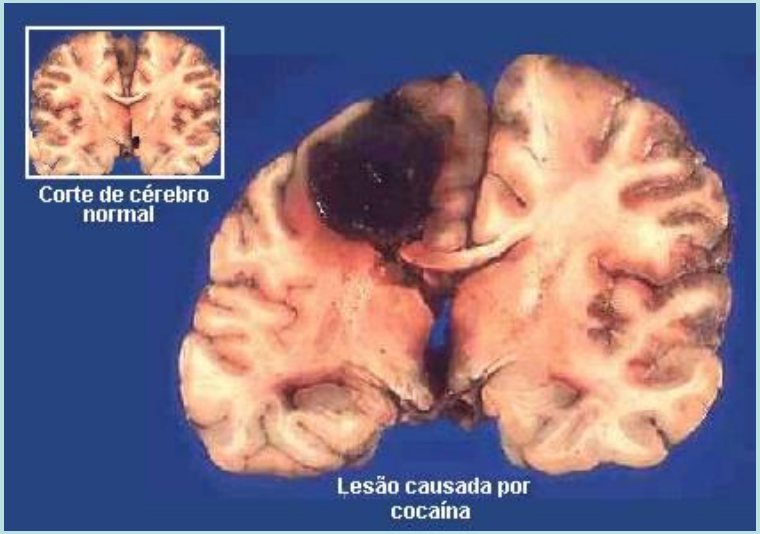
# How do we know about the brain?

Old Way:

**<u>Lesion:</u>** natural or experimentally damaged tissue of the brain used to study portions of the brain.




# Brain Imaging (new way)

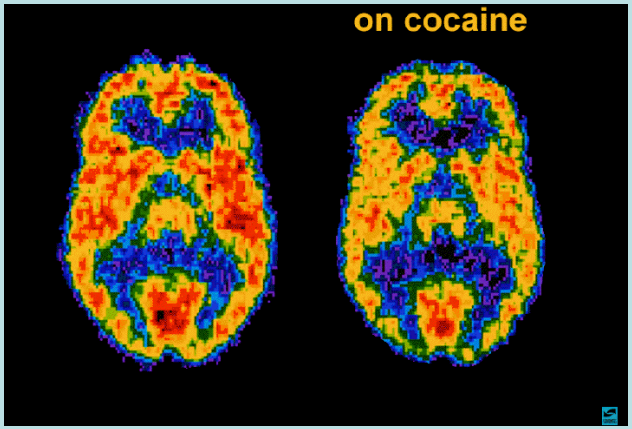
The way to learn about brain imaging methods is to determine if they show you the:

structure

where things are in the brain; are there any lesions

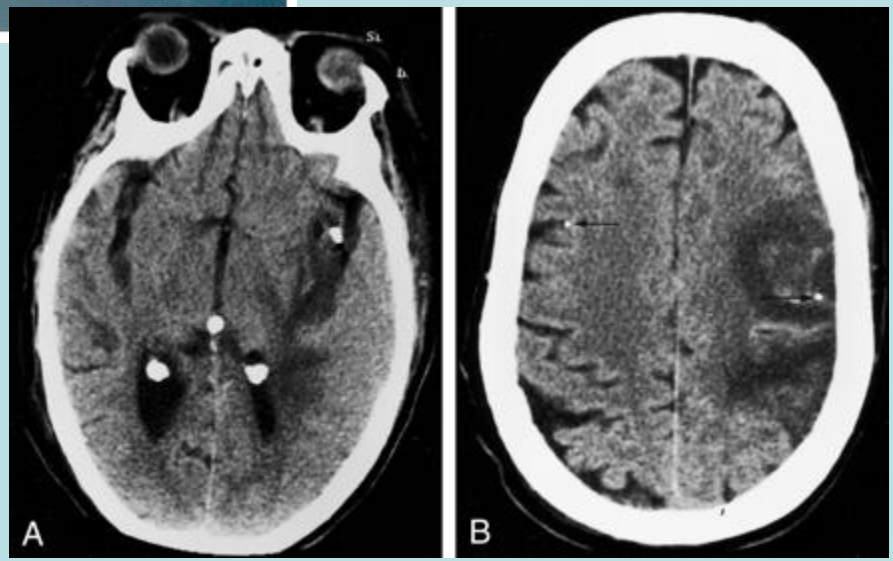
or

function




which part(s) of the brain are active

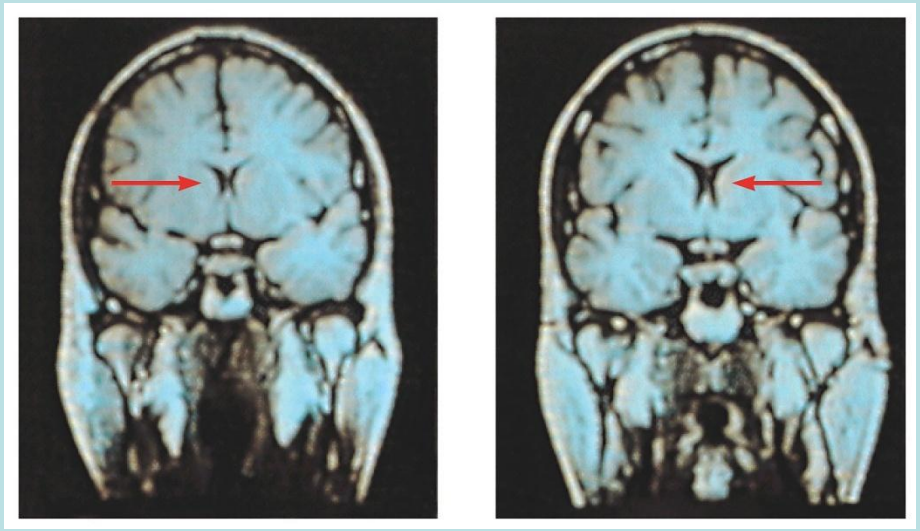
# CT scan

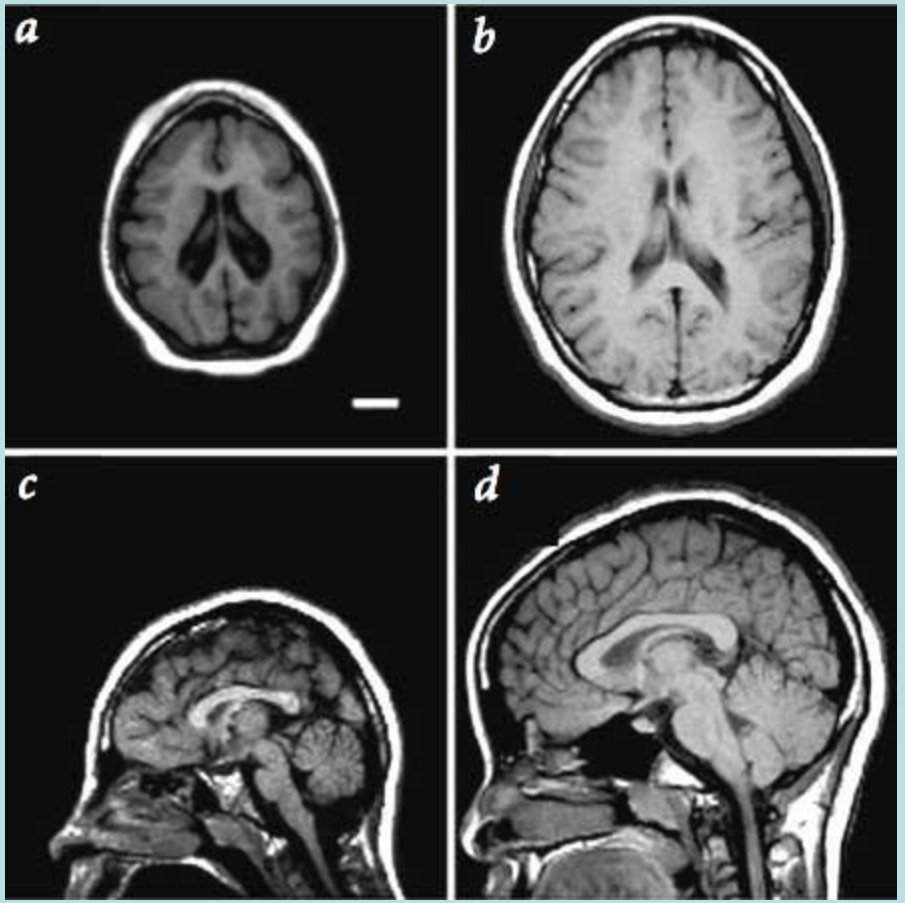


# CT
## computer tomography

- CT imaging uses special **x-ray** equipment to produce multiple images or pictures of the inside of the body and a computer to join them together in cross-sectional views of the area being studied. The images can then be examined on a computer monitor or printed.
- CT scans of internal organs, bone, soft tissue and blood vessels provide greater clarity than conventional x-ray exams.
- Used to plan surgeries, check bone density and some injuries to internal organs.
- Most neurologists will not use at this point because it is outdated.

# **MRI** – Magnetic Resonance Imaging





# MRI

## magnetic resonance imaging

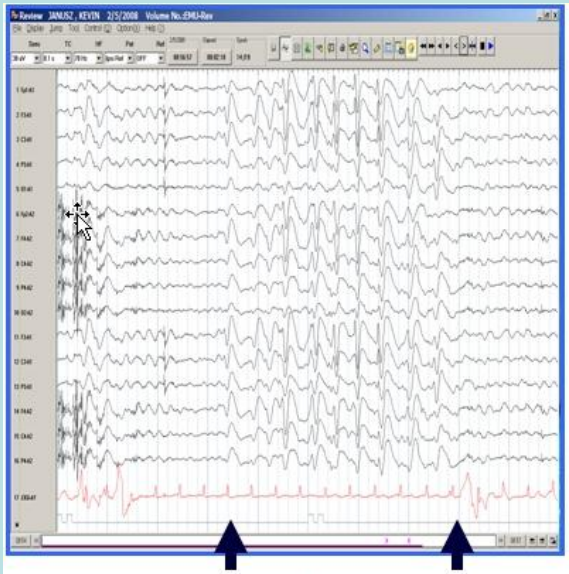
