

M U N I

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**1**

**Introduction to neuroscience**  
**The regulatory role of nervous system**

# Contact

Kamil Ďuriš

Department of Pathological Physiology (A18)

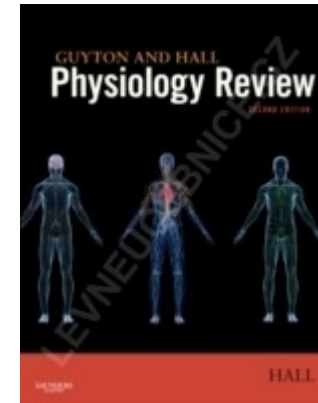
[kduris@med.muni.cz](mailto:kduris@med.muni.cz)

# The objectives

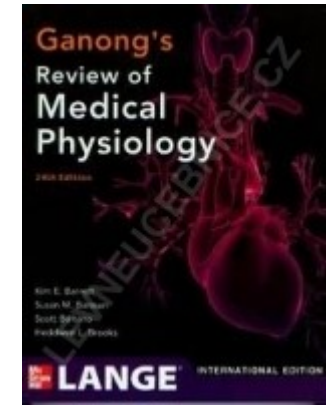
**Basic** understanding of the role and function of  
nervous system

# Literature

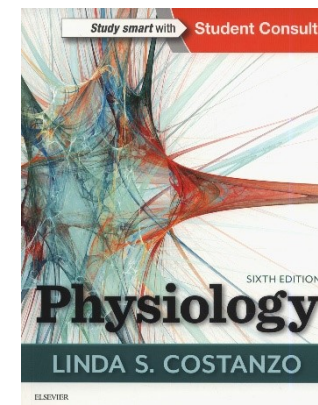
- Ganong's Review of Medical Physiology
- Guyton - Physiology Review
- Boron - Medical Physiology
- Costanzo - Physiology



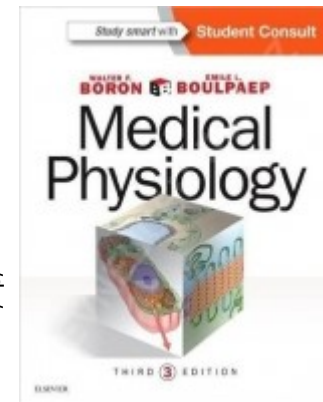
<https://www.levneucebnice.cz/p/guyton-and-hall-physiology-review/>



<https://www.levneucebnice.cz/p/ganong-s-review-of-medical-physiology-9781259009624/>



<https://www.amazon.co.uk/Physiology-6e-Linda-Costanzo-PhD/dp/0307347651>



<https://www.levneucebnice.cz/p/medical-physiology-3rd-ed/>

# The other sources

– Neuroscience Online

– <http://neuroscience.uth.tmc.edu/toc.htm>



The screenshot shows the homepage of Neuroscience Online. At the top left is a logo featuring a neuron and the text "Neuroscience Online" in a stylized font. To the right of the logo is the text "an electronic textbook for the neurosciences" and "an Open-Access educational resource provided by the Department of Neurobiology and Anatomy at The University of Texas Medical School at Houston". In the top right corner is the "UTHealth Medical School" logo, with "The University of Texas Health Science Center at Houston" written below it. A navigation bar below the header contains links for "Home", "Site Preface", "Cellular and Molecular Neurobiology", "Sensory Systems", "Motor Systems", "Homeostasis and Higher Brain Functions", and "Contact Us". Below the navigation bar is a search box with the text "Google™ Custom Search" and a "Search" button. To the right of the search box are two buttons: a red button labeled "Give to Neuroscience Online" and a grey button labeled "USER SURVEY". The main content area features a paragraph: "Visit *Neuroanatomy Online*, our new open-access electronic laboratory designed to compliment *Neuroscience Online*." Below this is a section header "Section 1: Cellular and Molecular Neurobiology" followed by a list of 11 chapters with their authors and degrees.

**Neuroscience Online**  
an electronic textbook for the neurosciences  
an Open-Access educational resource provided by the Department of Neurobiology and Anatomy at The University of Texas Medical School at Houston

UTHealth Medical School  
The University of Texas Health Science Center at Houston

Home | Site Preface | Cellular and Molecular Neurobiology | Sensory Systems | Motor Systems | Homeostasis and Higher Brain Functions | Contact Us

Google™ Custom Search Search

Give to Neuroscience Online USER SURVEY

Visit *Neuroanatomy Online*, our new open-access electronic laboratory designed to compliment *Neuroscience Online*.

