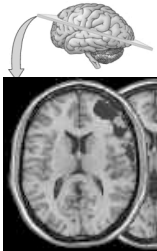
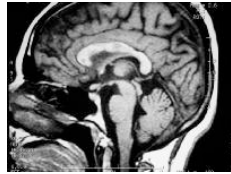


NEUROIMAGING

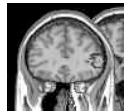
AXIAL (made along an axis)
transverse, horizontal
TYPICALLY NOSE UP



SAGGITAL



CORONAL

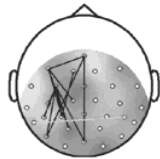
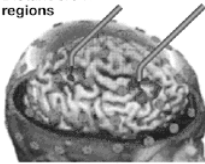


Non-invasive techniques

EEG (electroencephalogram)

metal electrodes measure electrophysiological activity
synchronized brain currents below scalp and skull

Distant brain
regions



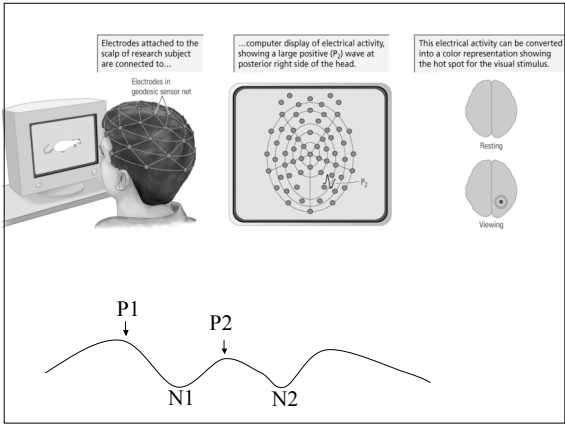
Uses evoked potentials, event related potentials (ERP) P1, P2, N1 etc

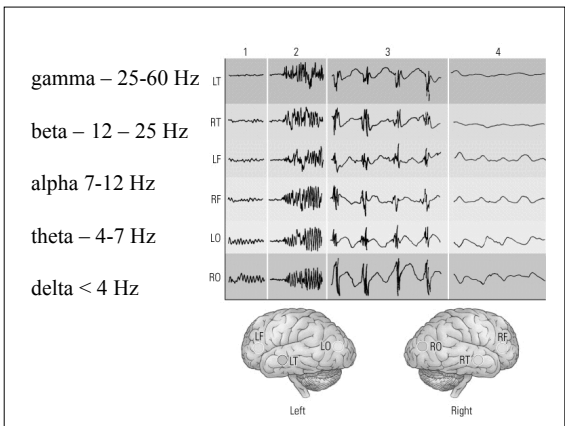
Good temporal resolution

poor spatial – difficult to determine source

Good for children, sleep studies, brain death







EEGs and sleep

Theta rhythms (4-7 hz) and behavior

Theta rhythms and autism

Is “binding” 40 Hz oscillations?

Computerized (AXIAL) tomography – 1970's

CT 3D reconstructions of thousands of x-ray images



- *X-ray source is rotated around the head
- *Sensors pick up relative changes as x-rays pass

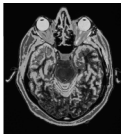
•Distinguish between bone, fluid, and brain tissue

•White matter and gray matter not well distinguished
(MS lesions not clearly visible)

•intracranial hemorrhage and calcified structures well defined

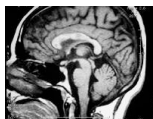


MRI conventional– images are static

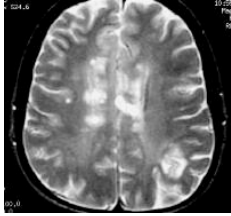


fMRI – REAL TIME

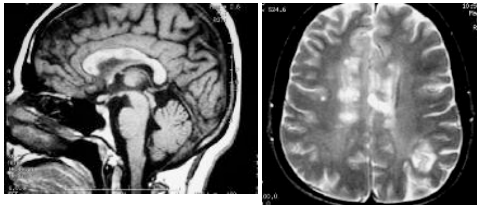
- Protons (nuclei of hydrogen atoms) usually rotate randomly
- Head placed in magnetic field, protons line up
- Radio frequency pulse makes aligned protons wobble (precession)
- When pulse stops, protons relax and realign to original magnetic field
- MRI measures the electrical signal as protons return to original state



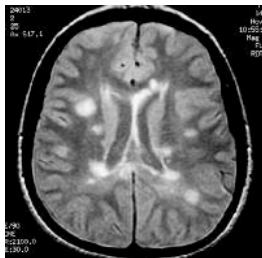
Multiple Sclerosis
Axial **T2-weighted** MRI scan - numerous white matter plaques



