

 **Rapid Learning Center**  
Chemistry :: Biology :: Physics :: Math 

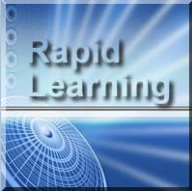
Rapid Learning Center Presenting ...

**Teach Yourself**  
**Neuroscience** in 24 Hours




1/44

Disclaimer: All contents in this tutorial are for informational purposes only and not intended to be a substitute for professional medical advice, diagnosis, or treatment. Reliance on any information provided by this tutorial is solely at your own risk. 

 **Neuroscience:  
Historical Development  
of Current Concepts**

**Rapid Learning Tutorial Series**  
Wayne Huang, PhD  
Joan Forder, PhD

**Rapid Learning Center**  
[www.RapidLearningCenter.com/](http://www.RapidLearningCenter.com/)  
© Rapid Learning Inc. All rights reserved. 



## Learning Objectives

By completing this Tutorial, you will:

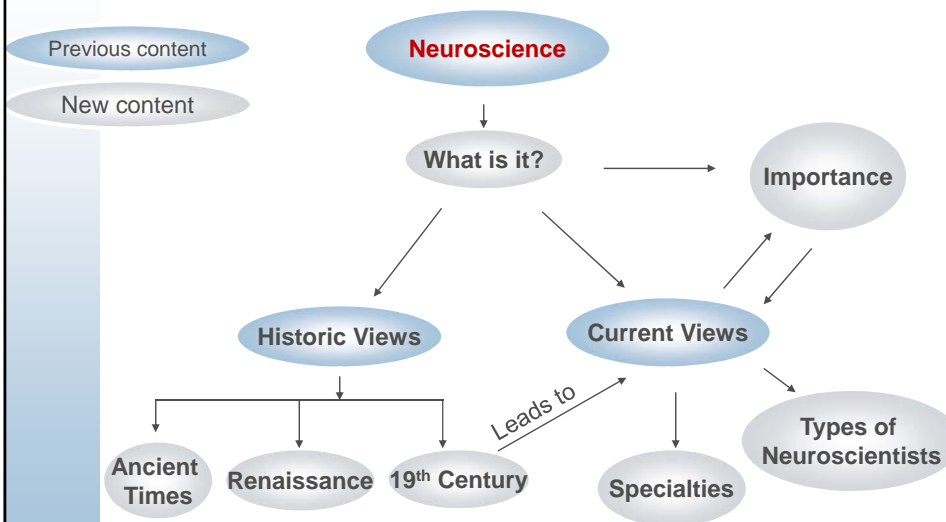


- Understand the scope of neuroscience and where it fits into science
- Appreciate the history of neuroscience and be able to name key events.
- Understand and describe the current premise of neuroscience.
- Describe the various fields of neuroscientific study
- Describe the main types of clinical study in neuroscience

3/44




## Concept Map




4/44







## The Scope of the Course




1. Unit by Unit Organization
2. Tutorial by Tutorial on Each Unit

5/44 



## The Neuroscience Course

<b>Core Unit #1</b>	⇒	Introduction to Neuroscience
<b>Core Unit #2</b>	⇒	Neural Communication
<b>Core Unit #3</b>	⇒	Sensory & Motor Systems
<b>Core Unit #4</b>	⇒	Psychobiology
<b>Core Unit #5</b>	⇒	Advanced Topics

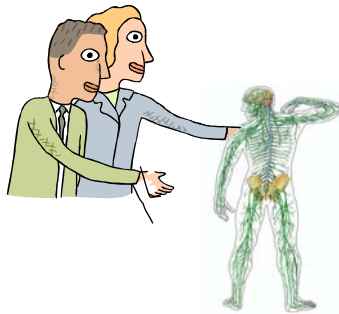
6/44 



## Core Unit #1: Introduction to Neuroscience

**This unit will include the following 4 tutorials:**

- Tutorial 01: Neuroscience: Historical Development of Current Concepts
- Tutorial 02: Structure of the Nervous System
- Tutorial 03: Development of the Nervous System
- Tutorial 04: Cells of the Nervous System