**Section 1: Cellular and Molecular Neurobiology**

- Introduction to Neurons and Neural Networks, John H. Byrne, Ph.D.
- Chapter 1: Resting Potentials & Action Potentials, John H. Byrne, Ph.D.
- Chapter 2: Ionic Mechanisms of Action Potentials, John H. Byrne, Ph.D.
- Chapter 3: Propagation of Action Potentials, John H. Byrne, Ph.D.
- Chapter 4: Synaptic Transmission at the Skeletal Neuromuscular Junction, John H. Byrne, Ph.D.
- Chapter 5: Mechanisms of Neurotransmitter Release, John H. Byrne, Ph.D.
- Chapter 6: Synaptic Transmission in the Central Nervous System, John H. Byrne, Ph.D.
- Chapter 7: Synaptic Plasticity, John H. Byrne, Ph.D.
- Chapter 8: Organization of Cell Types, Jack C. Waymire, Ph.D.
- Chapter 9: Synapse Formation/Survival/Elimination, Andrew J. Bean, Ph.D.
- Chapter 10: Transport and the Molecular Mechanism of Secretion, Jack C. Waymire, Ph.D.
- Chapter 11: Acetylcholine Neurotransmission, Jack C. Waymire, Ph.D.

# The other sources

– CNS online

– <http://www.cnsonline.cz/>



ÚVOD DO CENTRÁLNÍ  
NERVOVÉ SOUSTAVY

Online kurz

1. ZÁKLADY
2. NERVOVÁ TKÁŇ
3. DRÁHY A STRUKTURY CNS
4. KOMORY, CÉVY A PLENY
5. ZÁKLADY PERIFERNÍHO NERVOVÉHO SYSTÉMU
6. SMYSLY
7. MOTORIKA
8. INTEGRACE I – EMOCE A

## ÚVOD DO CENTRÁLNÍ NERVOVÉ SOUSTAVY



# The other sources

- MIT - Brain Structure and Its Origins
- <http://ocw.mit.edu/courses/brain-and-cognitive-sciences/9-14-brain-structure-and-its-origins-spring-2014/#>

Home » Courses » Brain and Cognitive Sciences » Brain Structure and Its Origins

## Brain Structure and Its Origins

**COURSE HOME** <

SYLLABUS

THIS COURSE AT MIT

▣ READINGS AND STUDY QUESTIONS

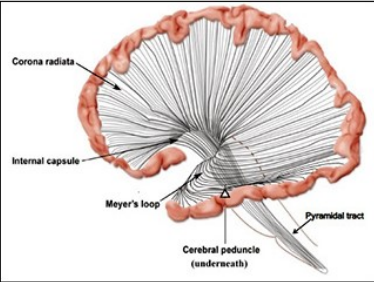
LECTURE NOTES

AUDIO LECTURES

ASSIGNMENTS

EXAMS

STUDY MATERIALS



**Instructor(s)**  
Prof. Gerald E. Schneider

**MIT Course Number**  
9.14

**As Taught In**  
Spring 2014

**Level**  
Undergraduate

[CITE THIS COURSE](#)

Drawing of the left hemisphere of the human brain together with the brainstem, dissected to reveal the course of axons that descend to the brainstem and spinal cord. (Courtesy of MIT Press. Used with permission. Figure 22.8 from Schneider, G. E. [Brain Structure and Its Origins. In the Development and in Evolution of Behavior and the Mind](#). MIT Press, 2014.)

**Course Features**

- > [Audio lectures](#)
- > [Subtitles/transcript](#)
- > [Lecture notes](#)
- > [Assignments \(no solutions\)](#)
- > [Exams and solutions](#)
- > [Instructor insights](#)
- > [This Course at MIT](#)



