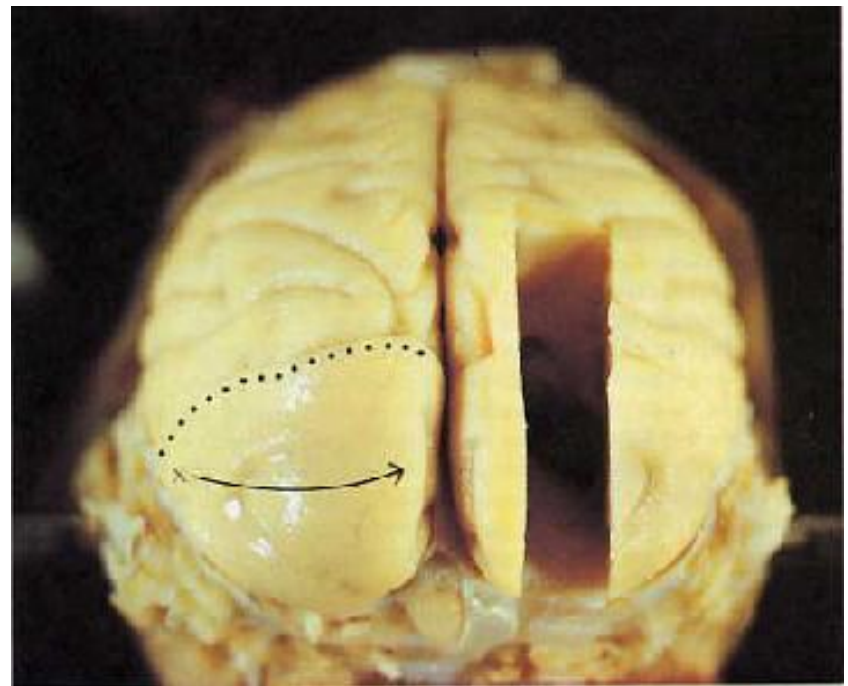


# Methods and Tools for Studying the Brain

# The Brain

## Techniques to Study the Brain

A brain **lesion** experimentally destroys brain tissue to study animal behaviors after such destruction.



Hubel (1990)

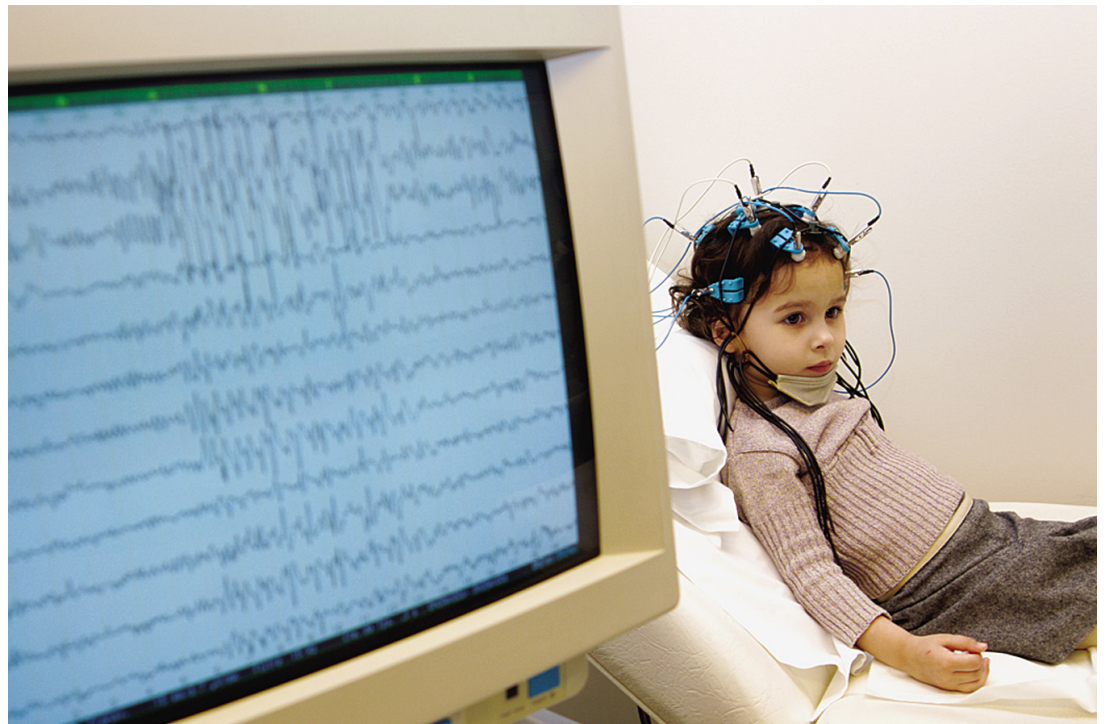
# Microelectrode Techniques

- Very small electrodes inserted into individual neurons
- Used to study activity of a single neuron



# Macroelectrode Techniques

- Used to get a picture of overall activity in the brain
- An example is an EEG (Electroencephalogram), which uses electrodes placed on a person's scalp to measure an amplified recording of the electrical waves sweeping across the brain's surface.



