

M U N I

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1

Introduction to neuroscience
The regulatory role of nervous
system

Contact

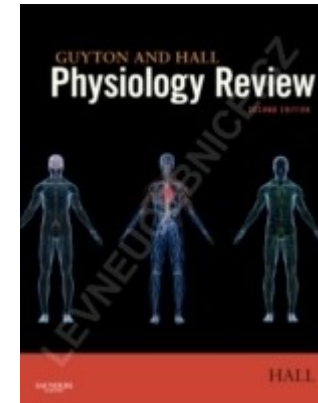
Kamil Ďuriš

Department of Pathological Physiology (A18)

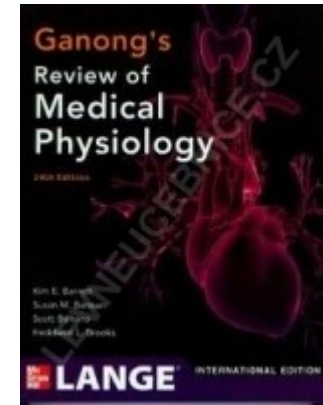
kduris@med.muni.cz

Literature

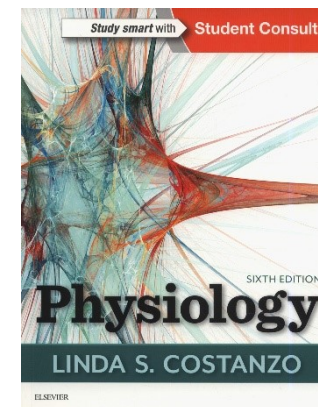
- Ganong's Review of Medical Physiology
- Boron - Medical Physiology
- Guyton - Physiology Review
- Constanzo - Physiology



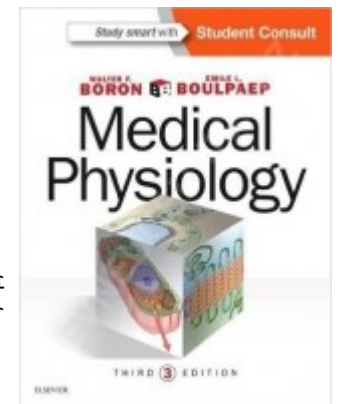
<https://www.levneucebnice.cz/p/guyton-and-hall-physiology-review/>



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



<https://www.amazon.co.uk/Physiology-6e-Linda-Costanzo-PhD/dp/03>



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

The other sources

– Neuroscience Online, The University of Texas



The screenshot shows the homepage of Neuroscience Online. At the top left is a logo featuring a neuron and the text "Neuroscience Online". To the right is the "UTHealth | Medical School" logo. Below the main title 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". A navigation bar 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 Google Custom Search box and a "Give to Neuroscience Online" button. A "USER SURVEY" button is also present. The main content area features a promotional message: "Visit *Neuroanatomy Online*, our new open-access electronic laboratory designed to compliment *Neuroscience Online*." Below this is a section titled "Section 1: Cellular and Molecular Neurobiology" with a list of chapters and authors.

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

- 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

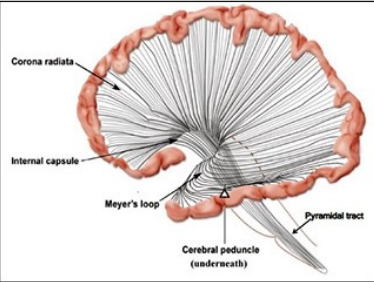
LECTURE NOTES

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](#)