# Why and how to **STUDY** neuroscience

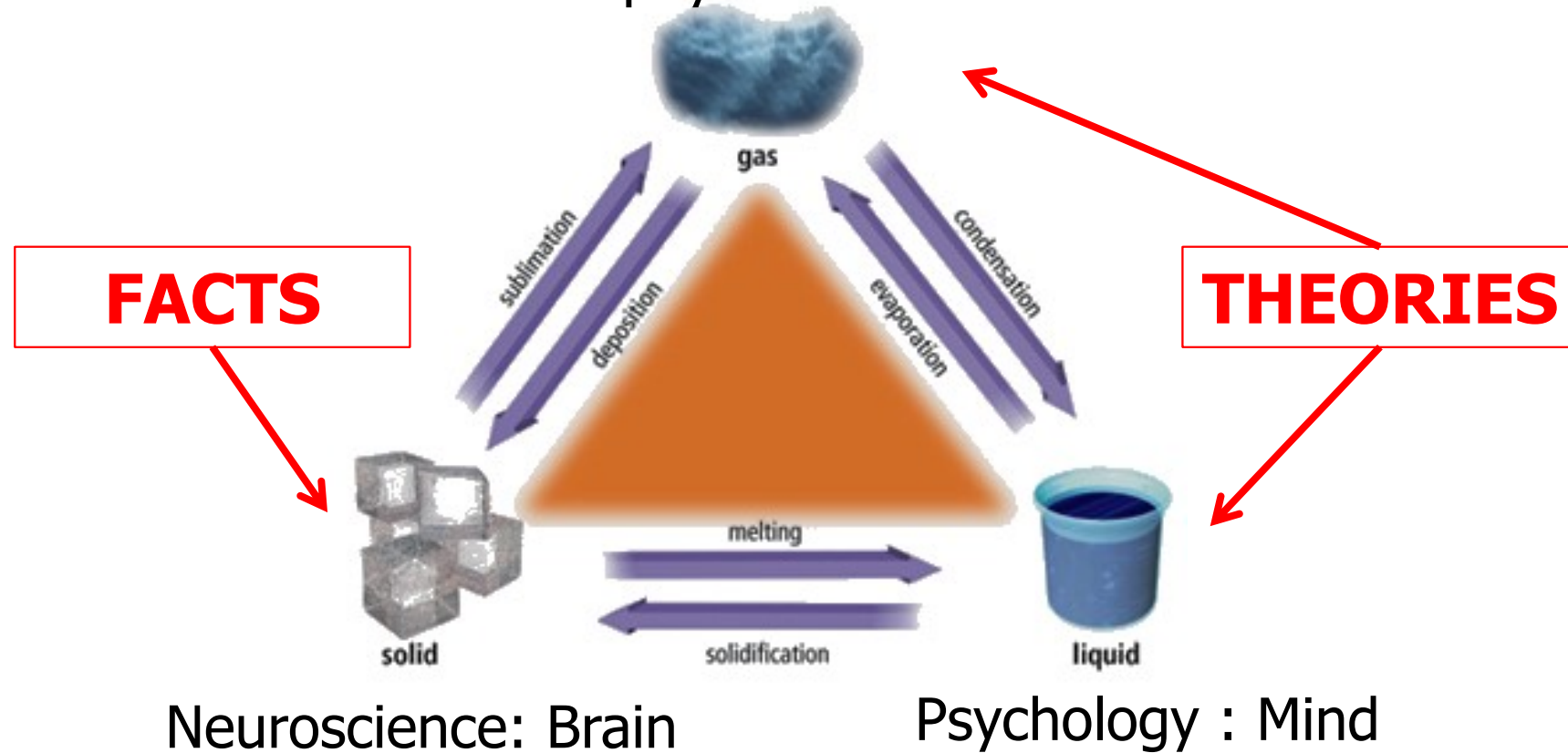
**FACTS**



Neuroscience: Brain

# Why and how to **STUDY** neuroscience

Philosophy : Mind behind Mind

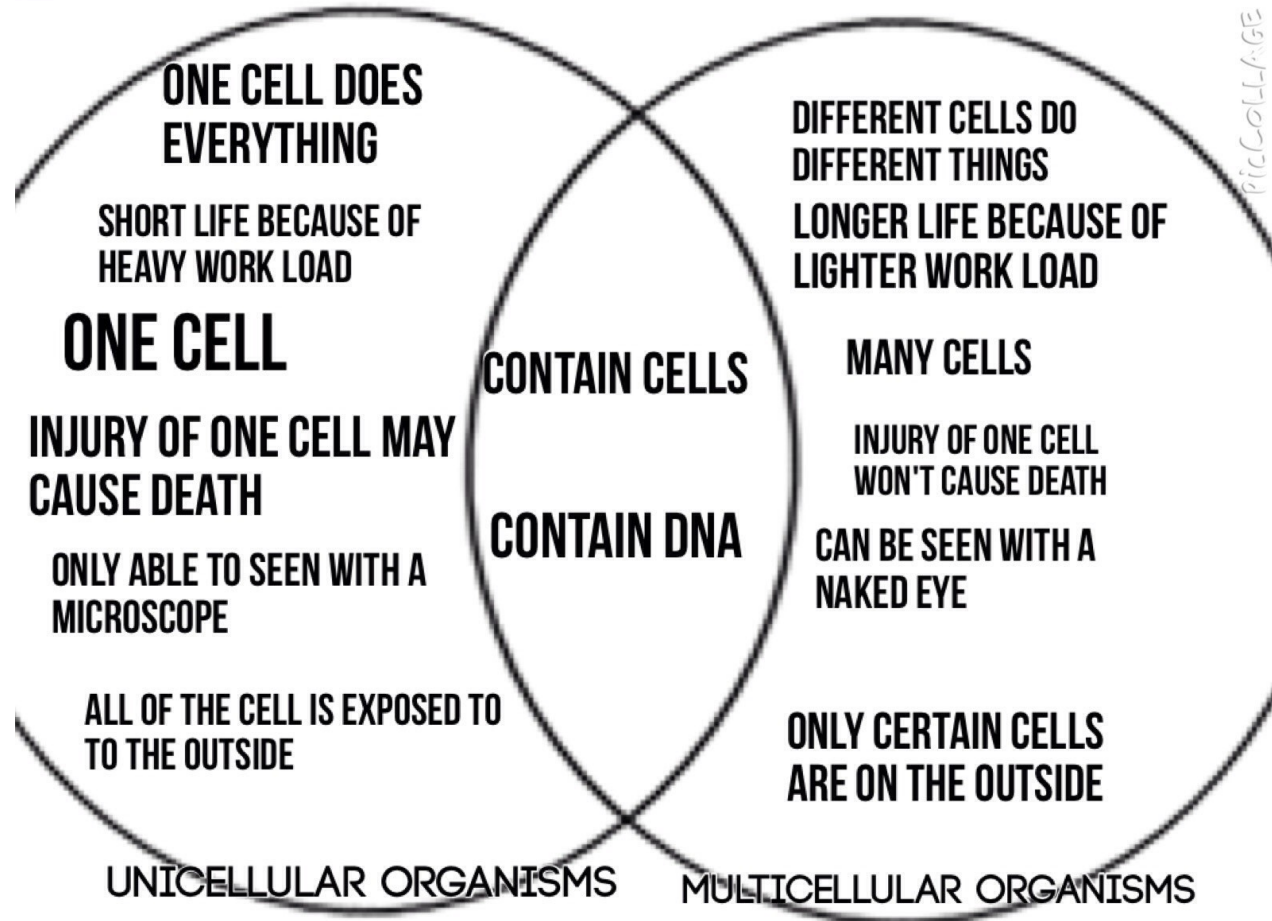


**PS Deb**

<http://www.slideshare.net/drpsdeb/presentations>

# What is nervous system good for?

# The role of nervous system



<http://edublog.amdsb.ca/>

# The role of nervous system

## Unicellular organism

- One cell has to do everything- lower effectivity
- Total dependence on environment
- High level of stress
- Short life time

## Multicellular organism

- Functional specialization of particular cells – higher effectivity
- Inner environment – homeostasis
- Lower level of stress
- Longer life time

# Compartmentalization

- Cellular specialization leads to compartmentalization on several levels
  - Tissue level
  - Organ level
  - Organ system level

# Compartmentalization

- Cellular specialization leads to compartmentalization on several levels
  - Tissue level
  - Organ level
  - Organ system level
- There are barriers in between compartments
- Properties/content may vary among different compartments

# The role of nervous system

- Essentials for survival of multicellular organism
  - To maintain homeostatis
  - To coordinate bodily functions