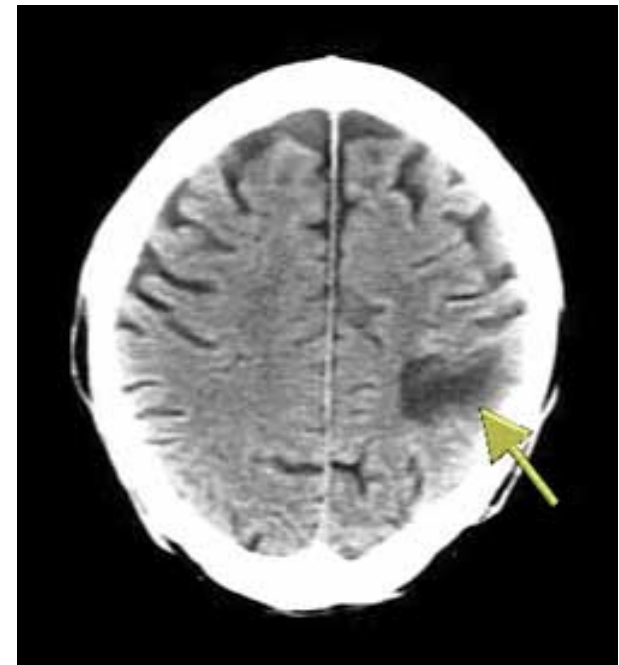
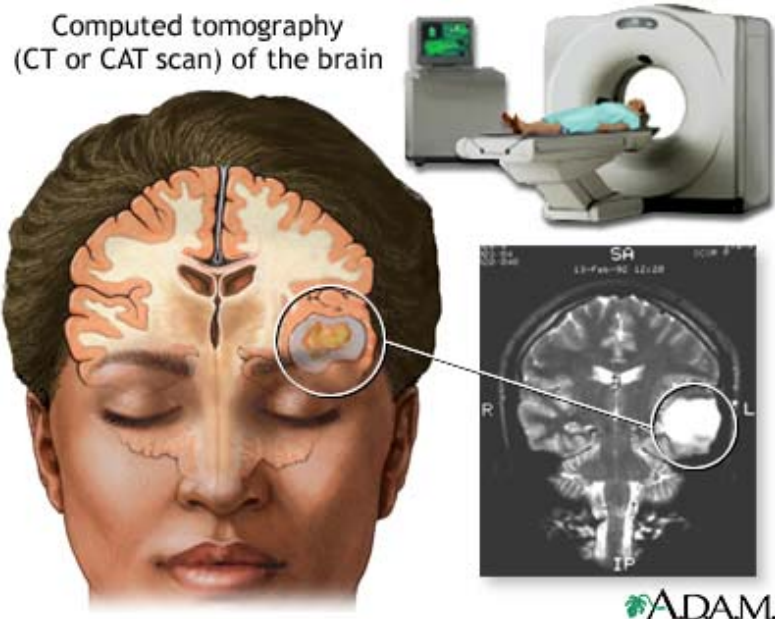
# Structural Imaging

- Can show the structure of the Brain
- Computerized Axial Tomography (CAT-scan)



# Structural Imaging

- Computerized Axial Tomography (CAT-scan)
  - Uses X-rays to create a 3-dimensional image of the brain
  - CT scans can often show the size and locations of brain abnormalities caused by tumors, blood vessel defects, blood clots, strokes and other problems.





# Structural Imaging cont' d

- Magnetic Resonance Imaging (MRI)
  - Uses a magnetic field and radio waves to produce computer-generated images
  - They distinguish among different types of brain tissue.
  - Image shows ventricular enlargement in a schizophrenic patient.



# CT Scan vs. MRI

- CT may be less expensive than MRI. In addition, it is less sensitive to patient movement.
- CT can be performed if you have an implanted medical device of any kind, unlike MRI.
- MRI contrast materials used for image enhancement have very low incidence of side effects