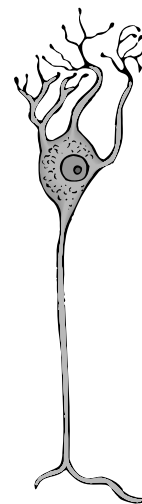
7/44



## Core Unit #2: Neural Communication

**This unit will explore the following 4 tutorials:**

- Tutorial 05: The Resting Neuronal Membrane
- Tutorial 06: The Action Potential
- Tutorial 07: Information Transfer at the Synapse
- Tutorial 08: Neurotransmitter Systems



8/44





## Core Unit #3: Sensory & Motor Systems

**This unit will include the following 5 tutorials:**

- Tutorial 09: Touch, Temperature & Pain: The Somatic Sensory System
- Tutorial 10: Control of Movement
- Tutorial 11: Taste and Smell: The Chemical Senses
- Tutorial 12: Hearing and Equilibrium
- Tutorial 13: The Eye and Visual Processing



9/44



## Core Unit #4: Psychobiology

**This unit will include the following 7 tutorials:**

- Tutorial 14: Control of the Brain & Behavior through Chemicals
- Tutorial 15: Learning and Motivation
- Tutorial 16: Determinants of Sexual Behavior & Gender
- Tutorial 17: Neuronal Determinants of Emotion
- Tutorial 18: Sleep Rhythms within the Brain
- Tutorial 19: Language and the Brain
- Tutorial 20: Finding Focus: Attention Determinants

10/44





## Core Unit #5: Advanced Topics

**This unit will include the following 5 tutorials:**

- Tutorial 21: Memory Systems in the Brain
- Tutorial 22: Learning & Memory Mechanism
- Tutorial 23: Diseases of the Nervous System
- Tutorial 24: Stress and the Brain



