


**Behavioral Neuroscience
PSB 3340**

**Section: 3924, spring semester 2012
Tuesday, period 1, Thursday periods 1-2
PSY room 130**

Professor: Dr. D. P. Devine
dpdevine@ufl.edu
Psychology Building room 324
273-2174
office hrs: T Th period 3
(9:35 – 10:25 p.m.)
or by appointment

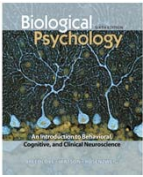
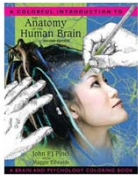
T.A.: Xiaomeng Yuan
verabbit@ufl.edu
Psychology Building room 361
office hrs: to be announced
or by appointment



**Behavioral Neuroscience
PSB 3340**

Required Textbook:
Biological Psychology, An Introduction to Behavioral and Cognitive Neuroscience, 6th edition by Breedlove, Watson, & Rosenzweig (2010)
ISBN # 0878933247


Optional Textbook:
A Colorful Introduction to the Anatomy of the Human Brain – A Brain and Psychology Coloring Book by John P.J. Pinel and Maggie Edwards (2007)

**Behavioral Neuroscience
PSB 3340**

**Grading:
3 in-class tests
Each of the tests will count 33 1/3% toward your final grade
1 optional final to replace a missed test, 33 1/3 %
(better grade counts). **There are no other make-up tests.****

A	93-100	A-	90-92		
B+	87-89	B	83-86	B-	80-82
C+	77-79	C	73-76	C-	70-72
D+	67-69	D	63-66	D-	60-62
Fail	<60				



WEBSITE: <http://www.psych.ufl.edu/~dpdevine/behneuro/bn.html>

January 10, 2011

Chapter 1: Introduction

- > Introduction: What is Behavioral Neuroscience?
- > Biological Explanations of Behavior
- > Understanding the Brain and Behavior
- > Ethical Issues in Research with Animals



Introduction: What is Behavioral Neuroscience?

- > Behavioural Neuroscience is the study of the physiological, evolutionary, and developmental mechanisms of behavior and experience.
- > This study focuses on the functioning of the nervous system and its **reciprocal** interactions with the rest of the body to control behavior.



Introduction: What is Behavioral Neuroscience?

- > What does a Behavioral Neuroscientist do?
 - 1) Studies of Normal Behaviour:
 - sensation
 - motor behavior
 - language
 - learning and memory
 - motivation
 - sexual behavior
 - parental behavior
 - ingestive behavior
 - stress responses
 - arousal
 - etc.
 - 2) Studies of neuropathological conditions that affect humans
 - addiction
 - anxiety and phobias
 - aggression
 - obsessions and compulsions
 - depression
 - schizophrenia
 - Alzheimer's disease
 - Parkinson's disease
 - other Psychiatric and neurologic disorders...

Introduction: What is Behavioral Neuroscience?

> **Where do Behavioral Neuroscientists work?**

- 1) **University** - basic research and teaching
- 2) **Research Institute** - basic research
- 3) **Pharmaceutical or Biotechnology Industries** – applied (preclinical and clinical) research

> **What other biomedical disciplines contribute?**

- 1) **CLINICAL:** Neurology, Endocrinology, Psychiatry
- 2) **BASIC RESEARCH:** Neuroanatomy, Neurochemistry, Electrophysiology, Developmental Biology, Molecular Biology

Integrative function of Behavioral Neuroscience

Introduction: What is Behavioral Neuroscience?

> **The Human Genome Project**

Structure of DNA published April 25, 1953
 Human genome draft sequenced June, 2000
 Human genome completely sequenced April 14, 2003

- more than 99.99% accuracy (less than 1 error per 10,000 bases)
- highly contiguous (gaps = sequences cannot be reliably resolved with current technology)
- only 1.1 – 1.4% of 3.2 billion base pairs encode proteins
- 20,000 – 25,000 genes (current estimate 23,299)



Single nucleotide polymorphism (SNP)
AAGGCTAA to ATGGCTAA

Behavioral Neuroscientists identify functions of these mapped genes as they relate to behaviour.