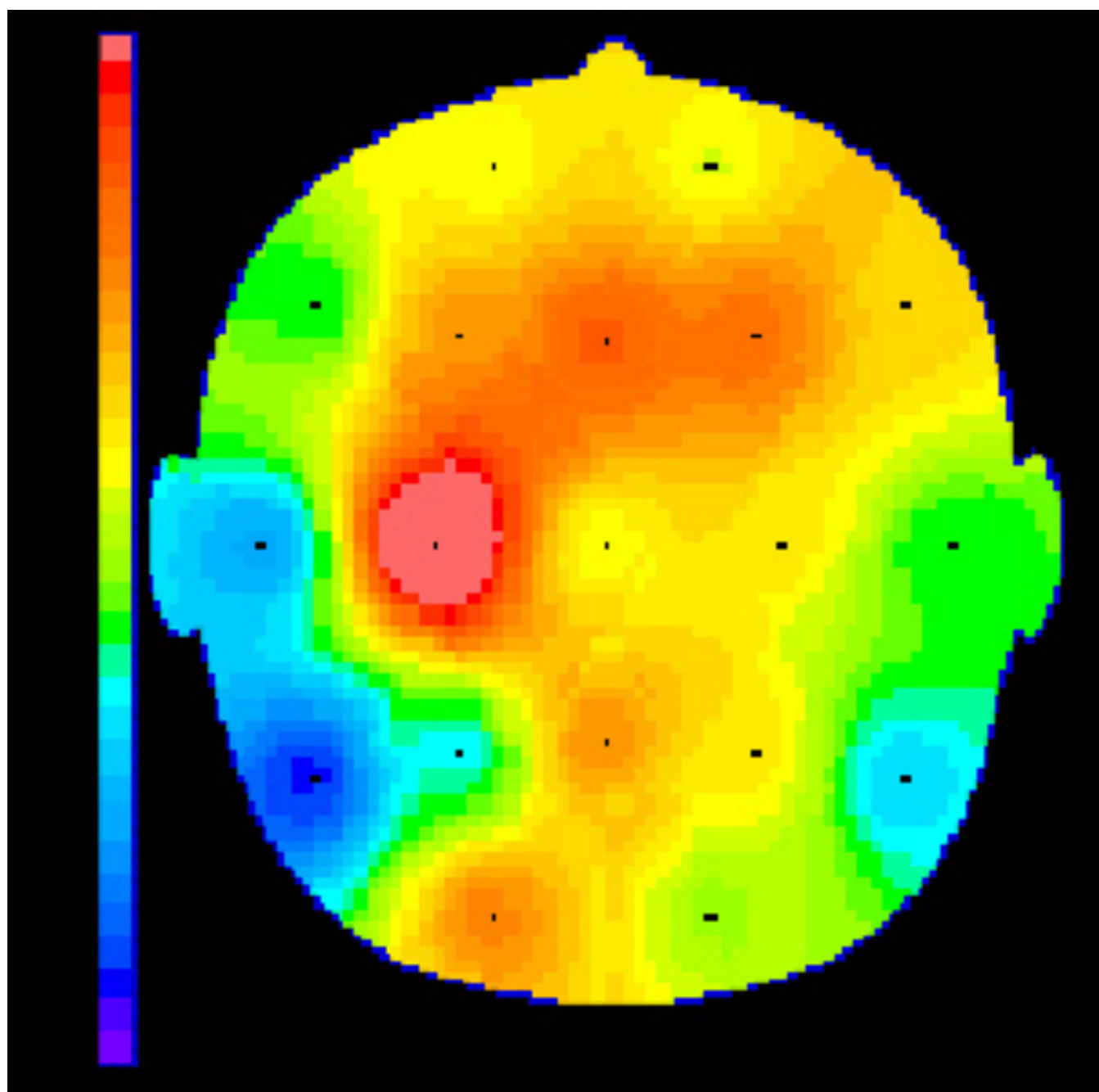


# Functional Imaging

## Shows the brain working (functioning in real time)

- EEG imaging
  - 21 Sensors on the scalp record changes in electrical activity and feed them into a computer. The computer translates them into color and motion on a map of the brain displayed on a television monitor



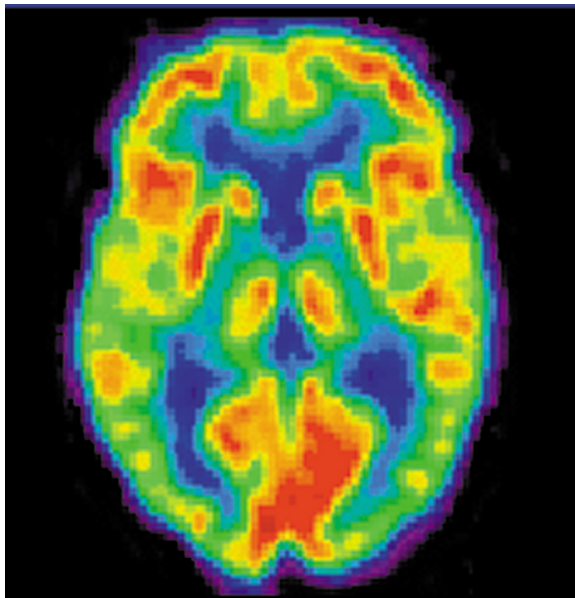


# Functional Imaging

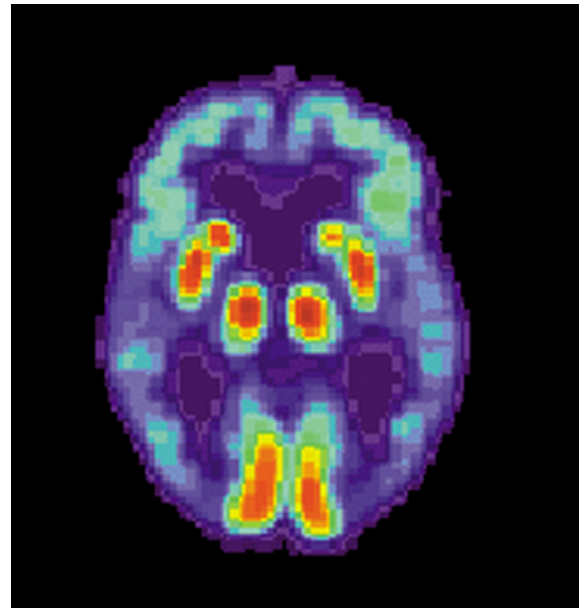
Shows the brain functioning in real time (movies or series of images)

- Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT)
  - Use radioactive glucose to determine location of greatest brain activity

PET Scan of  
Normal Brain



PET Scan of  
Alzheimer's  
Disease Brain



# Functional Imaging

- Functional Magnetic Resonance Imaging (fMRI)
  - Shows function and structure by measuring movement of blood molecules within the brain
  - [Click here](#)
  - [Click here](#)