11/44



## What is Neuroscience?



1. Definition
2. Relation to Other Sciences

12/44

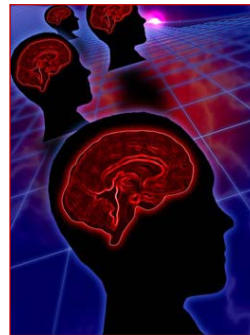




## Definition: Neuroscience

**Neuroscience:** The study of the brain and nervous system, from many different perspectives including:

- ✓ molecular
- ✓ cellular
- ✓ behavioral
- ✓ cognitive
- ✓ pathologies

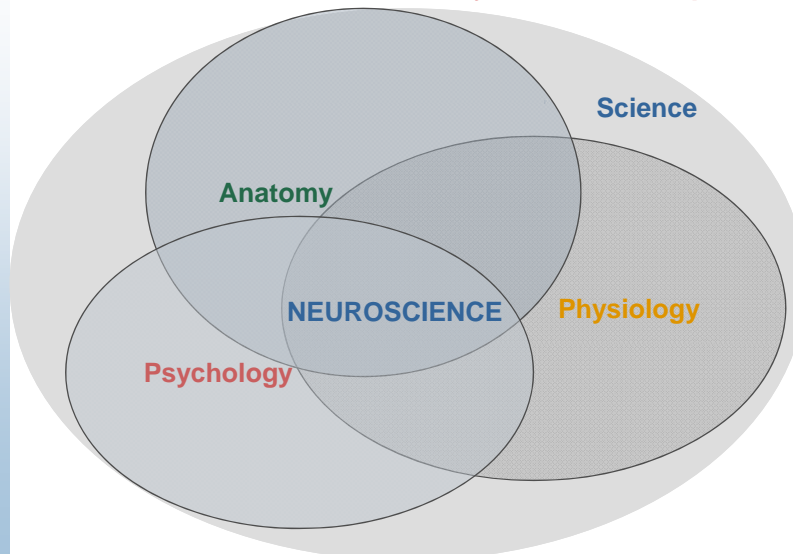


13/44





## Where Neuroscience Fits

**Neuroscience combines many different disciplines**





14/44



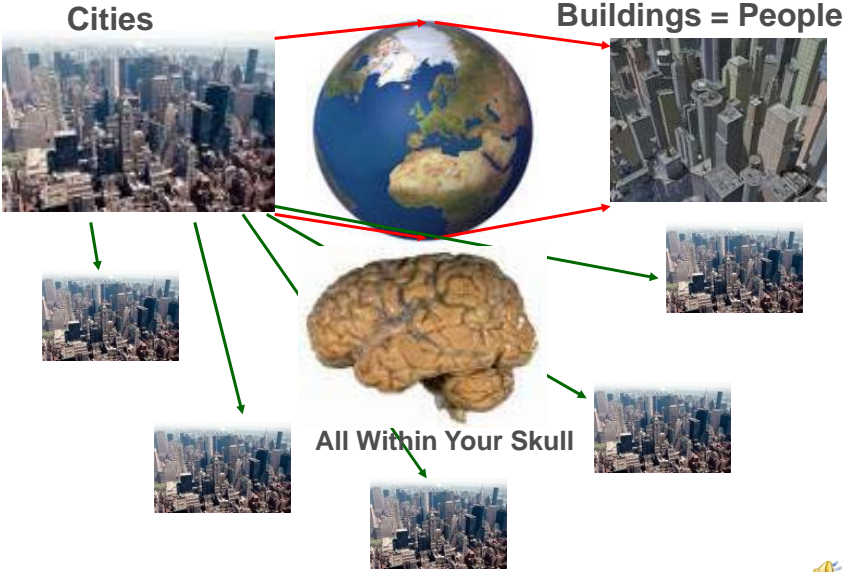
 **The Importance of Neuroscience** 

1. How can I visualize Neuroscience?
2. What are the “Burning Questions” in Neuroscience?
3. What is the Basic Premise?
4. What Happens When Things Go Wrong?


15/44 

 **Visualizing the Human Brain**

Cities Buildings = People



All Within Your Skull

16/44 

## Visualizing Brain Cells

**Neurons**

**Within YOUR brain!**

**Sending Signals**

**Organized**

**Receiving input**

17/44

## Visualizing Technology

**Seeing Living Cells**

**2D Imaging of Function**

**3D Imaging of Function**

**Inside a Neuron**

**The Electric Brain**

18/44



## Burning Questions in Neuroscience



How does the body direct its movement and functions  
How does the body take in the five senses?

How do Feelings Influence Brain Cells?

How do Brain Cells Influence Feelings?

How or Why do we sleep?

How do we think?



Where is the 'mind' generated?

Where does consciousness come from?

How do we know that we know what we know?

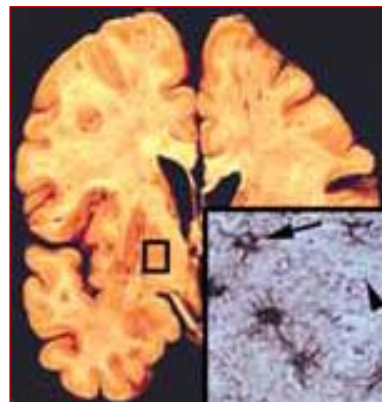
19/44



## Neuropathologies

When things go wrong with the nervous system:

- Alzheimer's disease
- Cerebral palsy
- Depression
- Epilepsy
- Multiple sclerosis
- Schizophrenia
- Spinal paralysis
- Stroke (Cerebrovascular Accident; CVA)



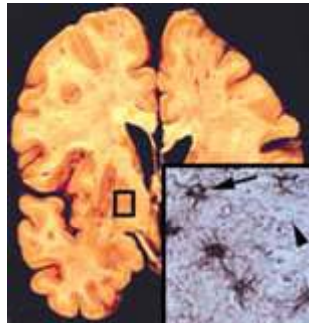
20/44





## Question: Neuropathologies

List any four pathologies studied in neuroscience:



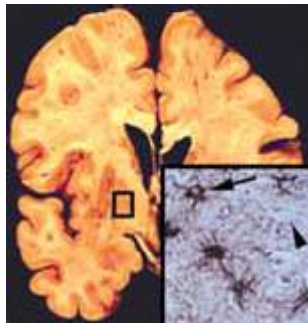
- ▶ \_\_\_\_\_
- ▶ \_\_\_\_\_
- ▶ \_\_\_\_\_
- ▶ \_\_\_\_\_

21/44



## Question: Neuropathologies

List any four pathologies studied in neuroscience



- ▶ Depression
- ▶ Alzheimer's disease
- ▶ Epilepsy
- ▶ Multiple sclerosis

22/44






## History of Neuroscience



1. The Origins of Neuroscience.
2. In Ancient Greece.
3. During the Roman Empire.
4. From the Renaissance to the Nineteenth Century.
5. The Nineteenth Century View.
6. Nerves as Wires.
7. Localizations of Functions.
8. Evolution of Nervous Systems.

23/44 🔊

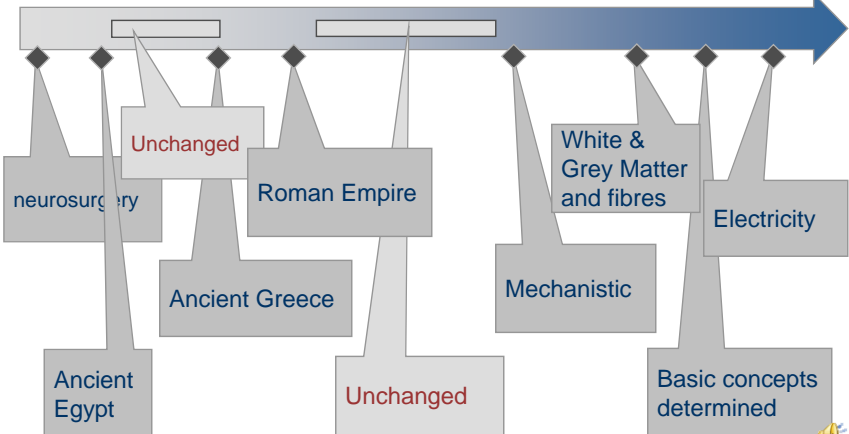


## The History of Neuroscience

**Uncovering the Nervous System and how it works**

B.C. | A.D.

| 7000 | 5000 | 1000 | 300 | 300 | 1000 | 1200 | 1400 | 1500 | 1600 | 1700 | 1800 | Now |



24/44 🔊



## The Origins of Neuroscience

### Prehistoric evidence of brain surgery

- 7000 years ago
  - Trepanation (drilling holes)
  - To cure
- 5000 years ago
  - Ancient Egypt
    - Physicians were aware of brain damage symptoms
    - Thought the heart was the seat of consciousness and memories
- This view wasn't challenged until the time of Hippocrates



25/44



## Ancient Greece (4<sup>th</sup> century B.C.)

### Obvious...and not so obvious conclusions

- Agreed: The Brain is the Organ of Sensation
  - Easily determined
  - Correlation between structure and function
- Disagreed: The Brain as the Seat of the Intellect
  - Hippocrates (460-379 B.C.)
    - Strongly agreed
  - Aristotle (384-322 B.C.)
    - Still thought the Heart fulfilled this function



26/44



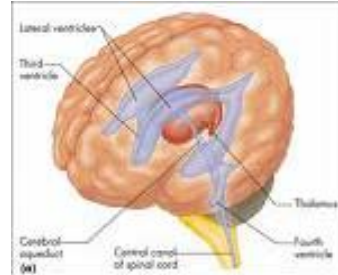


## The Roman Empire

### Support for Hippocrates

Galen (130-200 A.D.)