Biological Explanations of Behavior

> **Generalization:**

a type of scientific explanation;
 a general conclusion based on many observations of similar phenomena



> **Reductionism:**

the process of analyzing a complex behavior into elementary components, an attempt to find brain, neuronal and molecular mechanisms of behavior

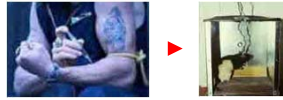
> **Explanatory Reductionism:**

the process of ascertaining knowledge of the components of a system that will ultimately explain properties of the system as a whole



Biological Explanations of Behavior

- > **Simplifying steps:** procedures that simplify experimental analysis without altering the level of analysis



- > **Reductive steps:** shifts in the level of analysis from the behaving organism to its neuronal system, circuit, cellular and molecular components



Biological Explanations of Behavior

Four categories of biological explanations of behavior
(Tinbergen, 1951)

- > **PHYSIOLOGICAL:** Relationship between a behavior and activity of the brain/other organs
- > **ONTOGENETIC:** Development within the individual (genes, nutrition, experience, etc.)
- > **EVOLUTIONARY:** Phylogenetic organization of the capacity for the behavior
- > **FUNCTIONAL:** What purpose is served by a particular behavior

Biological Explanations of Behavior

- > **PHYSIOLOGICAL:** A portion of the songbird's brain grows under the influence of testosterone during mating season. This enlarged brain area enables the mature male songbird to sing.
- > **ONTOGENETIC:** An immature male songbird must hear the appropriate song during a sensitive period early in life, even though he cannot sing until he is at least a year old.
- > **EVOLUTIONARY:** Species that are closely related exhibit similar songs. This suggests that these species evolved from a single common ancestor.
- > **FUNCTIONAL:** In most species, only the male sings, and only during the mating season, and only in his territory. The song functions to attract females and to defend territory, improving the odds of successful mating.



Birdsong

Biological Explanations of Behavior

Continuing Problems

- > **Easy Problem:** identification of which brain activity relates to which experience or behavior.
- > **Hard Problem:** Does consciousness emerge from brain activity, and if so - how does this occur?

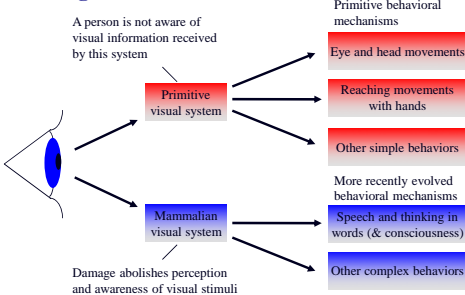
Understanding the Brain and Behavior

Blindsight

- > **2 visual systems:** primitive (found in fish, reptiles, etc.)
complex (both systems found in mammals)
- > After damage to brain on one side, apparent blindness in opposite side visual field, but subject can accurately reach and grasp object without seeing it
- > Illustrates that portions of the brain function in the absence of conscious awareness.
- > The primitive visual system does not have connections with parts of the brain that participate in conscious processing, but does have connections with parts of the brain that participate in control of hand movements

Understanding the Brain and Behavior

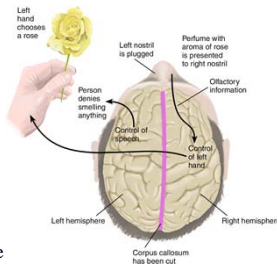
Blindsight



Understanding the Brain and Behavior

Split Brains

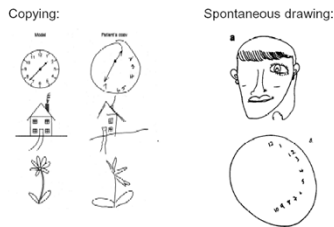
- > Surgical transection of corpus callosum
- > Intractable epileptic seizures
- > An odor presented to the right nostril only is not named because the information does not reach the left hemisphere
- > Yet, the person can use their left hand to reach for the source of the odor



Perspectives on Brain and Behavior

Unilateral Neglect

- > damage to the right parietal cortex
- > reported lack of awareness of left half of objects (including self)
- > not blind or numb
- > tests reveal awareness



Understanding the Brain and Behavior

- > **The Problem of Mind - Brain - Behavior Relations**
- > **Mentalism:** the philosophical position that an immaterial mind is responsible for behavior

Aristotle (384-322 BCE)
"All human intellectual functions are produced by a person's mind, or psyche"



Problem -
How does an immaterial mind influence a material brain?