# Nervous System

Central Nervous System

Peripheral Nervous System

Brain

Spinal Cord

Motor (Efferent) Neurons

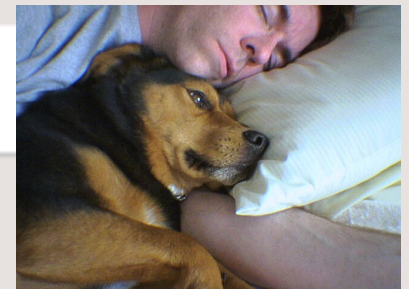
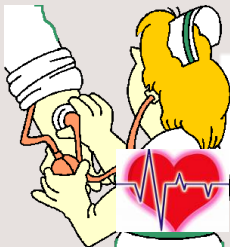
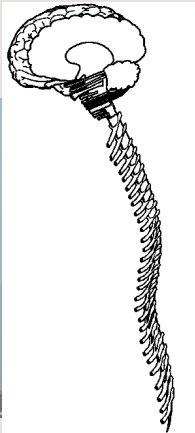
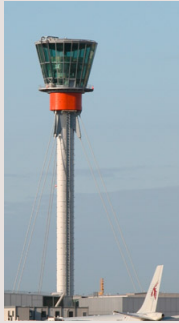
Sensory (Afferent) Neurons

Autonomic Nervous System

Somatic Nervous System

Sympathetic Nervous System

Parasympathetic Nervous System

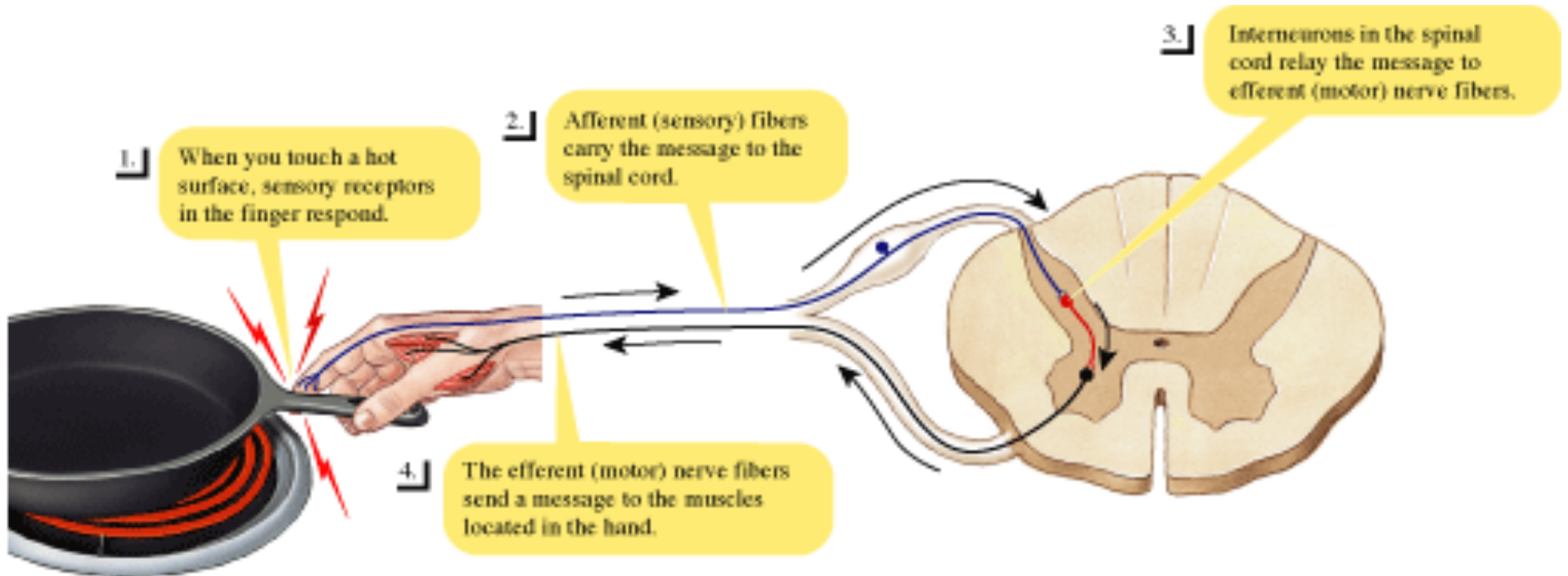


# The Spinal Cord

- Complex cable of nerves that connects brain to rest of the body
- Carries motor impulses from the brain to internal organs and muscles
- Carries sensory information from extremities and internal organs to the brain
- 400,000 people a year in US either partial or complete paralysis.