# The role of nervous system

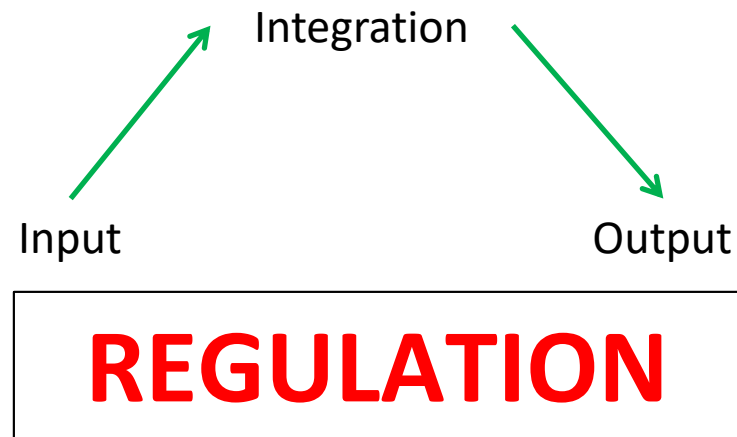
- Essentials for survival of multicellular organism
  - To maintain homeostatis
  - To coordinate bodily functions
- Maintaining homeostasis
  - The composition of inner environment
  - The integrity of organ/ bodily barriers

# The role of nervous system

- Essentials for survival of multicellular organism
  - To maintain homeostasis
  - To coordinate bodily functions
- Maintaining homeostasis
  - The composition of inner environment
  - The integrity of organ/ bodily barriers
- Coordination of bodily functions
  - To receive signals from outer and inner environment
  - To process this information
  - To respond in a coordinate manner to these stimuli

# The role of nervous system

- Coordination of bodily functions
- To receive signals from outer and inner environment
  - To process this information
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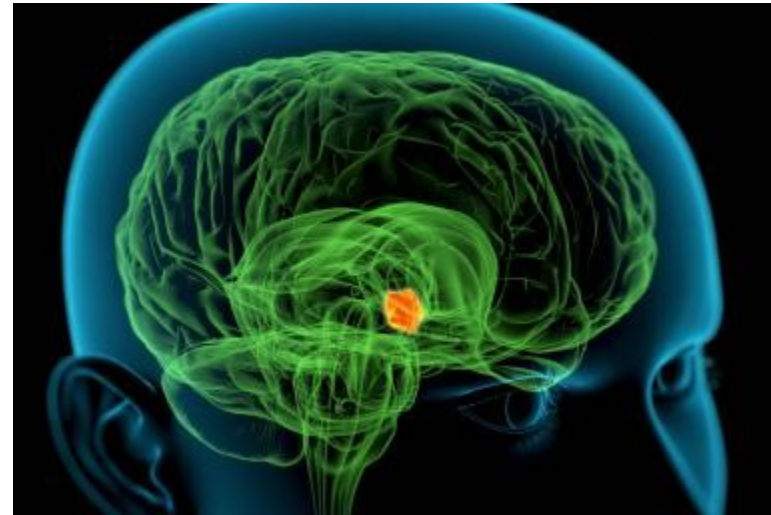


