

Psychology 105 Chapter 2

Biopsychology - Part 1 Internal communications

Spring 2008

Biopsychology - Outline

In Biopsychology we will look at:

Part 1: Internal communications in the body

- The Nervous System - fast via neurons
- The Endocrine System - slower via bloodstream

Part 2: The Brain, Mental Processes and Behavior

Part 3: Genetics and Behavior - Nature and Nurture

Psych 105 - Chapter 2: Biopsychology

2

What is Biopsychology?

Specialty in psychology that studies the interactions of biology, behavior, mental states and environment

➤ Sometimes also called

- Biological psychology
- Physiological psychology

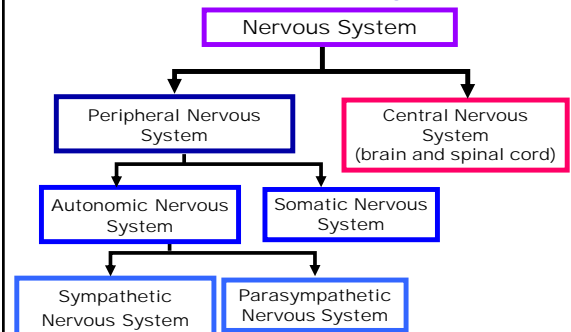
➤ Major related discipline: neuroscience

- Focuses on brain and its role in psychological processes

Psych 105 - Chapter 2: Biopsychology

3

Organization of the Nervous System ("fast" chemical messengers)



Psych 105 - Chapter 2: Biopsychology

4

The Neuron: Building Block of the Nervous System

➤ Types of Neurons

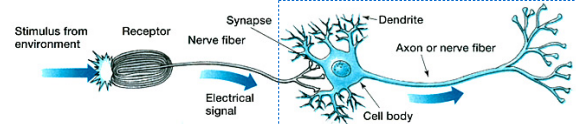
- **Sensory neurons** (carry messages from sense receptors towards the CNS)
- **Motor neurons** (carry messages from CNS toward muscles and glands)
- **Interneurons** (carry messages between nerve cells in brain and spinal cord)



Psych 105 - Chapter 2: Biopsychology

5

Basic Components of the Neuron



Receptor: specialized neuron that responds to a specific type of stimulus (here, a Pacinian corpuscle, responds to pressure)

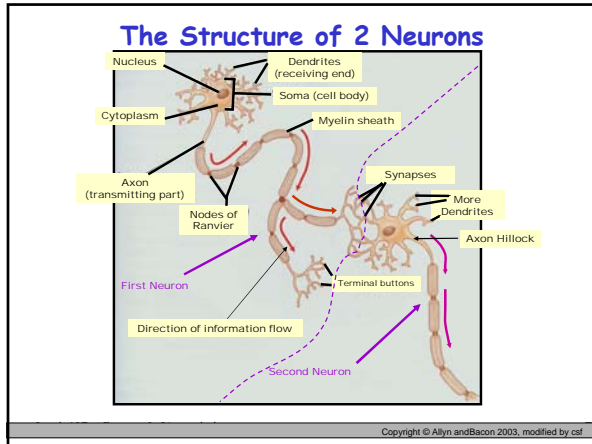
Neuron on right: one type of neuron in central nervous system

Synapse: point of communication between 2 neurons

(from Goldstein, E. B. (2005). *Cognitive Psychology*. Belmont, CA: Thomson Wadsworth, p. 29)

Psych 105 - Chapter 2: Biopsychology

6

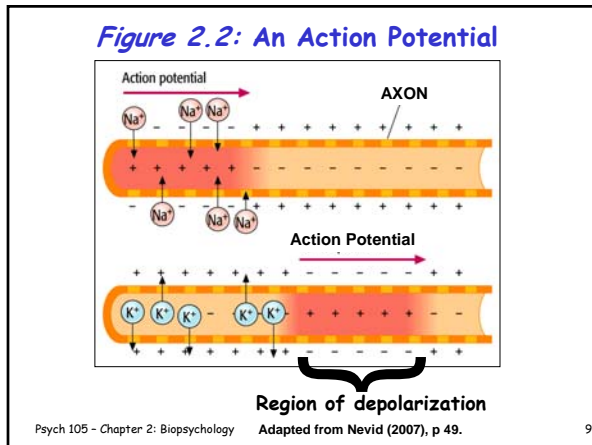


Neural Transmission: The Action Potential

- **Action Potential** - Brief electric surge that signals that a neuron has been activated and which originates in cell body and carries the neuron's message down the axon, to terminal buttons. AKA neural impulse, spike, the neuron "fires".
- **All or nothing** - When neuron *fires* (generates action potential), impulse is transmitted at full strength or not at all: nothing in-between
- **Strength of response** is coded by **frequency of action potentials** (aka firing rate, spikes per second)
 - Low firing rate - weak response
 - High firing rate - strong response
 - And, more neurons respond to a strong stimulus than to a weak one