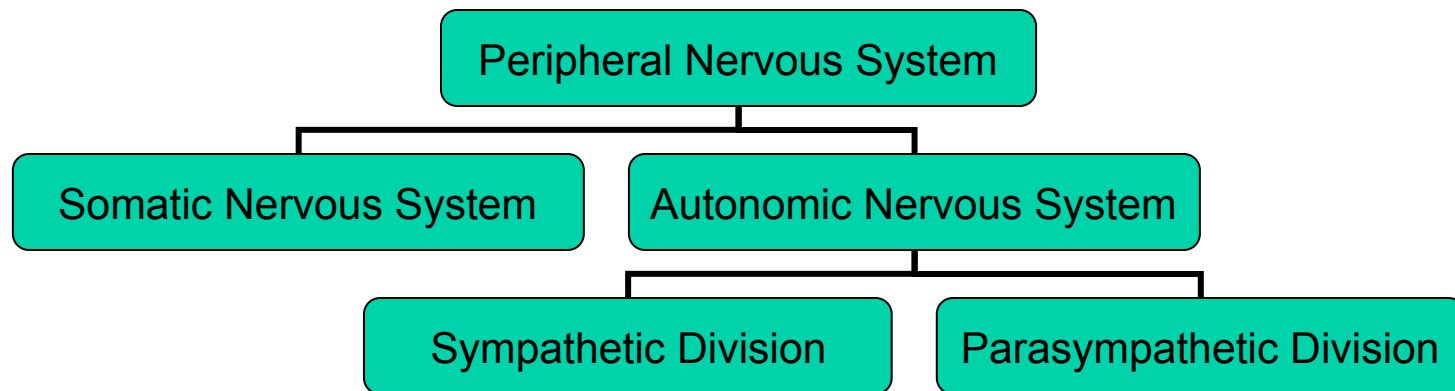
# The Spinal Cord

- The spinal cord controls some protective reflex movements without any input from the brain





