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

• “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.
We’ll talk a little more about these research methods when we get to Module 4.3

• 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 head/long tails (hawks) but not those with long head/short tails (geese). This is adaptive in that these chicks are more likely to survive and pass on their genes.

http://www.youtube.com/watch?v=wRM7vTrilis
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

Psychophysiological Measures

Read about these in Mod. 4

- EEG – electroencephalogram
- ERP – event related potentials
- EMG - electromyogram of muscle tension
- EOG - electrooculogram – eye movements
- SCR or GSR - skin conductance
- ECG/EKG - 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 to learn about brain imaging techniques

Converging sources of evidence improve our understanding.

<table>
<thead>
<tr>
<th>Table 1.2</th>
<th>The Six Major Disciplines of Biopsychology with Examples of How They Have Approached the Study of Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physiological Psychology</strong></td>
<td>Study of the mechanisms of behavior by manipulating the nervous systems of nonhuman animals or controlled experiments.</td>
</tr>
<tr>
<td><strong>Psychopharmacology</strong></td>
<td>Study of the effects of drugs and other chemicals on the brain and behavior.</td>
</tr>
<tr>
<td><strong>Neuropsychology</strong></td>
<td>Study of the psychological effects of brain damage in humans.</td>
</tr>
<tr>
<td><strong>Psychophysiology</strong></td>
<td>Study of the relation between psychological activity and physiological processes in humans.</td>
</tr>
<tr>
<td><strong>Comparative Psychology</strong></td>
<td>Study of the evolution, genetics, and adaptiveness of behavior primarily through the use of the comparative method.</td>
</tr>
<tr>
<td><strong>Neurophysiology</strong></td>
<td>Study of the neural mechanisms of human cognition, largely through the use of functional imaging techniques like fMRI.</td>
</tr>
</tbody>
</table>

May also need evidence from related disciplines outside of psych.
Other Disciplines Studying the Nervous System

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

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.

Human Stereotaxic Surgery
• 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.

Stimulation Data Can Complement Lesion Data
Whereas damaging the lateral hypothalamus abolishes eating behavior in rats while stimulating the lateral hypothalamus triggers eating behavior!

Delivery of Drug Stimulus to Rat Brain via a Cannula

Electrical Stimulation of Reward System

Transcranial Magnetic Stimulation (TMS)
Transcranial Magnetic Stimulation

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

• Another approach is to monitor brain or biological functioning to see how it is correlated with behavior or mental processes.

Monitoring Electrical Activity During Sleep and Waking

Recording Electrodes in Monkey

• Brain imaging can be used to examine the structure (anatomy) or the functioning of the brain.
• Structural imaging
  – CAT or CT scans
  – MRI scans
• Functional imaging (show brain activity)
  – PET scans
  – SPECT and regional cerebral blood flow scans
  – fMRI scans

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.

2 Techniques Similar to PET scans
- SPECT scan
- Regional cerebral blood flow (rcbf scan)