- Physician to gladiators
- Conducted animal dissections
- What he got right:
  - Cerebrum for sensations
  - Cerebellum for control of muscles
- What he got wrong:
  - Fluid-mechanical theory of brain function: fluid in ventricles controlled sensations and muscles



27/44



## Renaissance to 18<sup>th</sup> Century

### Early support for Fluid-Mechanical Theory

- Rene Decartes (1596-1650)
  - Explained animal behavior
  - Humans possessed intellect and God-given soul
- 17<sup>th</sup> & 18<sup>th</sup> Century
  - Moved away from Galen
    - Observed grey and white matter in the brain
    - White matter contained fibers that brought information to and from the grey matter



28/44





## By the End of the 18<sup>th</sup> Century

- Injury to the brain can cause disruption in:
  - Sensations
  - Movement
- Injury can cause death
- The nerves allow the brain to communicate with the body
- The brain has distinct parts which probably carry out different functions
- The brain operates like a machine and follows the laws of nature



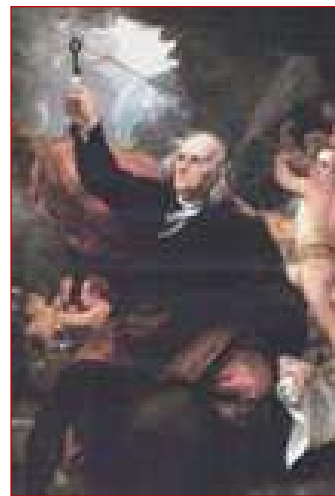
29/44



## 19<sup>th</sup> Century: Nerves as Wires

### Scientific “discoveries” influence neuroscience

- 1751: Benjamin Franklin, “Experiments and Observations on Electricity”
- ~1800: electricity and muscles
  - Experiments by Italian and German scientists:
    - Muscles twitch when electrically stimulated
    - The brain generates electricity
- New concept emerged “nerves as wires”



30/44





## Further Refinement of Signaling Direction

**Do the SAME wires that signal muscle movement also register sensation from the skin (bidirectional signals in the same wires)?**

- Evidence in agreement:
  - When a nerve in the body is cut, there is usually a loss of both sensation and movement
- Evidence against the idea:
  - Within each nerve are many fibers
  - Each fiber may be a wire to carry information in only one direction (like electricity)
- Answered in 1810: nerves divide into two branches before entering the spinal cord
  - Cutting Dorsal branch (root) results in loss of sensation
  - Cutting Ventral branch (root) results in loss of movement

31/44



## 19<sup>th</sup> Century: Localization of Functions

- **1809: Franz Joseph Gall**
  - Phrenology (behavior relates to the size of the bumps on the head)
- **1823: Marie-Jean-Pierre Flourens**
  - Experimental ablation methods
- **1861: Paul Broca**
  - Found a lesion in the frontal lobe of a patient who could understand language but was unable to speak
- **1870-80: experiments applying electric currents to different regions and elicited specific reactions**



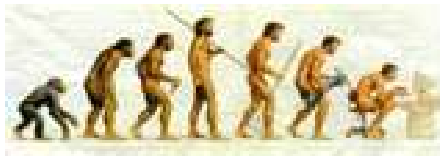
32/44



## 19<sup>th</sup> Century: Evolution of the Nervous System

### Charles Darwin: 1859: On The Origins of Species

- Inclusion of behavior
  - Heritable trait
  - Evolves
- Behavior reflects activity of the nervous system
  - Common between species
    - Lead to use of animal models
- Doesn't include species specific behaviors

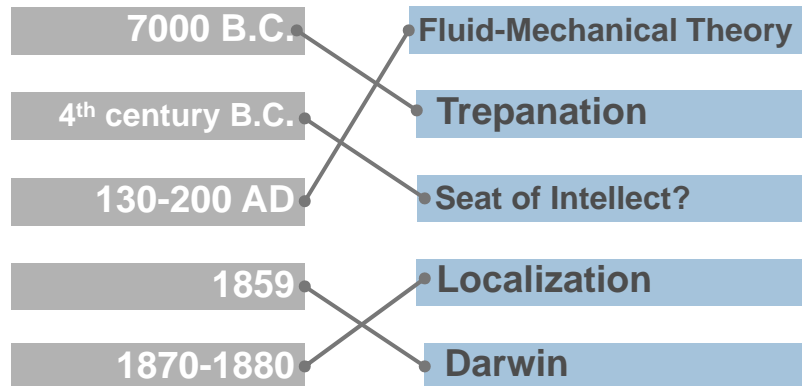


33/44




## History: Stop and Think

Match the left list item with its right list item.




