Welcome to Biopsychology!

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Syllabus is NOT on E-learning: https://sites.uni.edu/walsh/phys98.html

Our text ➔ (plus some online readings)

Psychology: the scientific study of behavior and mental processes
Biopsychology: the subarea which attempts to understand behavior & mental processes by studying their underlying biological basis
a.k.a. biological psychology, physiological psychology, psychobiology, behavioral biology, behavioral neuroscience
Biopsychologists also study how the biological mechanisms underlying how behaviors develop in the individual, how they evolved in the species, and what function the behavior or process served.
Studies both animals & humans, uses both experimental & non-experimental methods, and includes both basic research & applied research.

Areas of Study
Within Biopsychology and Some Related Disciplines

Biopsych is multi-faceted and interdisciplinary. Different areas of biopsych may use very different, very specialized research methods & tools.

See Biopsych reading linked to syllabus)

“Physiological psychology” – mostly basic research making use of surgical, electrical or chemical manipulations of brain in controlled experiments to study the brain’s influence on behavior

“Behavioral neuroscience” is a newer term for this area

This rat has surgically produced brain lesions in the ventromedial hypothalamus leading to overeating until it weighs 5 X normal weight.

Read about invasive research methods on 105-106

Psychopharmacology – basic and applied research studying the effects of drugs on brain chemistry and behavior/mental processes

This rat, lying on its back, is under the influence of THC, the active ingredient in marijuana, hence his rather dazed, immobile appearance

Comparative psychology (think “comparing different species”) – the study of the behavior and mental processes of different species

Jane Goodall studying chimpanzees
Studying Language Comprehension in a Bonobo Chimpanzee
Sue Savage-Rumbaugh
Great Ape Trust of Des Moines, Iowa

http://www.youtube.com/watch?v=wRM7vTrIIis

Evolutionary Psychology

- Area interested in the evolutionary origins of behaviors and mental processes. Attempts to study the adaptive functions of behaviors and the presumed selective pressures that caused them to evolve.

Example: Chicks of some bird species can distinguish predators from non-predators flying overhead. They flee from birds with short heads/long tails (hawks) but not those with long heads/short tails (geese). This is adaptive in that these chicks are more likely to survive and pass on their genes.

Behavior Genetics

- Area of study which seeks to understand both the genetic and environmental contributions to individual variations in behavior.

- This young man is grimacing because his genetic makeup allows him to taste the bitter chemical on the paper strip on his tongue. Others may be unable to taste this chemical or will experience a much milder bitter taste.

Psychology – studies the effects of brain damage in humans & how to assess those effects

This student is completing the block design test to measure visual-spatial ability. She must rearrange her blocks to match the design the tester has placed before her.

Best Known Psychophysiological Measures (see Chap 4)

- EEG – electroencephalogram
- ERP – event related potentials
- EMG – electromyogram of muscle tension
- EOG – electrooculogram – eye movements
- SCR – skin conductance
- ECG/EKG – electrocardiogram & BP and HR measures

Psychophysiology uses non-invasive recording techniques (HR, BP, EEG, etc.) to study bodily changes during behavior or psychological processes

This student has an array of EEG electrodes applied to his scalp to monitor brain electrical activity.
• Cognitive neuroscience — hot new area examining the neural basis of mental processes, usually using new brain imaging techniques like PET scans or fMRI scans.

Here the red and yellow spots of fMRI scans reveal what areas of brain are active during bilingual or single language naming of objects.

• Please learn about brain imaging (p 107-111 and also syllabus links)

Other Neuroscience Disciplines

• Neuroanatomy
• Neurochemistry
• Neuroendocrinology
• Neuropathology
• Neuropharmacology
• Neurophysiology

Converging types of evidence improve our understanding

One way to study brain-behavior relationships is to study the effects of brain damage.

Lesion = area of damage
Ablation = removal of a region
Temporary “lesion” by inactivating a brain area – with a drug or transcranial magnetic stimulation, for example

• Related Medical Specialties

• Neurologist – diagnoses & treats those with brain damage or nervous system disorders
• Neurosurgeon – performs brain surgeries
• Physical therapist– provides treatments to improve movement and decrease pain
• Occupational therapist – works with individuals to improve or retrain the activities of daily living

Brain Atlas

• Detailed map of brain with coordinates
• Our library has brain atlas guides for rats, monkeys, “domestic animals” and humans.
Holds the head (or attaches to
the head in larger species) in a
standard position, to allow the
insertion of electrodes or
surgical tools to precise
locations within the brain, using
calibrations on the stereotax in
conjunction with the 3-D
coordinates provided by brain
atlases. In human brain
surgeries the location of the
electrode is also verified with
brain scans and behavioral
testing.

Atlas Guided Stereotaxic Surgery

- Using an electrode
to create a lesion
or area of brain
damage

- An alternative to studying the effects of damaging a
  brain region is to study the effects of stimulating or
  activating that brain region on behavior.

Human Stereotaxic Surgery

Stereotactically implanted
stimulating or recording electrodes

- Have animal engage in task
- See what brain areas have
  active neurons
Electrical Stimulation of Reward System

Delivery of Drug Stimulus to Rat Brain via a Cannula

Chemical Stimulation via an implanted “cannula”

Remote Control Electrical Brain Stimulation by Delgado

Bull Stereotaxic Surgery

Transcranial Magnetic Stimulation (non-invasive)

Magnetic pulses alter the electrical activity of brain area beneath wand – either increasing or decreasing the activity depending on the settings used.

http://www.youtube.com/watch?v=FMR_T0mM7Pc&feature=related
http://www.youtube.com/watch?v=stJFwxVH2_s
Start at 32 sec
Stimulation Data Can Complement Lesion Data

Damaging the lateral hypothalamus abolishes eating behavior in rats. Stimulating the lateral hypothalamus triggers eating behavior.

• Another approach is to monitor brain anatomy or functioning to see how it is correlated with behavior or mental processes.
• Assignment: Watch the various research methods video examples next to 8/28 in syllabus.

Monitoring Electrical Activity During Sleep and Waking

• The EEG is one of the oldest methods of monitoring brain activity.

Brain imaging can be used to examine the structure (anatomy) or the functioning of the brain.
• Structural imaging
  • CAT or CT scans – fancy x-ray technique
  • MRI scans – strong magnets rather than radiation
• Functional imaging (show brain activity)
  • PET scans – injected radioactive tracer
  • fMRI scans – MRI anatomy + oxygen use by brain

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CT or CAT Scan of Intracerebral Hemorrhage

“Frontal” or “Coronal” View of brain using MRI (magnetic resonance imaging)

Positron Emission Tomography (PET Scan)

- Brighter colors indicate more active regions
- Uses injection of a radioactive chemical

The “functional MRI” or fmri monitors the brain’s use of oxygen to tell which areas are most active during some task.