- Exposes the brain to a magnetic field and measures radio frequency of waves
- Shows high-resolution image (structure) of brain anatomy
  - No exposure to radioactivity
- Produces computer generated images that distinguish among different types of soft tissue

# MRI

MRIs:

- Help locate tumors
- Show images of :
  - the internal structure of the eye and ear
  - heart and major blood vessels
  - blood flow in the circulatory system
  - joints and soft tissues, particularly of cartilage, ligaments and tendons within joints such as the knee
- Disorders of chest and lungs
- Disorders of abdominal organs and the digestive tract
- Disorders of the kidneys, urinary tract and pelvic organs
- Infections

# **EEG** - electroencephalogram



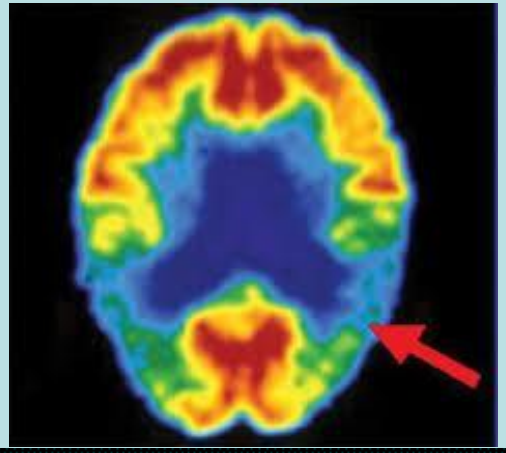
Slow spike and wave complexes (between arrows)