The objectives

Basic understanding of the role and function of
nervous system

Why and how to **STUDY** neuroscience

FACTS

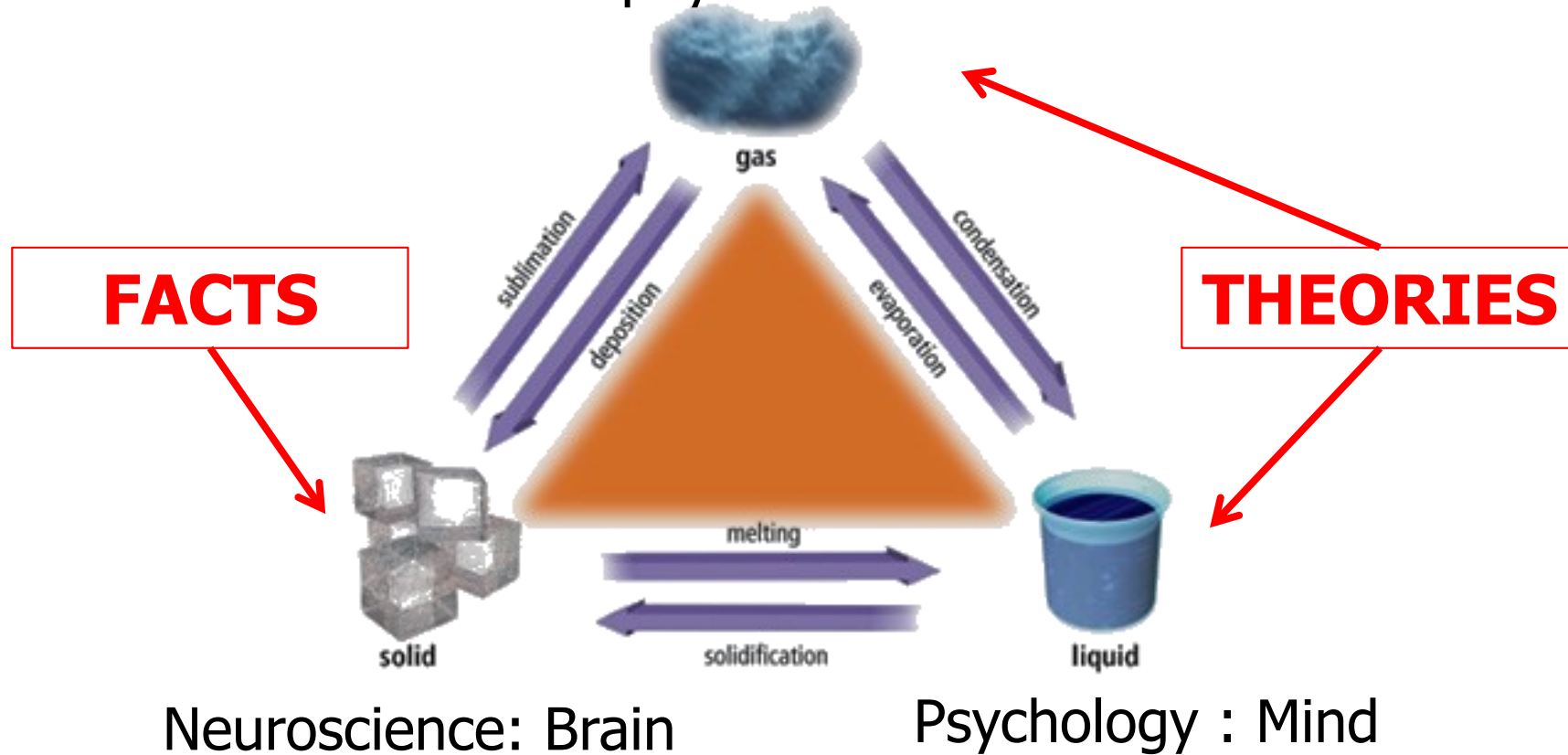


solid

Neuroscience: Brain

Why and how to **STUDY** neuroscience

Philosophy : Mind behind Mind

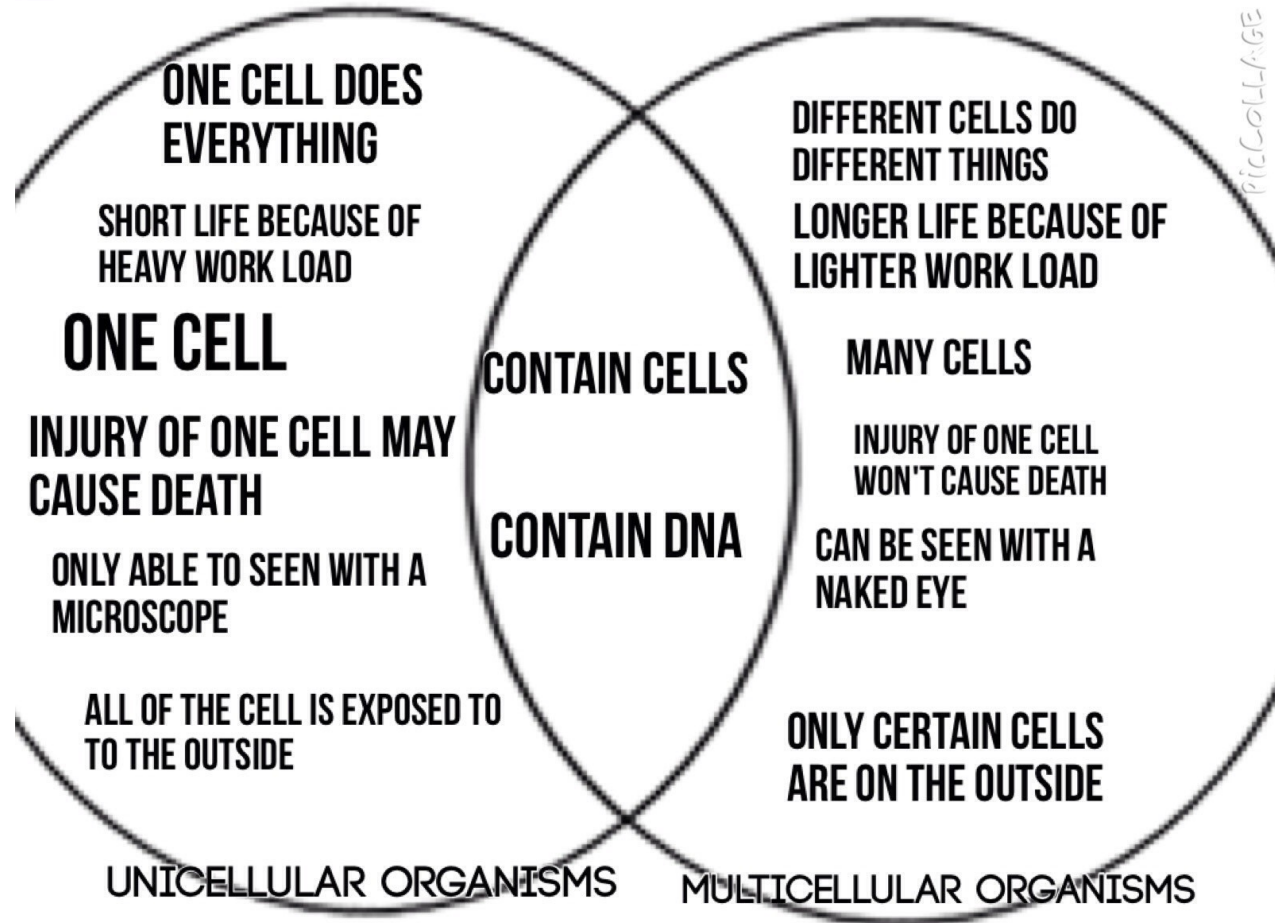


PS Deb

<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

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

The role of nervous system

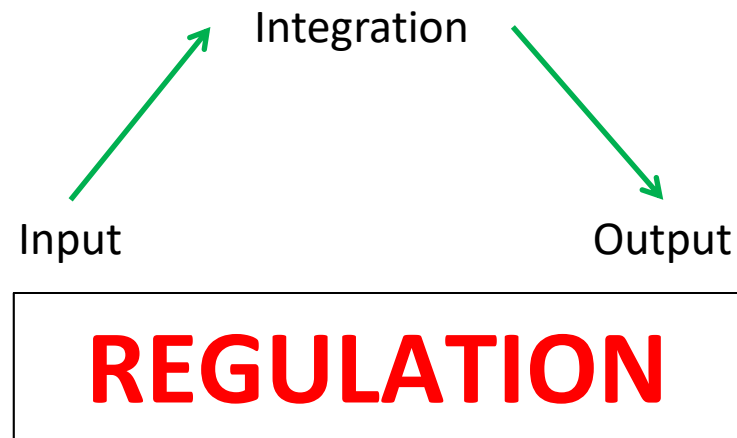