# The role of nervous system

- Regulation
  - Nervous
  - Humoral

# The role of nervous system

- Regulation
  - Nervous
  - Humoral



<http://biology.about.com/od/anatomy/p/Hypothalamus.htm>

**Central nervous system controls both types of regulations**

# The role of nervous system

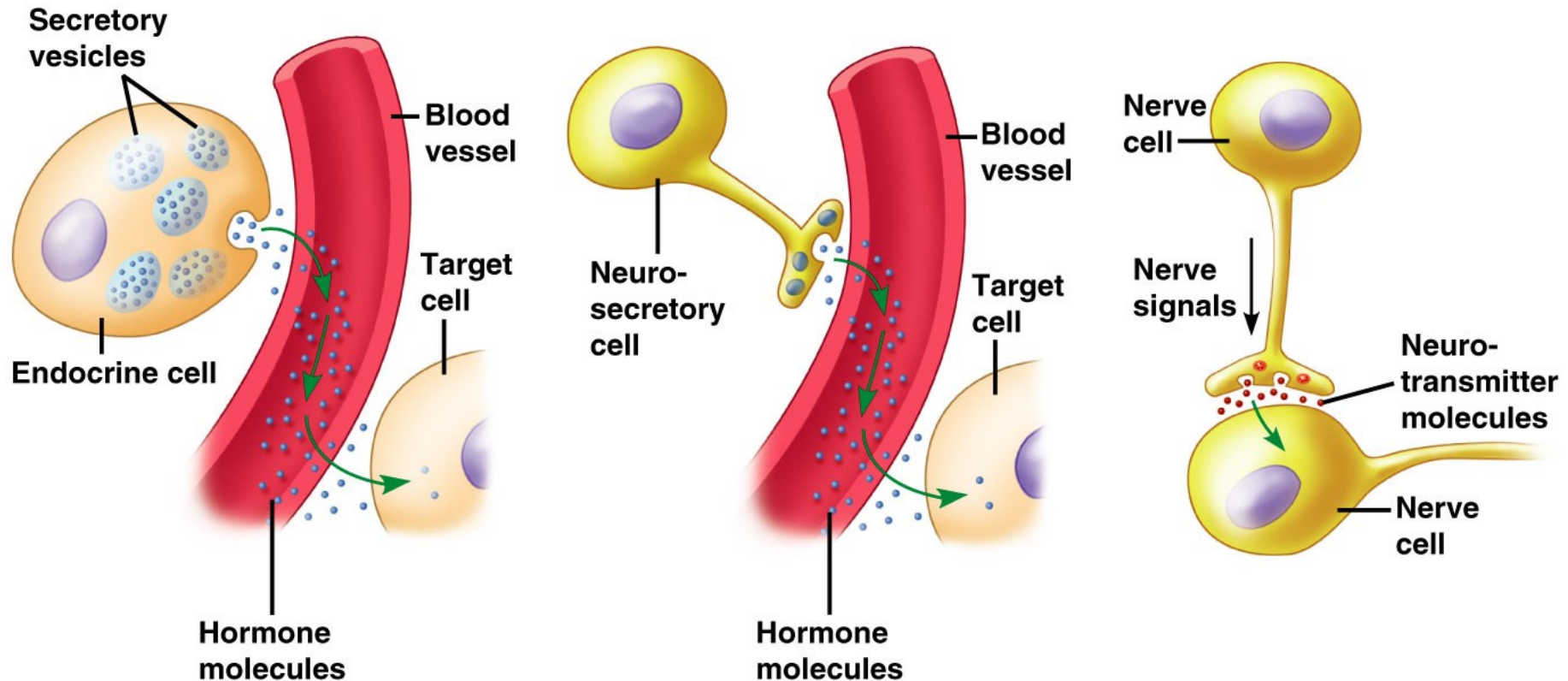
## Humoral regulations

- Hormone
- Non-specific channel of conduction (blood stream)
- Target site defined by specific receptor
- Low energetical demands
  - Slow
  - Long duration

## Nervous regulations

- Neurtransmitters
- Specific channel of conduction
  - Target site defined by infrastructure
- High energetical demands
  - Fast
  - Short duration