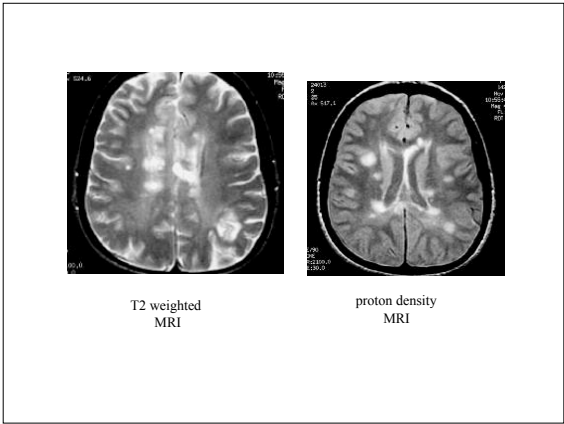
good distinctions between white and gray matter
grey matter brighter than white
but CSF appears too bright



proton density MRI



same as T2 but CSF is dark

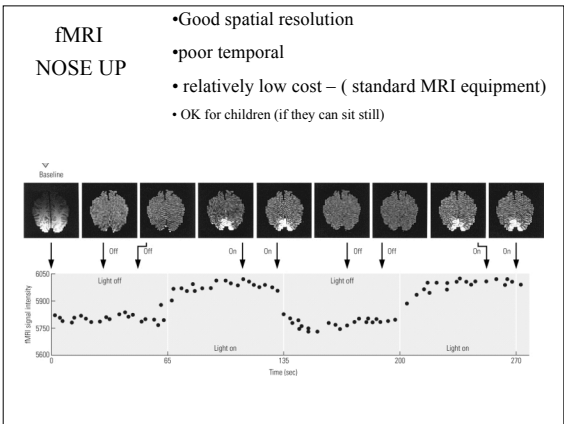


Some MRI variations include:

FLAIR – fluid attenuated inversion recovery

– suppress signal from ventricular CSF

critical to MS diagnosis and therapies



FUNCTIONAL NEUROIMAGING

Sometimes invasive (radioisotopes)
Expensive (need cyclotron)

Metabolic activity is measured, using conventional MRI principles and radioisotopes (in bloodstream) to tag molecules of interest.

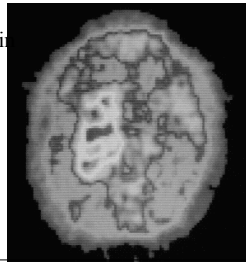
Basically – what regions are using more oxygen?

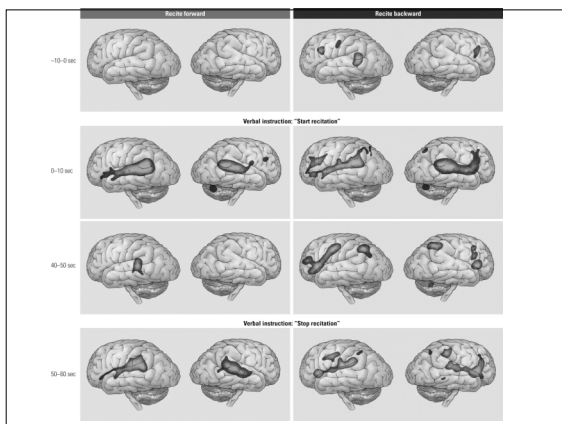
PET positron emission tomography

positrons emitted from radioactive substance
(emit positron when decaying)

collide with electrons in brain

energy released





PET— short-lived isotopes

Isotope attached to molecule used to locate changes in blood flow, areas of high metabolic activity

Example: radioactive oxygen (^{15}O) use measured (principle -high oxygen use = high metabolic activity.)

- superimposed on MRI image.
- High spatial resolution (poor temporal)
- high cost (cyclotron needed to create the isotope)
- invasive (limited used in children)

•MEG - magnoelectroencephalogram –

Detects changes in brain's magnetic field.

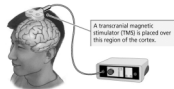
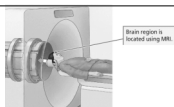
brain activity accompanied by magnetic fields

- Expensive (earth's magnetic field must be blocked)
- special sensors encased in liquid helium
- Good spatial and temporal resolution
- source is relatively clear –IF source lies tangential to brain surface.

USES SQUID – superconducting quantum interference device

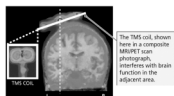
TMS

transcranial magnetic stimulator



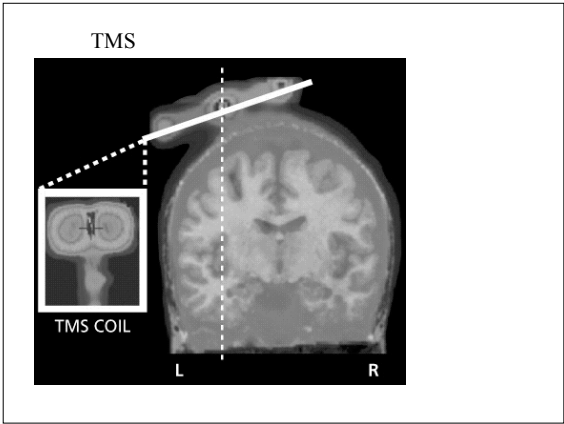
disrupts activity

uses PET scanner



Penfield?





Newest way to diagnose mental disorders?

PET and addiction and schizophrenia

PUT A LOAD ON YOUR BRAIN?!