- The essentials for survival of multicellular organism
 - To maintain homeostatis
 - To coordinate bodily functions
- Maintaining homeostasis
 - The composition of inner environment
 - The integrity of organ/ bodily barriers

The role of nervous system

- The 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
- 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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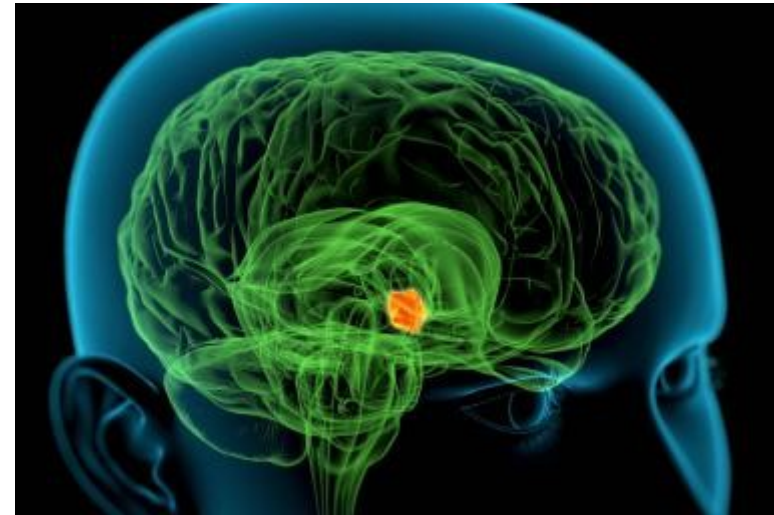