Psych 105 - Chapter 2: Biopsychology

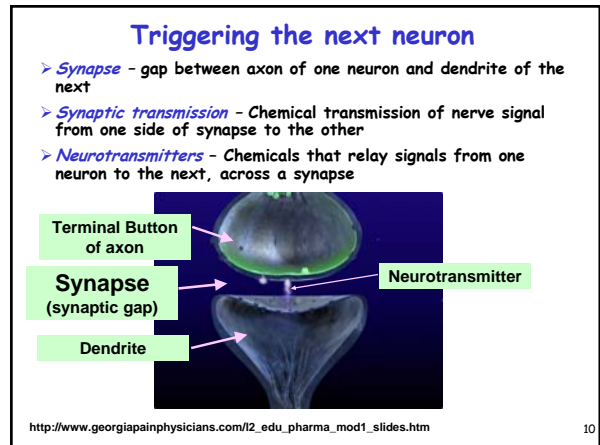
8



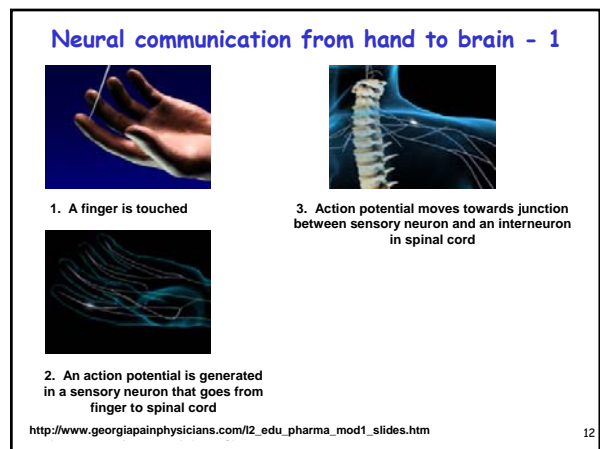
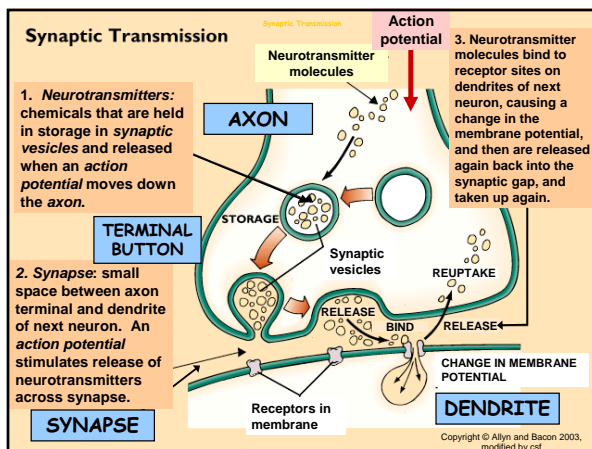
Psych 105 - Chapter 2: Biopsychology

Adapted from Nevid (2007), p 49.

9

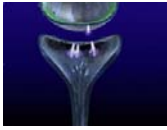


10



12

Neural communication from hand to brain - 2



4. Neurotransmitter moves across synapse between sensory neuron and interneuron, and is taken up by dendrite of interneuron in spinal cord



5. Neural impulse moves up spinal cord and arrives in brain

Neurotransmitters

- More than 200 different types of neurotransmitters have been identified in the human body
- Each neuron
 - **produces** only one or two types of neurotransmitter
 - **can respond to** one or more different types of neurotransmitter
- Most neurotransmitters have either an **excitatory** or **inhibitory** effect on the **post-synaptic** neuron (some can have both effects)
 - **Excitatory** - increases activity in post-synaptic neuron
 - **Inhibitory** - decreases activity in post-synaptic neuron
- Activity in post-synaptic neuron is **sum** of excitatory and inhibitory effects - **DEMO**