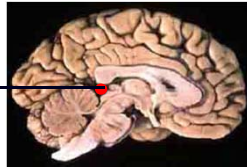
Hippocrates (460-370 BCE) "Men ought to know that from nothing else but the brain come joys, delights, laughter and sports, sorrows, griefs, despondency, and lamentations..."

Understanding the Brain and Behavior

- > **The Problem of Mind - Brain - Behavior Relations**
- > **Dualism:** the belief that the body is physical but the mind is not - the mind and brain are separate but interacting.

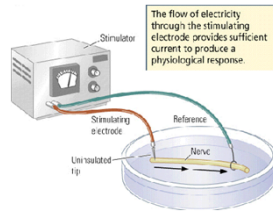
René Descartes (1649) -
"Pineal gland is the seat
of the soul"

pineal
gland



Understanding the Brain and Behavior

- > **The Problem of Mind - Brain - Behavior Relations**
- > **René Descartes** believed that the nerves were tubes that conveyed fluid from the ventricles of the brain to the muscles, causing the muscles to swell and producing behaviour
- > **Galvani** soon showed that stimulation of isolated frog nerves will evoke muscle contraction, proposed that the nerve conducts electricity to the muscle



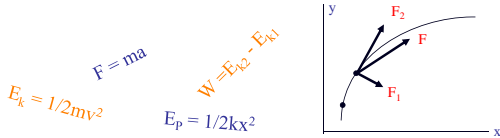
Understanding the Brain and Behavior

- > **The Problem of Mind - Brain - Behavior Relations**
- > **Johannes Muller** – "The Doctrine of Specific Nerve Energies"
 - identified that all nerves convey the same kind of signal, *electrical impulses*
 - however, different perceptions result
 - concluded that the brain is functionally divided, and that specific nerves convey specific types of information (*auditory, visual, etc.*)



Understanding the Brain and Behavior

- > Why reject the idea that an immaterial mind controls a material brain?
- > **Mentalism and Dualism are not scientific perspectives**
- > **Physics - Law of Conservation of Energy:** The only way to accelerate any matter or to transform any energy is to act upon it with other matter or energy.
- > **Need for Heuristic Approaches** - fruitful research strategy



Understanding the Brain and Behavior

- > **The Problem of Mind - Brain - Behavior Relations**
- > **Monism:** the belief that the world consists only of matter and energy and the mind is part of it - the mind is really activity of the brain

William James (1890) - observation that chemicals, injuries, etc. severely alter behaviour



Understanding the Brain and Behavior

Wilder Penfield (1930's - 1960's)
Penfield electrically stimulated brain sites during surgical ablations (interventions to remove epileptic foci).

Occasionally, electrical stimulation evoked visual or auditory hallucinations that were sometimes described as memories - especially when stimulation was administered to temporal lobe sites.

Repeated stimulation at the same site often evoked responses in the same sensory modality, but in different contexts.

Ethical Issues in Research with Animals

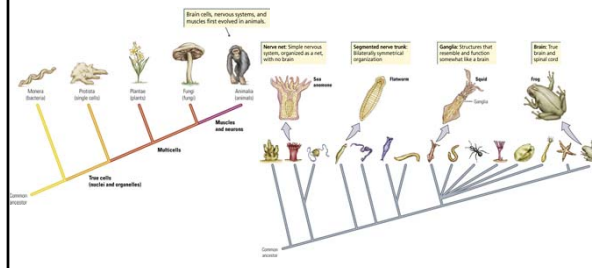
Ethical Issues in Research with Animals

> What is an animal with rights?

Approximately 1 million species in 15 phyla of animal kingdom

Divergent views on what constitutes an animal with rights.

Divergent groups oppose different kinds of animal use.



Ethical Issues in Research with Animals

> How are animals used by humans?

Animals have been traditionally hunted by humans for food and clothing

Modern man uses animals for more purposes than ever before:

pets/companionship, guide dogs, search and rescue, research, vaccines

Modern societies differ in their use of animals.