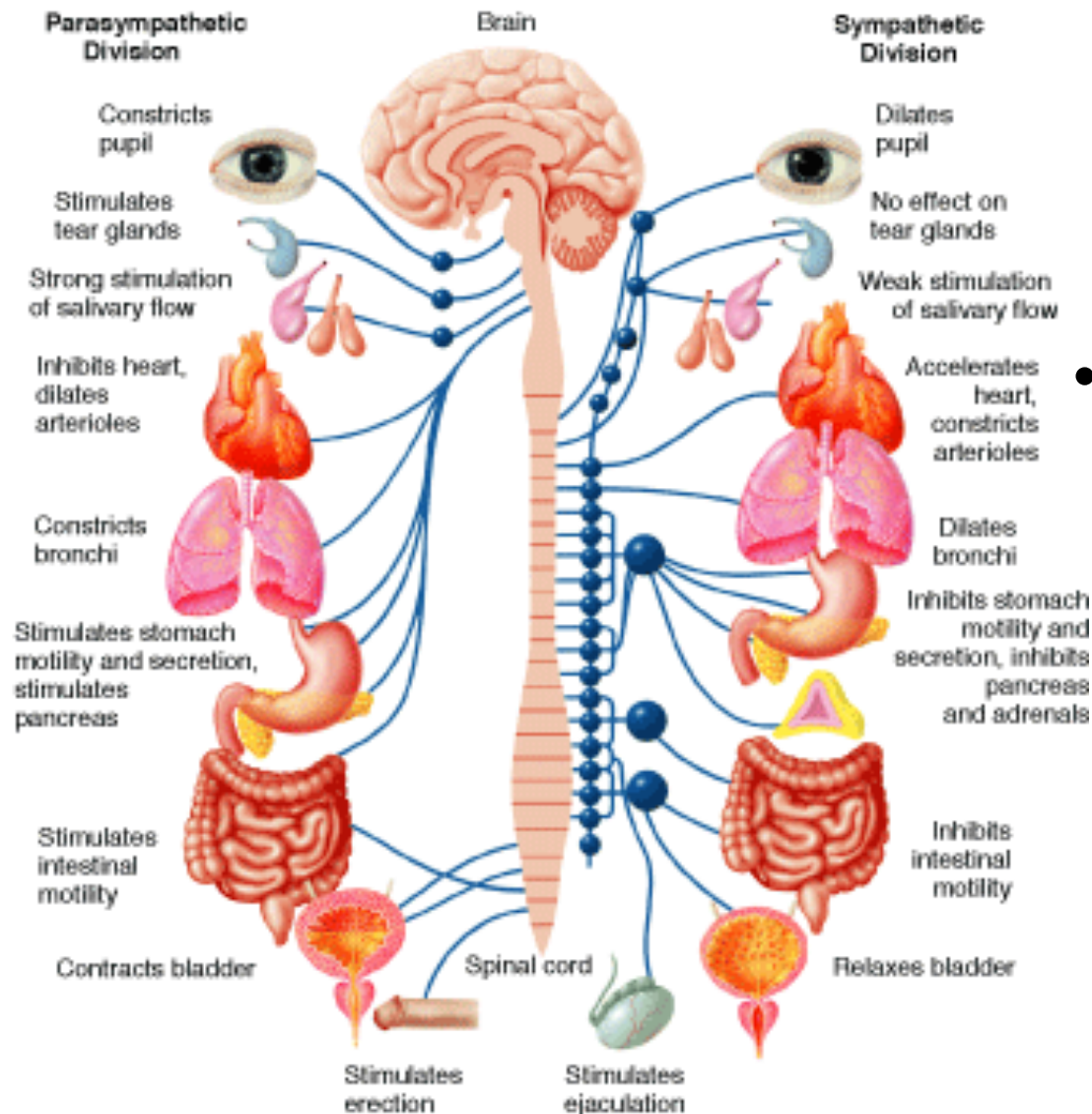
# The Peripheral Nervous System



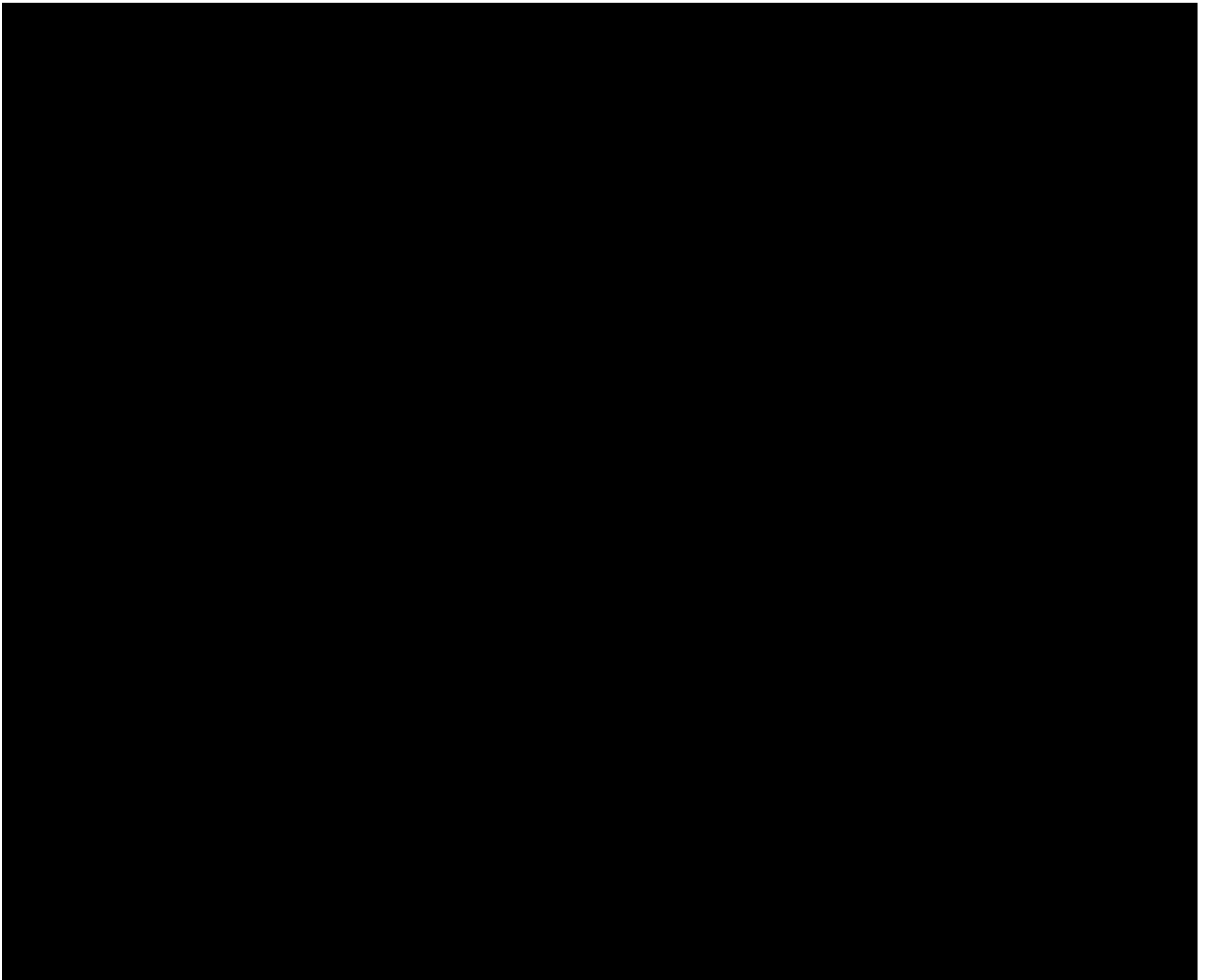
# The Somatic Nervous System

- Consists of neurons that communicate between the body and the brain
- Motor Neurons
  - Neurons that carry messages from the spinal cord or brain to muscles and glands

