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.

• **Physiological psychology** – mostly basic research making use of surgical, electrical or chemical manipulations of brain in controlled experiments to study the biology of 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 110-112.

• **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.

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 as 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.
• Neuropsychology – 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.

• 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. Read about psychophysiological research methods on 106-109.

Best Known Psychophysiological Measures

- EEG – electroencephalogram
- ERP – event related potentials
- EMG - electromyogram of muscle tension
- Eco EEG-electrocardiogram & BP and HR measures

• 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 read 5.1 (102-105) to learn about brain imaging techniques & watch videos linked to syllabus.

Converging sources of evidence improve our understanding.

Other Neuroscience Disciplines Biopsygh Draws From

- Neuroanatomy
- Neurochemistry
- Neuroendocrinology
- Neuropathology
- Neuropharmacology
- Neuropsychology

May also need evidence from related disciplines outside of psych.
Related Medical Specialties

- Neurologist – diagnoses and 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

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

Brain Atlas

- Detailed map of brain with coordinates
- Our library has brain atlas guides for rats, monkeys, “domestic animals” and humans.

The stereotaxic device

Device which 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 coordinates provided by brain atlases. In human brain surgeries the location of the electrode is also verified with brain scans and behavioral testing.

Stereotaxic Surgery on a Rat

Atlas Guided Stereotaxic Surgery

- Using an electrode to create a lesion or area of brain damage
- Can replicate same surgery in many animals
Human Stereotaxic Surgery

• But we can't do human brain surgeries simply for research purposes — we must rely on piecing together the effects of brain damage or disease based on individual cases
  • Jimmy G's loss of memory (p. 3 & 12)
  • Mr. R's loss of verbal memory (p.9)

• 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.

Chemical Stimulation via an implanted “cannula”

Transcranial Magnetic Stimulation (TMS)

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
Be a Critical Thinker!

• Caution! Fancy surgical or electrical manipulations or brain imaging does not necessarily mean good research!

Remote Control Electrical Brain Stimulation by Delgado

Bull Stereotaxic Surgery

Egas Moniz removed cores of white matter to “disconnect” prefrontal cortex.

Later Walter Freeman simplified the procedure with his “transorbital” approach.

http://www.youtube.com/watch?v=_0aNILW6ILk&feature=related
First 3 minutes