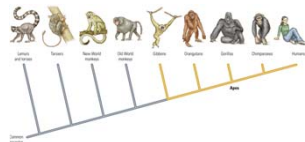
> How are animals used in research?

1. Characterization of normal physiological and psychological processes
pain, stress, maternal care, development...
2. Characterization of abnormal functioning
addiction, schizophrenia, depression, Parkinson's disease, brain/spinal cord injury...
3. Screening drugs for efficacy / toxicity
Parkinson's disease: L-DOPA
Depression: chlorpromazine, imipramine, fluoxetine
Panic: Xanax

Ethical Issues in Research with Animals

> Why do we use animals in research?

1. Studying the physiology and behaviors of animals contributes to health and well-being of humans & animals
 - similar mechanisms of behavior, easier to understand
 - some processes are exaggerated
 - interest in animals for their own sake
2. Study of animals can be a source of insight into evolution
 - natural selection is one of the most important foundations of science
3. Many questions cannot be answered by human experiments
 - animals have shorter reproductive and growth cycles, which are critical for genetic and developmental experiments
 - ethical issues



Ethical Issues in Research with Animals

> Why do we use animals in research?

4. Animal Research has led to the development of conservation programs.



Ethical Issues in Research with Animals

> What are the arguments against using animals in research?

"Scientific" Arguments

1. Some claim that animals are too different from humans to yield useful biological information about human function and disease.
 - thalidomide
2. Some claim that animal research has not cured all disease and is therefore ineffective.
 - "If [animal experimentation] were such a valuable way to gain knowledge, we should have eternal life by now." (Ingrid Newkirk, 1985)
 - Millions of mice (referred to as "preclinical models") have suffered and lost their lives to futile cancer research (PETA Media Center, www.peta.org)



Ethical Issues in Research with Animals

> What are the arguments against using animals in research?

Philosophical Arguments

1. Animals are capable of feeling pain and pleasure, and their experience cannot be discounted (Singer, 1990).
 - "Needless" pain and suffering are difficult to measure and to define.
 - Most research animals (94%) experience only brief/minimal pain/discomfort, or are given drugs to relieve any pain caused by a procedure (U.S. Dept. of Agriculture, Animal Welfare Enforcement Report, 1988).
 - In the remaining 6%, suffering must be justified by the magnitude of the problem addressed (USDA Animal Welfare Enforcement Report, 1988).
 - 85 million Americans suffer from chronic pain caused by arthritis, back disorders, injuries, cancer, headaches, or other conditions (Dubner, 1984).
 - On average, humans experience 10 years of pain in a lifetime (Regan, 1996)

Ethical Issues in Research with Animals

> What are the arguments against using animals in research?

Philosophical Arguments

2. Since animals have life, their value is equal to that of humans and they should not be used for any purposes by humans (Regan, 1996).
 - universal vegetarianism, animals cannot be killed under any circumstances
 - sewer rats in New York, pests consuming crops, infestation of human homes, plagues



Ethical Issues in Research with Animals

Animal Rights Activists

1. Abolitionists - Demand cessation of animal captivity, slaughter of animals for food etc., use of animals for work, and all animal research - as a moral imperative.

2. Minimalists - Desire reduction in animal research and controls on type of research, distress to animals, and species used.

Refinement – alternative techniques or procedures to minimize potential pain, distress, or discomfort to those animals which must be used.

Reduction – alternatives or methods which allow you to minimize the number of animals used to obtain significant results.

Replacement – alternatives to the use of live animals for this research.

Ethical Issues in Research with Animals

Conclusions

- > Human use of animals will continue for the foreseeable future.
- > Ongoing efforts/dialogue will continue to assure humane treatment.
- > "Middle ground" can be found by reasonable people in this debate.



UCLA pro-test protest.

Reading Assignment

Before next class

Chapter 2: Functional Neuroanatomy: The Nervous System and Behavior
Breedlove, Rosenzweig, & Watson

Optional Reading

- > Animal Experimentation: The Moral Issues
Robert M. Baird and Stuart E. Rosenbaum (1991)