# The Autonomic Nervous System

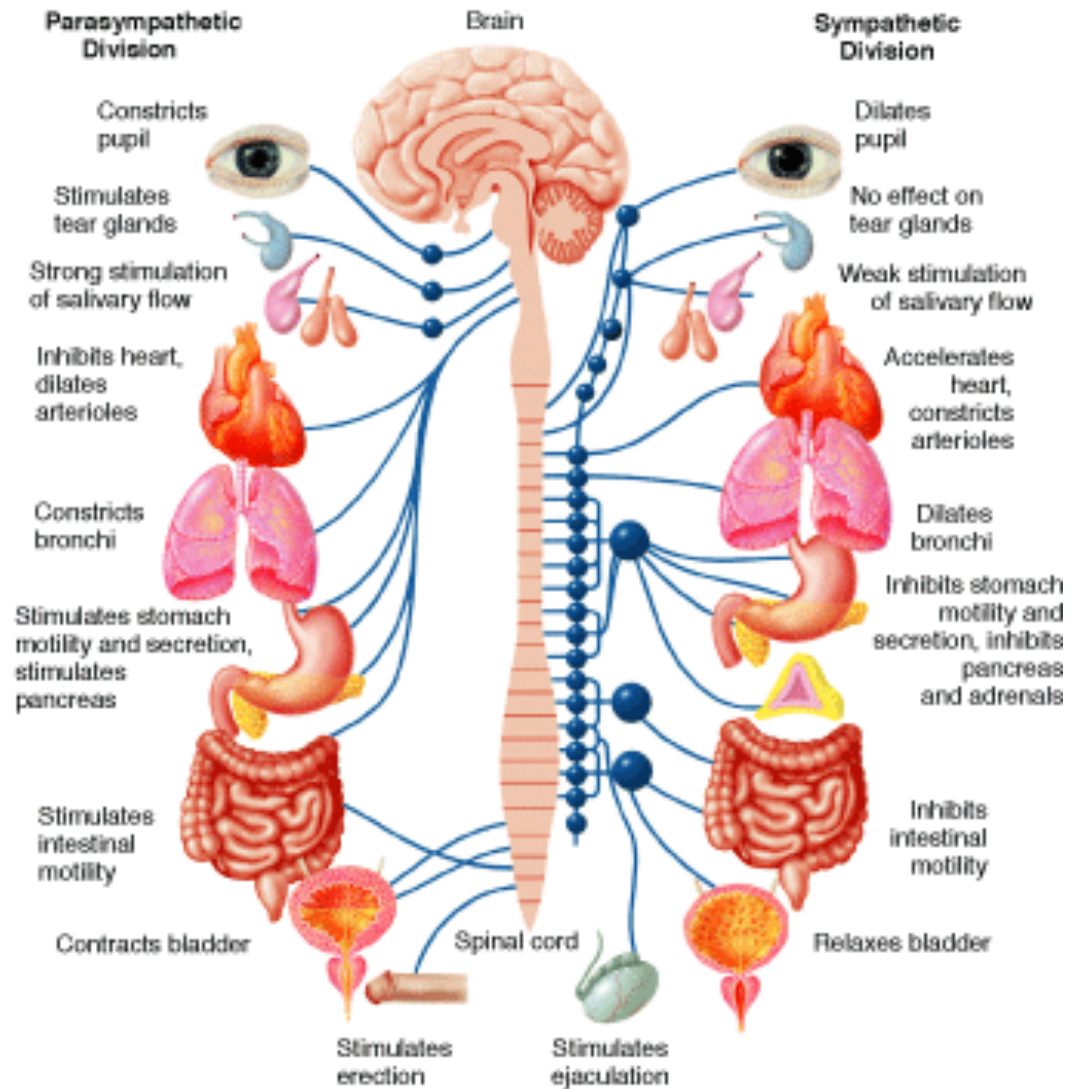


- Sympathetic division
  - Most active when you are angry, afraid, or aroused
  - Increases heart rate and breathing
  - Stops digestion
  - “Fight-or-flight”



# The Autonomic Nervous System

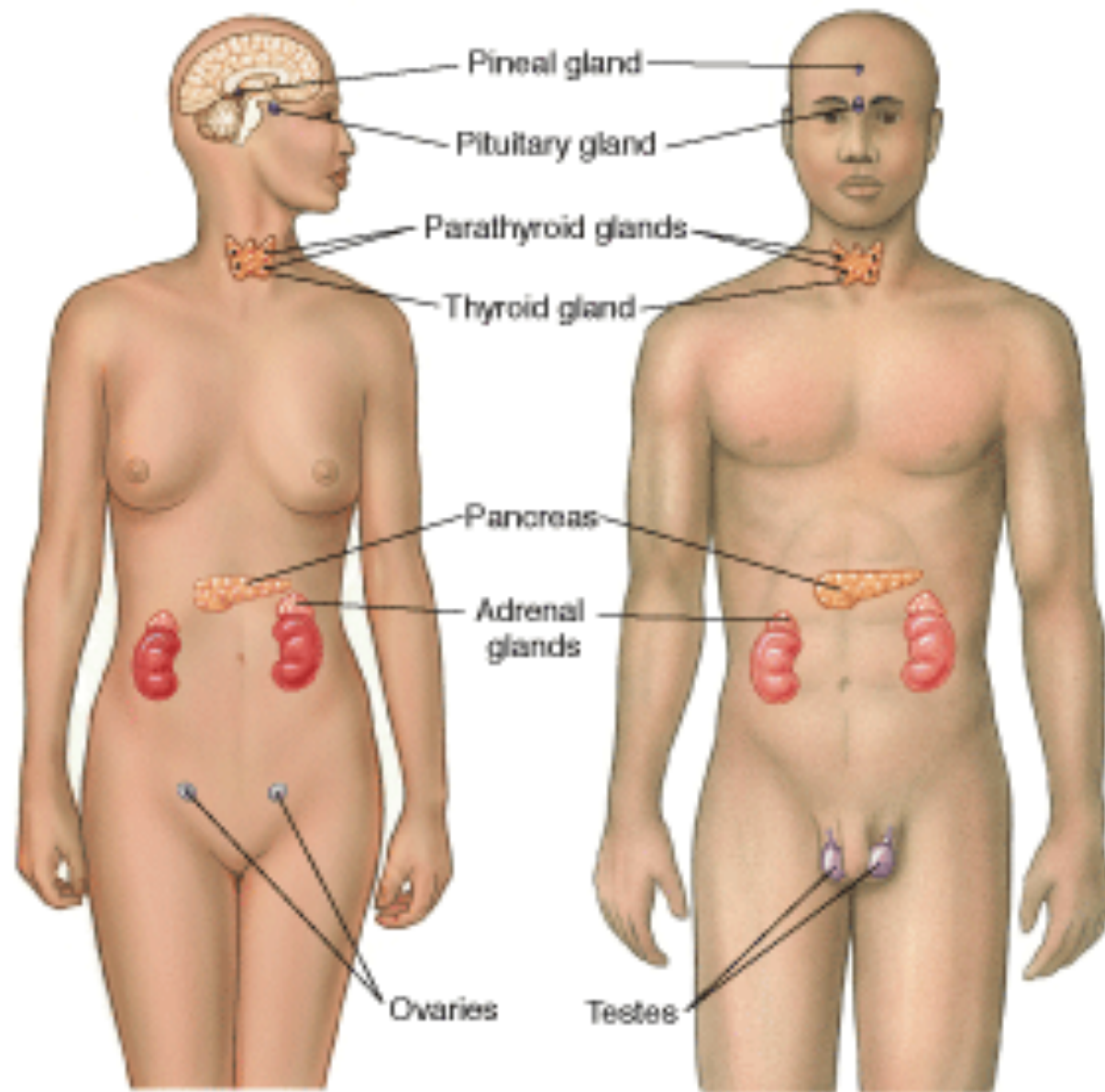
- Parasympathetic division
  - Calms body
  - Produces effects opposite to those of the sympathetic division
  - Reduces heart rate and breathing
  - Restores digestion
  - “Rest and Digest”