The role of nervous system

- 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

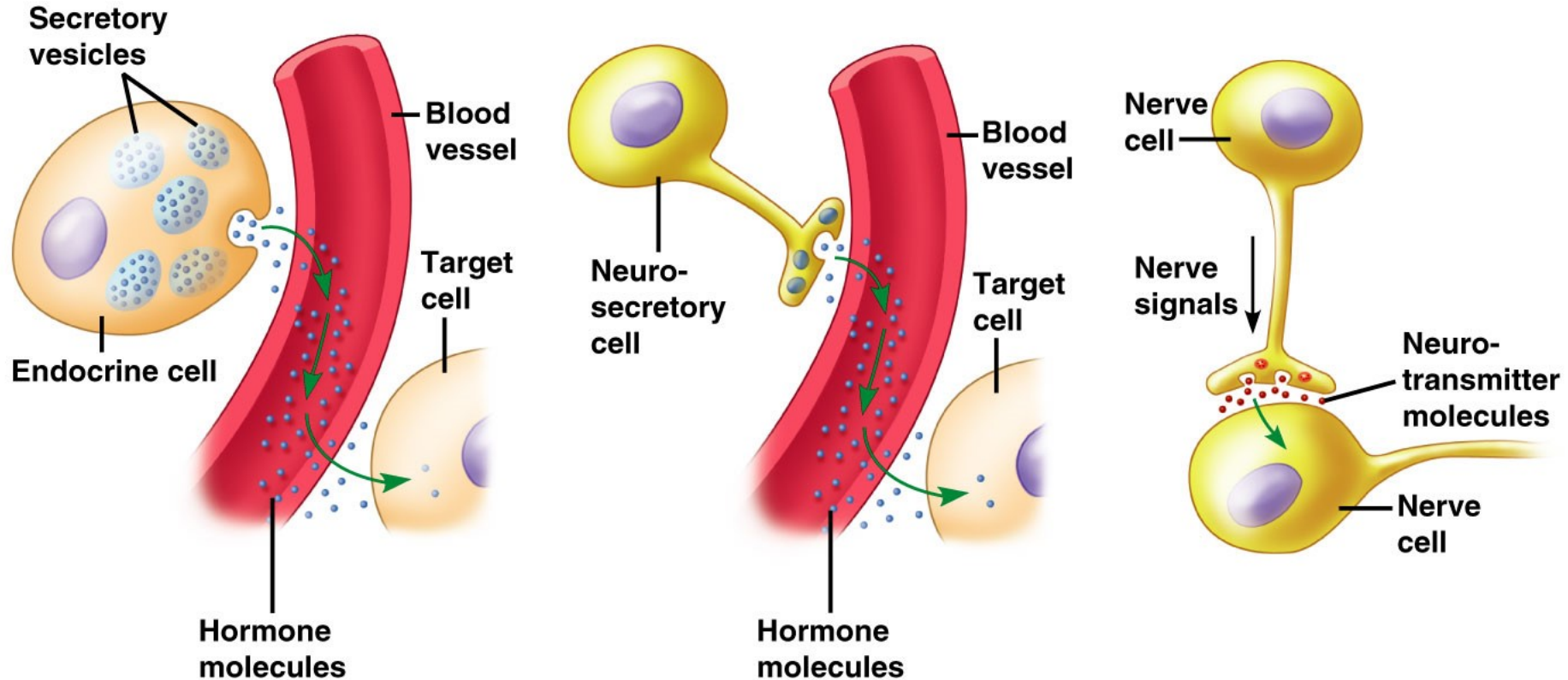
Humoral regulations

- 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

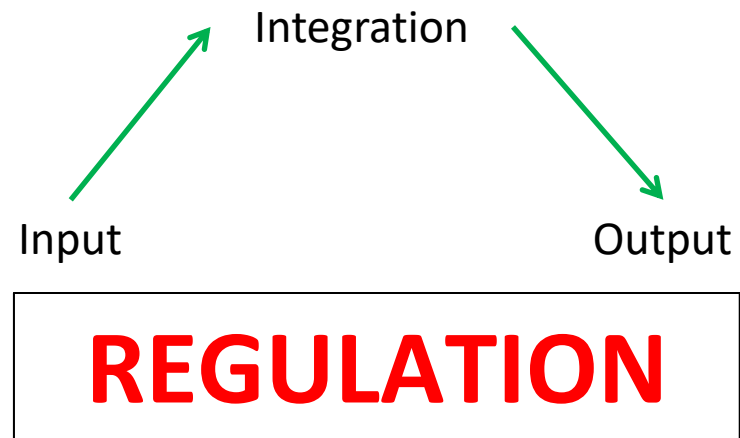
Hormonal and nervous regulations



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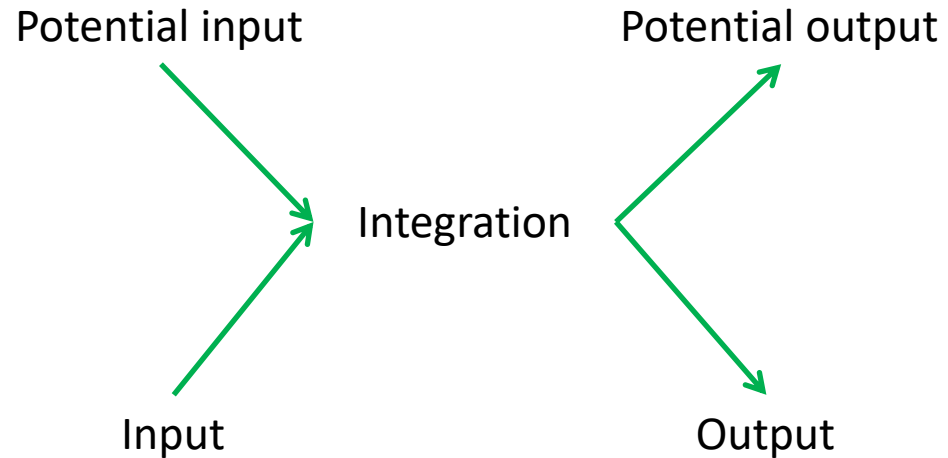
<http://www.austincc.edu/>

