



Non-Invasive Techniques

Key: Does not hurt the organism

Psychology 372

Physiological Psychology

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Many Procedures

- X-Ray
- CT (CAT)
- MRI
- FMRI
- PET
- SPECT
- SQUID
- EEG

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X-RAY

- Typical X-Ray you receive at the physician's office.
- Can be used to examine brain structures
- Dyes can be injected and brain structures examined
- Air can be inserted into the spinal column and brain structures examined

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Advantages

- Is relatively cheap.
- Good to look at basic structures
- Good for bones and other things

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Disadvantages

- When injecting air, causes a major headache
- Cannot look at function
- Cannot see detail as well as other procedures
- Cannot be used to examine function.

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Cerebral Angiography

- Uses radio-opaque dyes
- Inject dye into the vertebral or carotid artery.
- X-ray the brain
- Dyes blocks x-rays and allows you to see brain arteries extremely well.
- Allows you to see vascular deformities
 - Balloon shape – aneurysm
 - Deformity from where the artery should be – Tumor

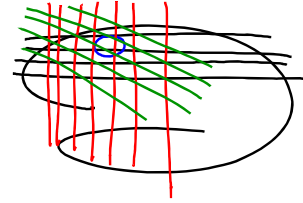
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Computerized Axial Tomography
CT or CAT

- Generally is a fancy X-Ray but uses a computer to create the image
- X-Ray unit moves around the structure (e.g., head) and puts X-Rays through to a detector on the opposite side
- Basically gives you a picture of a slice of tissue.
- Gives a good picture of the tissue at that level.

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Positron Emission Tomography

- Similar to A CT Scan
- Can be used to look at brain structures
 - Not used for as much today
- Primarily is used to examine brain functioning

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Procedure

- Use C11 or O15
- Use a Cyclotron to produce radioactive labels
- C11 or O15 attaches easily to other compounds such as glucose
- Result 2-DG = 2 Deoxyglucose
 - Has a short half life

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Procedure

- Make Glucose "Hot"
- Put radioactive glucose into the patient
- The patient is now emitting particles in all cells but particles concentrate in:
 - tumor sites
 - places that are using lots of glucose
- Have a scanner pick up the particles
- Computer makes a picture of where the glucose is concentrated

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Result

- Can see where a tumor is located
- Can determine which part of the brain is operating when doing a particular task.
 - Movement
 - Thinking
 - Visual Processing

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Psychological/Psychiatric Disorders

- People with Schizophrenia show more activity in the Frontal and Occipital lobes than normals
- People with depression show decreased glucose usage than normals
- Can be used with a variety of disorders.

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Advantages

- Great for looking a brain functioning
- Is helping us to understand how the brain is working.
- Is relatively safe

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Disadvantages

- Cyclotron is expensive
- Thus, PET is expensive
- It it an invasive technique
 - anytime you add something in a organism, you risk a reaction
- Can get the label “to hot”

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Magnetic Resonance Imagery

- Similar to a CT scan but uses magnetic fields instead of X-Rays
- Causes the nuclei of some atoms to spin in specific orientations
- When you add specific radio frequencies, the nuclei from water molecules (Hydrogen) emit particular frequencies as well
- Have a detector for the Hydrogen frequencies

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Magnetic Resonance Imagery

- Is also used to examine brain structures
- Great to determine things about
 - Tumors
 - Strokes
- Other things (hydrocephalus)
- Can be used for any structure
 - Full body scans

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Uses

- Very good at detecting certain diseases
 - MS
- Have little water in White Matter
- Lots of resonance in Gray Matter
 - Myelin has little water
 - With demyelination, glial cells move in- have lots of water

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Uses

- Good for finding tumors
- Good for strokes
- Good for finding focal point seizures
- Can be used on any body structure as well

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Advantages

- Can be used on any structure
- Provides better detail than CT
- Does not use X-Rays - Lower radiation
- Great for focal points

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Disadvantage

- Is expensive
- Hear lots of loud noise like banging
- Can be scary

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Functional MRI (fMRI)

- Similar to MRI but look at function
- Looks at Oxygen metabolism instead of Hydrogen
- Have higher resolution than PET scans
 - Get better detail about particular brain regions.

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Single-Photon Emission Computerized Tomography (SPECT)

- Is like a PET Scan but more refined

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Superconducting QUantum Interference Device (SQUID)

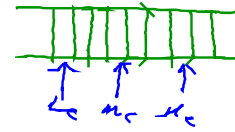
- Like MRI – Are used to pick up changes in magnetic fields
 - When neurons fire
 - creates a change in electrical current
 - causes a magnetic field
 - So, changes in magnetic field indicate changes in neural activity.
 - Can monitor changes of one milliseconds while other techniques take seconds.
 - Is extremely sensitive

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Williamson and Kaufman

- Used SQUID to monitor the brain of a person listening to a piano
- Found
 - the brain hears loud sounds in a different place from quieter sounds
 - Brain distance between areas that hear a low C on a piano is the same distance that hears middle C from a high C

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Faces

- Place where the brain remembers faces is different from where it remembers objects
 - Faces - Right hemisphere that specializes in spatial configurations
 - Objects - (Spatial) - Is recalled in the cortex that originally processed how the spatula felt and how the hands moved it.
- When objects to be recalled close to where you want to use the information.

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Magnetic Source Imaging (MSI)

- Uses SQUID to measure ions in the brain or other areas (e.g., heart).
- Magnetoencephalography (MEG)
 - Measures magnetic fields of the brain
- Magnetocardiography (MCG)
 - Measures magnetic fields of the heart.

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Some Websites for More Information

SQUID

- <http://www.wikipedia.org/wiki/SQUID>
- <http://www.siue.edu/~tpartha/images/magnetometry.htm>

Medical Techniques

- <http://imasun.lbl.gov/~budinger/medhome.html>

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