# **The Hypothalamus Has Central Control of the ANS**

- The hypothalamus is involved in the coordination of ANS responses
- One section of the hypothalamus seems to control many of the "fight or flight" responses; another section favors "rest and digest" activities

# The Endocrine System





# The Endocrine System

- Controlled by the Hypothalamus
- Helps coordinate and integrate complex psychological reactions
- Endocrine glands secrete hormones into the bloodstream
- Hormones are chemical substances (similar in function to neurotransmitters) that help regulate bodily activities.

# The Endocrine System

- Thyroid gland
  - Secretes hormones (primarily thyroxin) that control metabolism
    - How alert an energetic or how fat and thin you are
    - Overactive Thyroid can mean insomnia, reduced attention span, agitation
    - Too little thyroxin can mean feeling constantly tired
- Parathyroid glands
  - Control levels of calcium and phosphate which in turn controls levels of excitability

# The Endocrine System

- Pineal gland
  - Secretes melatonin which regulates the sleep-wake cycle
  - Disturbances in melatonin are responsible for “jet lag”
- Pancreas
  - Regulates blood-sugar levels
  - Secretes insulin and glucagon

# The Endocrine System

- Pituitary gland
  - Referred to as the “master gland” because it regulates many other glands
  - Influences blood pressure, thirst, contractions of the uterus during childbirth, sexual behavior and interest, body growth etc.
- Gonads
  - Ovaries and testes secrete estrogens and androgens (testosterone)
  - We know they play a role in development, aggression and sexual drive but don't have the whole story.
- Adrenal glands
  - Secretes hormones in reaction to stress
  - Activates (via epinephrine) the sympathetic nervous system.



You

## Effect of hormones on rat sexual orien...

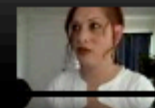
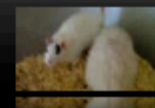
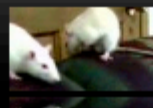
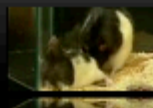


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Causation of homosexuality: the older...

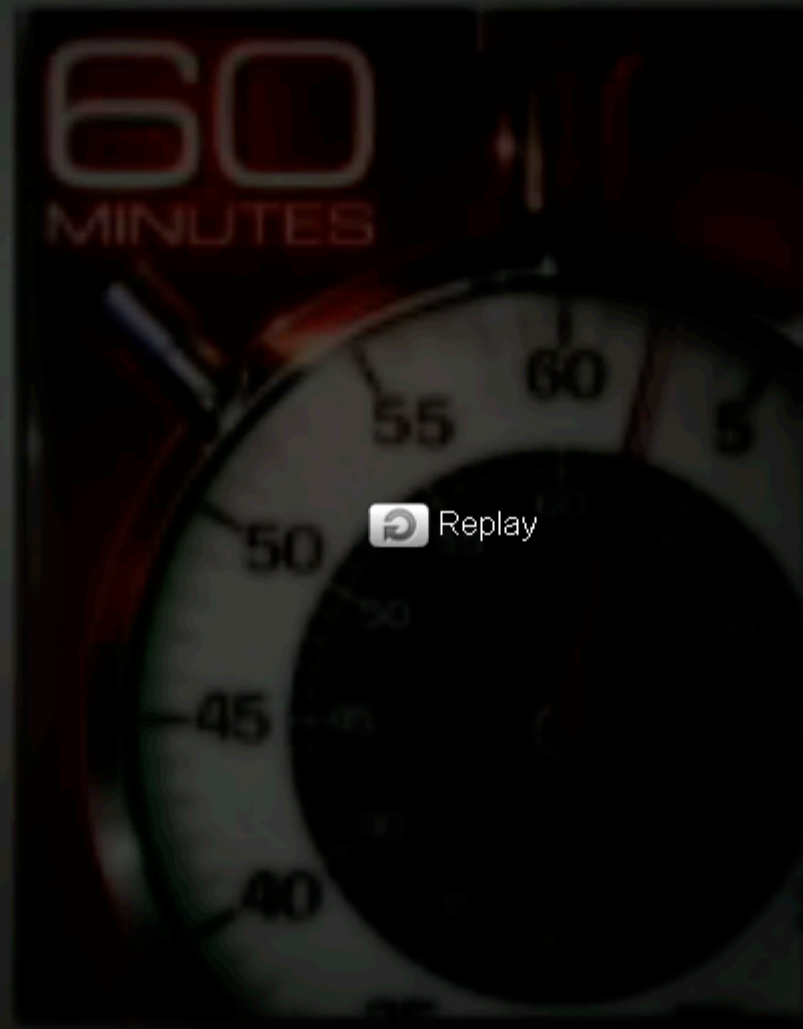
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