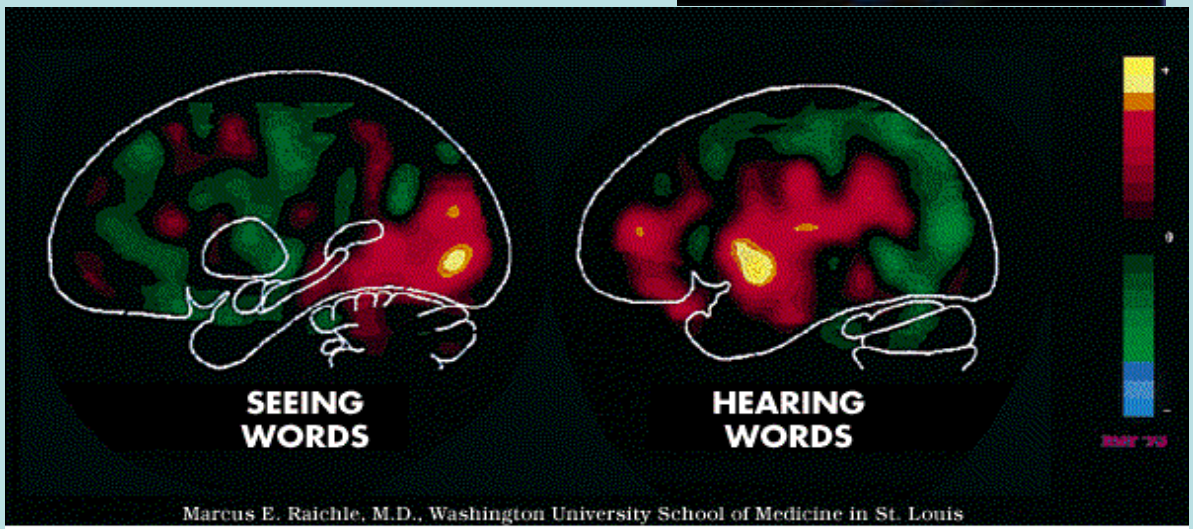
# EEG - Electroencephalogram

- Records electrical brain activity by placing electrodes to the outside of the head
- The brain's spontaneous electrical signals are traced onto paper
- Used to assess brain damage, epilepsy and other problems
- Its use in brain research is limited. The electrodes detect the activity of only a few neurons in the cortex out of the billions that are present

# PET Scan

positron emission tomography






Marcus E. Raichle, M.D., Washington University School of Medicine in St. Louis

*The PET scan on the left shows two areas of the brain (red and yellow) that become particularly active when volunteers read words on a video screen: the primary visual cortex and an additional part of the visual system, both in the back of the left hemisphere. Other brain regions become especially active when subjects hear words through ear-phones, as seen in the PET scan on the right.*

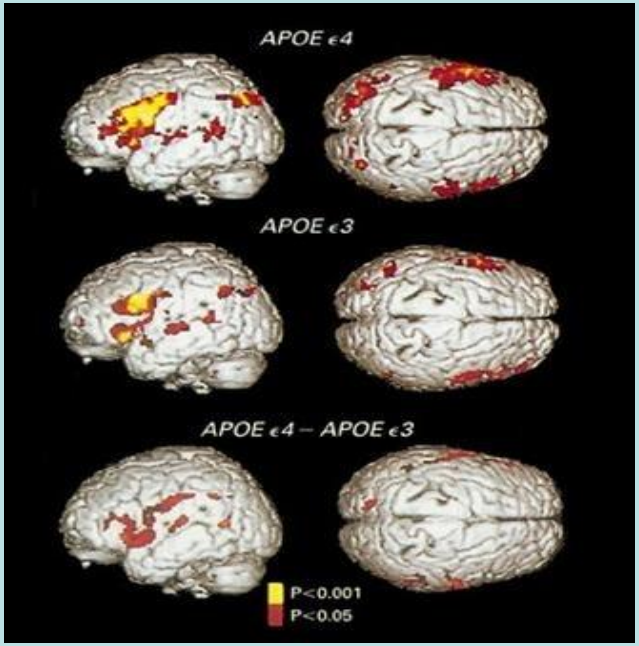
# PET Scan

positron emission tomography

- Visual display of brain activity (function) that detects where a radioactive form of glucose goes while the brain performs a given task
- PET scanning is useful in evaluating a variety of conditions — including neurological disease (such as Alzheimer's), heart disease, infections, certain inflammatory diseases and cancer

# fMRI

functional magnetic resonance imaging



# fMRI
## functional magnetic resonance imaging

- In an fMRI examination, a patient performs a particular task during the imaging process, causing increased metabolic activity in the area of the brain responsible for the task.
- Neuronal firing is fueled by glucose and oxygen, which are carried in blood. When an area of the brain is fired up, these substances flow towards it, and fMRI shows up the areas where there is most oxygen. The latest scanners can produce four images every second.