34/44







## Current Views in Neuroscience



1. The Cell Theory
2. An Integrative Science.
3. Types of Experimental Neuroscientists.
4. Medical Specialists.


35/44 




## The Cell Theory

**Established the Neuron as the Basic Functional Unit**

- Advances in technology
  - Microscope allowed scientists to see the cells in the brain
  - 1839 Theodor Schwann
- Cell Theory
  - All tissues are composed of cells
    - “nerve cells” in the brain
- Question: are cells ‘fused’ together (like blood vessels) or **do they pass a signal between them?**



36/44 



## An Integrative Science

In this fast-paced, exciting field of study, the greatest advances in neuroscience are achieved when scientists realize the best hope for understanding the workings of the brain come from an **interdisciplinary** approach.

Neuroscience research can be divided into two types:

**experimental** (foundation; PhD's) and

**clinical** (medical; MD's).

37/44



## Types of Experimental Neuroscientists

Type	Description
Molecular Neurobiologist	Uses genetic material of neurons to understand function and structure of brain molecules
Developmental Neurobiologist	Analyzes the development and maturation of the brain
Neuroanatomist	Studies structure of the nervous system
Neurochemist	Studies chemistry of the nervous system
Neuroethologist	Neural basis of species-specific behavior
Neuropharmacologist	Effects of drugs on the nervous system
Neurophysiologist	Measures electrical activity of the nervous system
Psychobiologist	Studies the biological basis of behavior
Psychophysicist	Quantitatively measures perceptual abilities

38/44



**➤ Medical Specialists**

Associated with the Nervous System


Specialist	Description
Neurologist	MD trained to diagnose and treat diseases of the nervous system
Psychiatrist	MD trained to diagnose and treat disorders of mood and personality
Neurosurgeon	MD trained to perform surgery on the brain and spinal cord
Neuropathologist	MD or PhD trained to recognize changes in neural tissue resulting from disease

39/44

**? Current View: Stop and Think**

This type of neuroscientist uses genetic material of neurons to understand function and structure of brain molecules


**Pick the one correct specialty:**



- Neurophysiologist
- Developmental Neurobiologist
- Neuroanatomist
- Psychophysicist
- Molecular Neurobiologist

40/44

## ➤ How To Study Neuroscience



**Take Breaks Often**  
Research has shown that people learn best in short bursts.

**Concepts First**  
Understand key concepts first before trying to memorize details.

**Talk out loud**  
Saying the information out loud helps to lock it into your memory.

**Connect Concepts**  
Use Mind Mapping to connect the concepts together.

**Quiz Yourself**  
Use the Problem Set provided with each tutorial to test yourself.

**Review Often**  
Review before going on. Use the Cheat Sheet!

**Stop and Think**  
Make use of the question(s) at the end of each topic. "What did I just learn?"

41/44

## 📌 Learning Summary

**Current View**

- ✓ Cell theory
- ✓ The electric brain
- ✓ interdisciplinary

**What is Neuroscience?**

- ✓ The study of the brain and nervous system

**The Importance of Neuroscience**

- ✓ Understanding behavior and disease

**History of Neuroscience**

- ✓ From ancient times to 19<sup>th</sup> century


42/44



**Congratulations**

You have successfully completed  
the core tutorial

**Neuroscience: Historical  
Development of Current  
Concepts**

**Rapid Learning Center**



 **Rapid Learning Center** 

Chemistry :: Biology :: Physics :: Math

**What's Next ...**

Step 1: Concepts – Core Tutorial (Just Completed)  
→ Step 2: Practice – Interactive Problem Drill  
Step 3: Recap – Super Review Cheat Sheet

**Go for it!**

44/44 <http://www.RapidLearningCenter.com> 