The role of nervous system



The role of nervous system

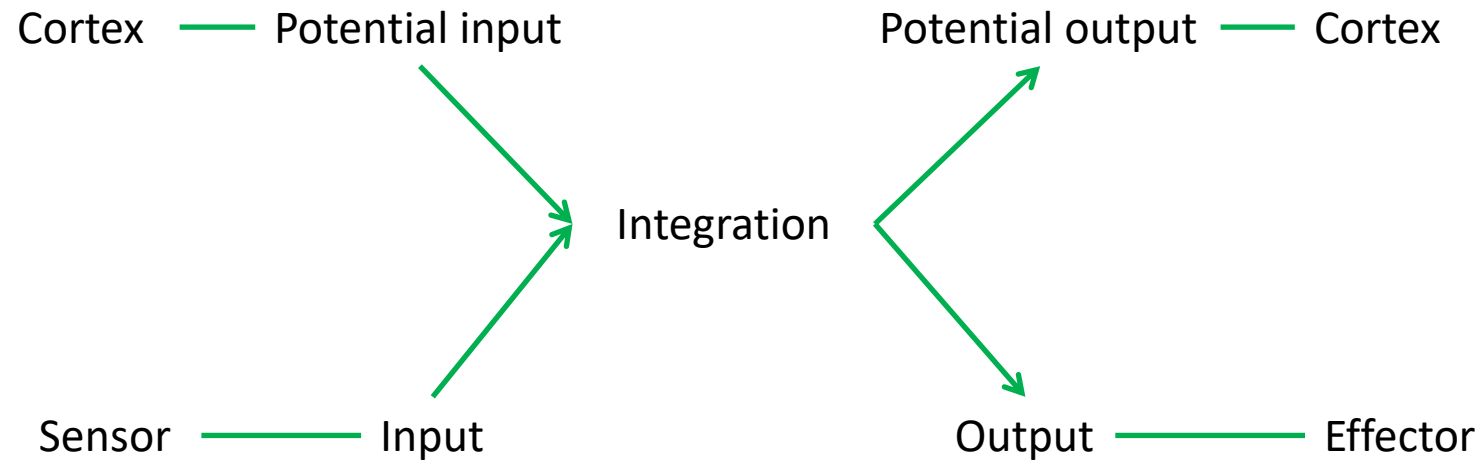
ANTICIPATION



REGULATION

The role of nervous system

ANTICIPATION



REGULATION

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

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- 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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