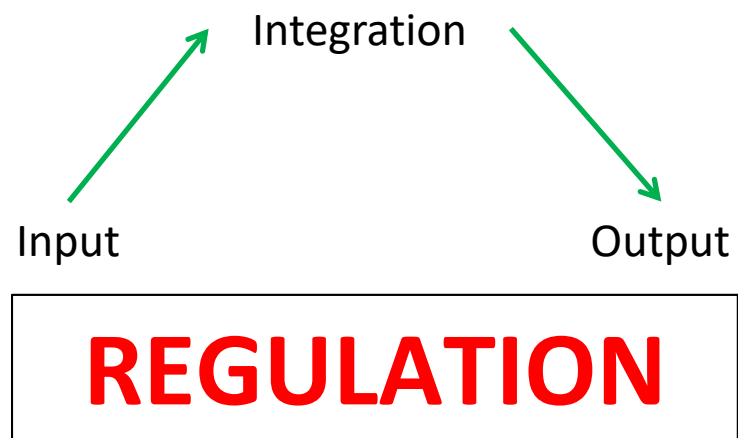
# Hormonal and nervous regulations



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<http://www.austincc.edu/>

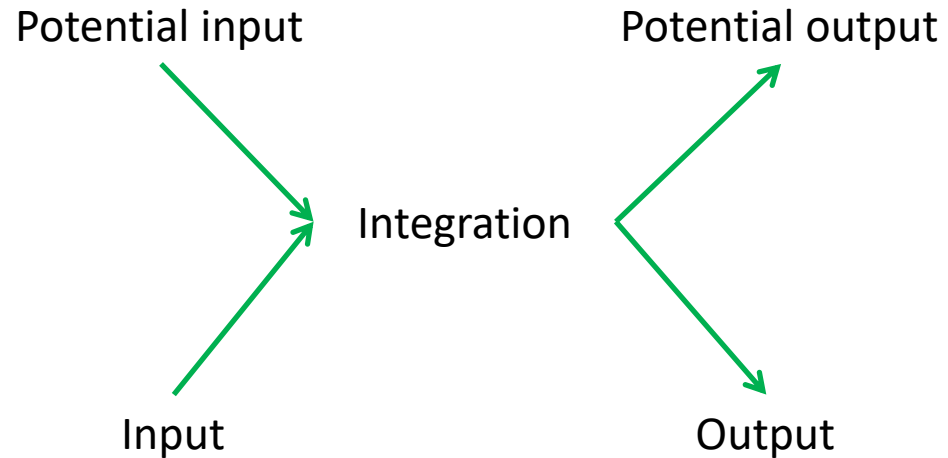
# The role of nervous system





# The role of nervous system

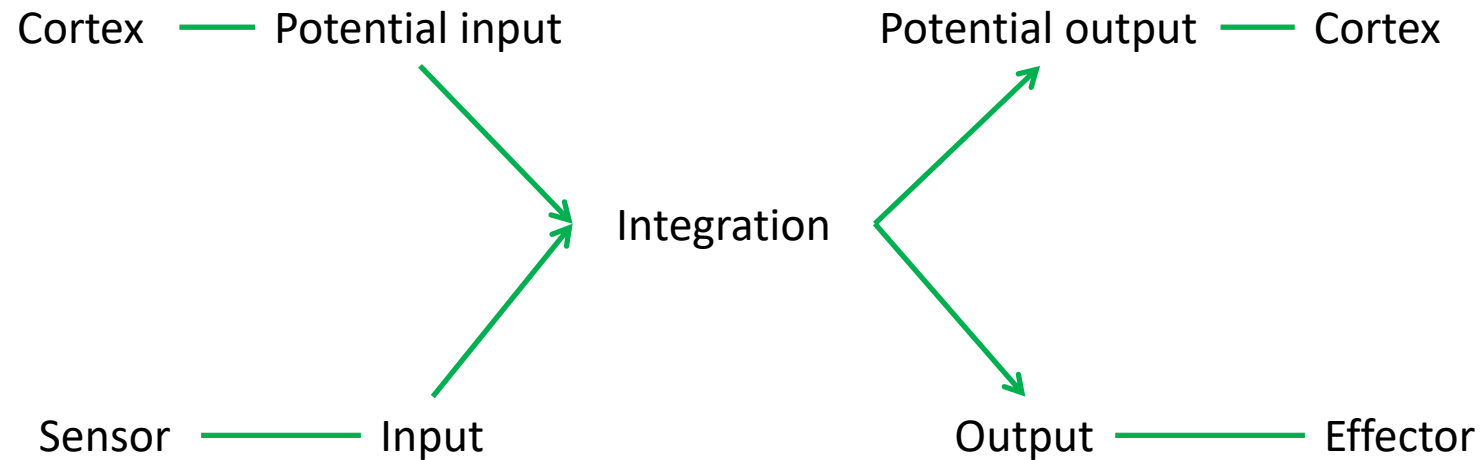
**ANTICIPATION**



**REGULATION**

# The role of nervous system

**ANTICIPATION**



# Evolutionary approach



# Evolutionary approach

## Evolution is not revolution



# Evolutionary approach

- Evolutionary old structures have not been replaced by new ones during evolution, but the old has been kept and the new added

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- Evolutionary younger structures were associated with new functions or with the improvement in existing functions

# Evolutionary approach

- Evolutionary old structures have not been replaced by new ones during evolution, but the old has been kept and the new added
- Evolutionary younger structures were associated with new functions or with the improvement in existing functions
- It is important to ask what is any particular function good for and how it has been improved in course of evolution

## 67. The importance and the regulatory role of nervous system

- ✓ Unicellular versus multicellular organisms, compartmentalization, control is essential
- ✓ Nervous system is essential for multicellular organisms
  - Homeostasis maintenance
  - Bodily functions coordinations
- ✓ Regulation
  - Definition
  - Nervous vs. humoral
- ✓ Regulation vs. anticipation



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