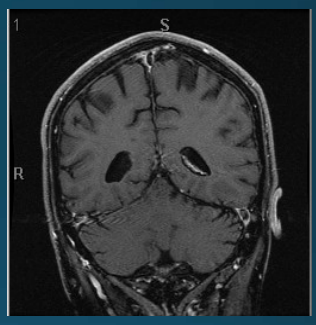
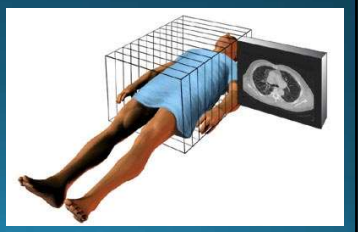
VIEWING IMAGES - Orientation

- Your right side corresponds to the patient's left side



- Axial Images: Like standing at patient's feet looking up
  - Your right side is the patient's left



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Cross Sectional Imaging

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COMPUTED TOMOGRAPHY

Generates a three-dimensional image of the body from a large series of two-dimensional X-ray images taken around a single axis of rotation

Reconstructs from a series of digital numbers from a Hounsfield Unit scale

An AP and Lateral Scout image is obtained to designate where the slices will be imaging

Scans are taken on one plane and reconstructed to create the sagittal and coronal planes

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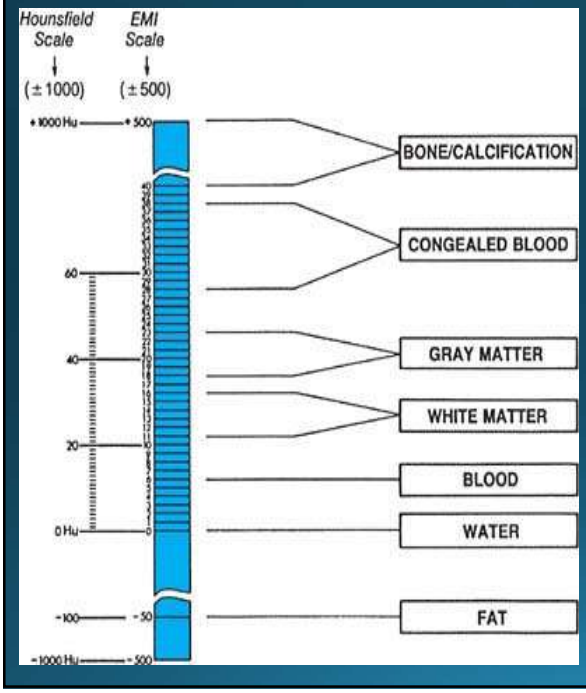

Hounsfield Units

- Bone = +1,000 HU (bright white)
- Water = 0 HU (grey)
- Air = -1,000 HU (black)

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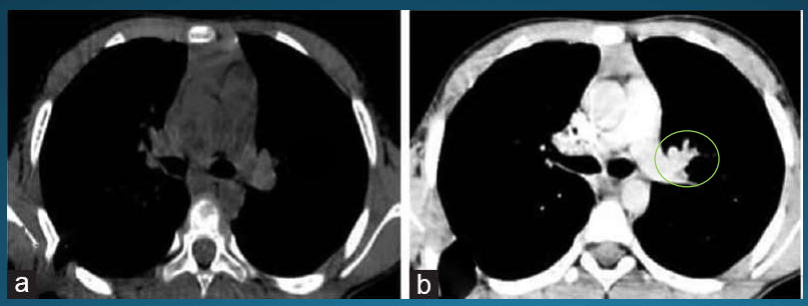
CONTRAST USE

Iodine-based and a barium-sulfate type contrast can be used in CT. This is used to highlight different structures of the body to evaluate pathologies and disease.

Examples: cancer work-up, dissection, vascular, tumors. Abdomen imaging – liver, pancreas, kidneys, bladder



NO CONTRAST CONTRAST

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COMPUTED TOMOGRAPHY: Advantages

- Visualization of anatomy without superimposition of structures
  - Axial imaging
  - Computerized mathematical reconstruction of digital numbers
- Ability to differentiate small differences in density of anatomic structures and abnormalities
  - 2 tissues with similar densities distinguished

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Computed Tomography: Indications

- Diagnose muscle and bone disorders
- Pinpoint the location of a tumor, infection or blood clot
- Guide procedures such as surgery, biopsy and radiation therapy
- Detect and monitor diseases and conditions
- Detect internal injuries and internal bleeding

**_Scans_: Brain, Mastoid/IAC, Neck, Chest, Abdomen, Pelvis, Spine, Extremity

Contraindications?

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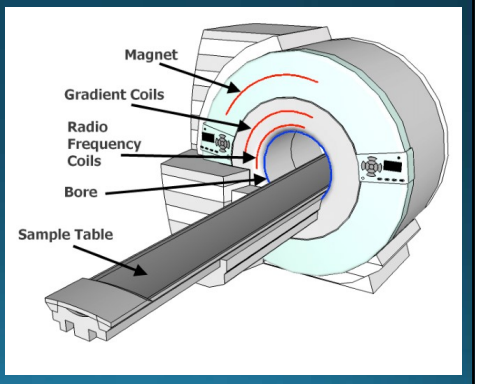
MAGNETIC RESONANCE

Utilizes a powerful magnetic field to align the magnetization of some atoms in the body

- Magnetic properties of hydrogen atoms
  - Human body = 80% hydrogen



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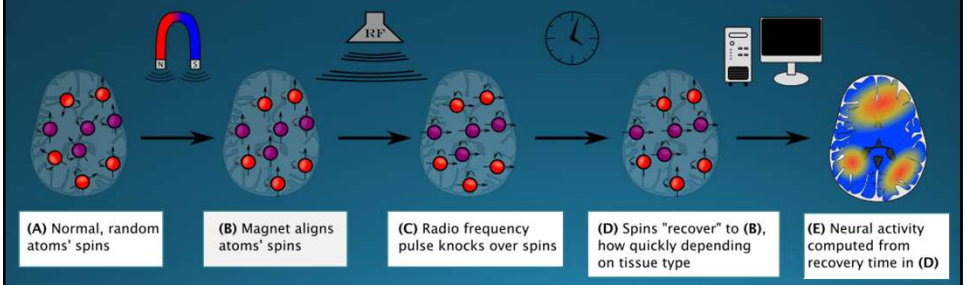
How does MRI work?