Neurotransmitters - 2

- How is the continued stimulation of postsynaptic neurons prevented?
 - Reuptake of released neurotransmitters
 - Enzymes in synapse break down neurotransmitters
 - Release of neuromodulators modify sensitivity of receiving neuron
- **Agonists**: drugs that enhance action of neurotransmitters or mimic their action
- **Antagonists**: drugs that block action of neurotransmitters

Some Major Neurotransmitters

Name	Function	Malfunctions: neuron releases +: too much -: not enough
Acetylcholine	Control of movement, learning and memory, autonomic nervous system	+ Muscle spasms - Alzheimer's disease
Dopamine	Control of movement, learning, reward, planning, attention, addictive behavior	+ schizophrenia - Parkinson's disease
Serotonin	Sleep, appetite, mood, hunger, arousal	+ Hallucinations, serotonin syndrome - Depression, anxiety, obsessive-compulsive disorder
GABA	Mood, seizure threshold; major inhibitory neurotransmitter	+ Deep relaxation, loss of consciousness - Seizures, tremors, insomnia, anxiety

Some Major Neurotransmitters - 2

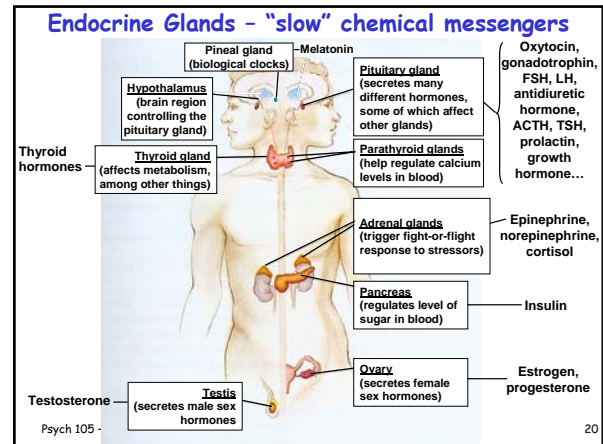
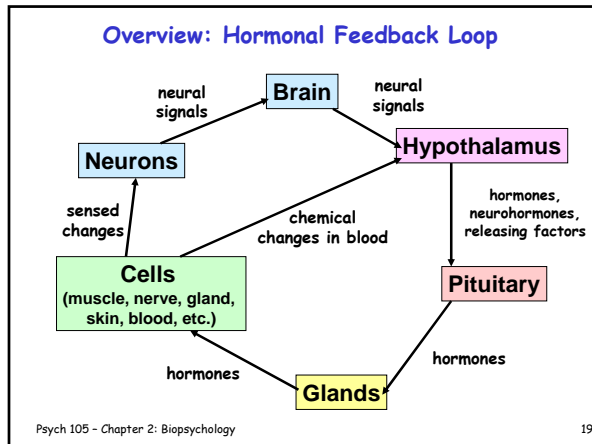
Name	Function	Malfunctions +: too much -: not enough
Norepinephrine	Arousal, vigilance, mood, heart rate, appetite	+ euphoria, low blood pressure - depression
Glutamate	Learning, memory; Major excitatory neurotransmitter	+ Migraines, seizures (MSG) - Chronic Fatigue Syndrome, Fibromyalgia?
Endorphins	Pleasurable sensations, control of pain	+ drowsiness, suppression of breathing - pain, low pleasure; nausea, dizziness, chills, tremors, cramps, diarrhea, agitation (opiate withdrawal syndrome)

The Endocrine System - "slow" chemical messengers"

Endocrine Glands - produce **hormones**, which are chemical messengers that travel through bloodstream and influence activity in a variety of body tissues (muscles, glands, nerves, skin...)

Pituitary gland:

- Once called the *master gland*, but
- **controlled** by *hypothalamus (part of brain)*
- **secretes** several different hormones that influence the secretions of other endocrine glands



- ### Hormones and Behavior
- **Testosterone**
 - Aggression
 - Sexual arousal
 - **Thyroid hormones and metabolism**
 - Excess: Anxiety and irritability
 - Deficit: Fatigue, sluggishness
 - **Estrogen/progesterone levels (or changes):**
 - Premenstrual syndrome (PMS)
 - Post-partum depression and progesterone?
- Psych 105 - Chapter 2: Biopsychology 21