- A "coil" is placed around the area of interest to obtain the information of that specific area of anatomy
- Radiowaves enter patient from another angle—this radio wave causes the nuclei to flip positions and either align with the magnet or against it
- At termination of radio signals, nuclei return to original position by spinning like a top back into their varied position
  - Energy that is released from that relaxation is used to generate images (the energy released from the protons relaxing back into their normal neutral position)



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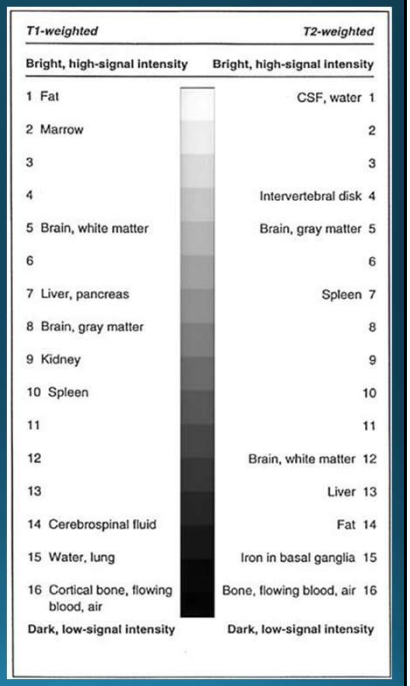
MAGNETIC RESONANCE

- T1 weighted images
  - Fat appears bright
  - Water appears dark
  (Short TR and TE)
- T2 weighted images
  - Water appears bright
  - Fat appears dark
  (Long TR and TE)



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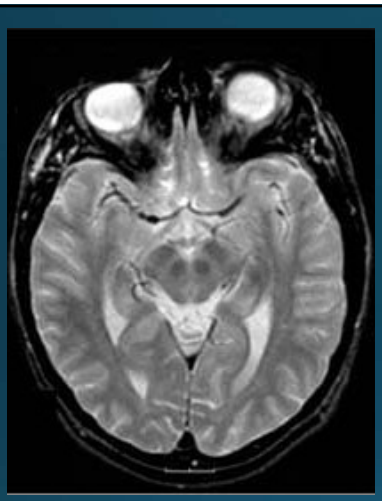
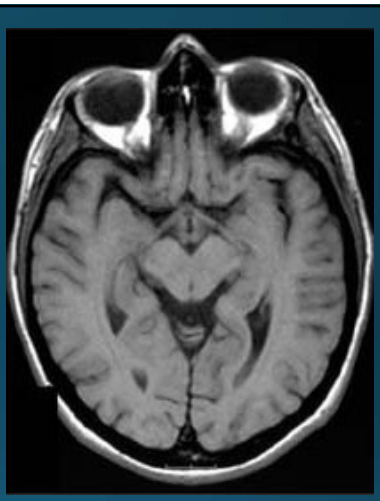


T2

- Fat behind eyes and under skin is dark
- Water inside ventricles and behind eyes is bright



T1

- Fat behind eyes and under skin is bright
- Water inside ventricles and behind eyes is dark

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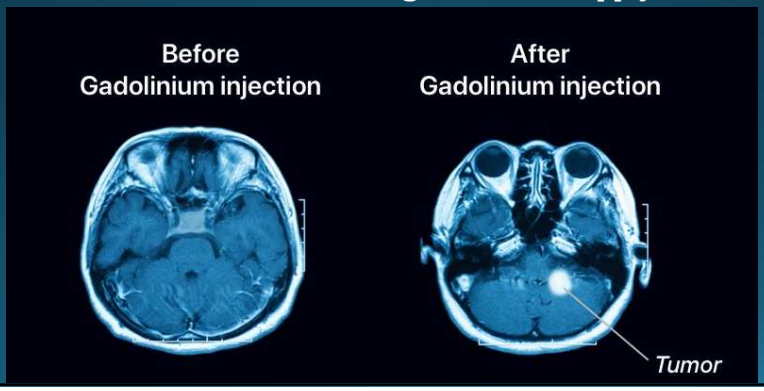
CONTRAST USE

Gadolinium is a contrast used in many MRI scans to improve the clarity of the images and to improve the diagnostic accuracy of the MRI scan

Examples: it improves the visibility of inflammation, tumors, blood vessels and, for some organs, blood supply



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Magnetic Resonance Imaging: Advantages

- No exposure to ionizing radiation
- Superior contrast resolution
- Superior tissue characterization
- Multi-planar capabilities
- Possibly safer intravenous contrast agents
- Visualization of angiography without using contrast

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Magnetic Resonance Imaging: Indications

A noninvasive way to examine organs, tissues and the skeletal system by producing high-resolution images that help diagnose a variety of problems.

- Brain/spinal cord
- Heart and blood vessels
- Liver
- Kidneys
- Spleen
- Breast
- Pancreas
- Uterus
- Ovaries
- Prostate
- Testicles
- Bone and Joints

Contraindications?

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