

# Ch. 1 – Introduction to Physiology

## Ch 1 Objectives:

**Part 1.** Understand homeostasis & feedback loops

**Part 2.** Review chemistry of pH (as it applies to physiology)

### Announcements:

- Are you something other than pre-nursing (pre-pharmacy, pre-med, pre-vet)?
- Course webpage is NOT on Blackboard! It's simply [online](#).
- A link to the course textbook can be found on online syllabus.



1

## Part 1. Physiology, homeostasis, and feedback loops.

Physiology = the study of how the body maintains homeostasis.

Homeostasis = how the body keeps vital functions within normal range.

**2 Systems that regulate homeostasis:** *Wikitext Pg 8*

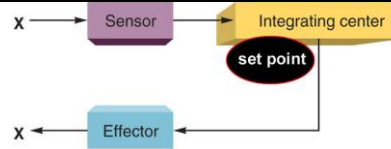
1. Nervous system
2. Endocrine system

**List some important vital signs (which body maintains homeostasis of) that nurses routinely measure on patients in an office visit:**

BP
temp
weight
blood glucose
resp. rate

2

### Homeostasis components:



a) **Stimulus**: a change in a body function, usually outside of normal range.

b) **Sensor (receptor)**: detects this change. Sends signal to integrating center.

c) **Integrating center**: where sensory info. Is interpreted, compared to a “set point” or normal range for that body function. Responds by sending a command (nervous or endocrine).

e) **Effector** = muscle or gland that responds to the command.

f) **Effect** = usually reverses the initial change in body function (if neg. feedback loop).

*Wikitext Pg 4*

3

### Feedback Loops:

#### 1. Positive Feedback Loop

= when change occurs body responds by causing **more** of that change.  
(Amplifies the effect) \* rare feedback system in the body!

#### 2. Negative Feedback Loop (most common!)

= when change occurs body responds by **reversal** of the change.  
(Reverses the effect) \* **Most common feedback system!**

4

**Ex. A) Positive Feedback Loop = Nursing & Oxytocin release – slide updated 5/26/25**

Wikitext Pg 5

1. Stimulus = baby suckles nipple

2. Sensor = nipple touch/pressure receptors

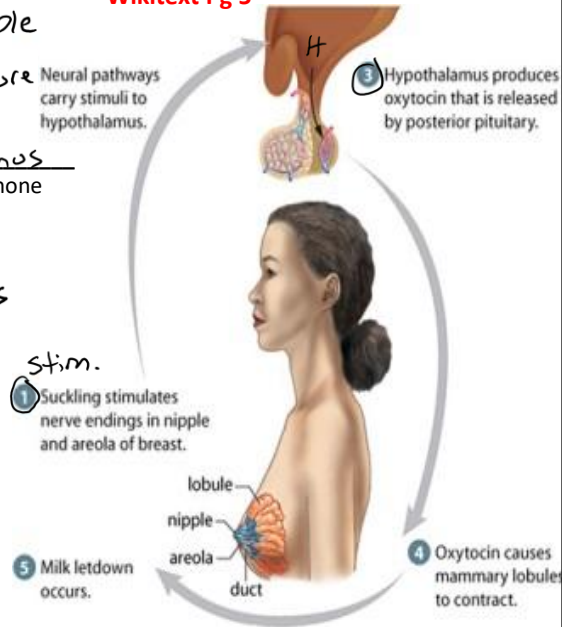
3. Integrating center Hypothalamus  
(paraventricular nucleus) releases hormone Oxytocin

4. Effector = mammary glands

5. Effect = milk letdown

> As long as baby nurses, oxytocin is released.

> When nursing stops, oxytocin release stops.



5

**Ex. B) Positive Feedback Loop = Birth & Oxytocin release – slide updated 5/26/25**

Wikitext Pg 5

1. Stimulus = baby's head presses on cervix

2. Sensor = Cervix stretch receptors

3. Integrating center Hypothalamus  
hypothalamic nucleus (paraventricular) release oxytocin

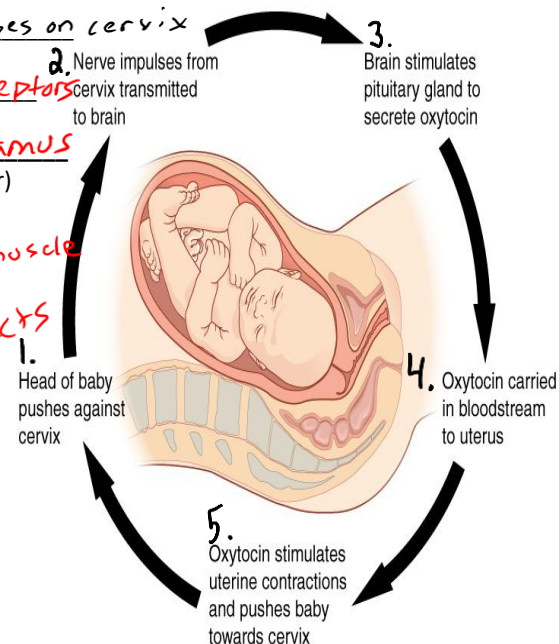
4. Effector = uterus smooth muscle

5. Effect = uterine contractions

> Squeezes baby more against cervix  
> Cervix stretch receptors activated more

> More oxytocin released

> This continues until "stimulus" is gone (baby has cleared the cervix - been born)



6

**Ex. A) Negative Feedback Loop = Body temperature**

Body Temp Set point = 98.6 °F (range 97.6 - 99.6 °F)

**Stimulus** =  body temp above setpointSensors = thermoreceptorsIntegrating center = Hypothalamus (anterior nucleus)Effectors = Sweat glands - produce sweat.Effect =  body temperature

shutterstock.com • 120823501

**Stimulus** =  body temp:Sensors = thermoreceptorsIntegrating center = SameEffectors = Skeletal muscleEffect =  body temperature

Wikitext Pg 11

7

See practice flow diagram on [negative feedback regulation of body temperature](#)

(blank and KEY both found in online syllabus)

8

### Ex. B) Negative Feedback Loop = Regulation of blood glucose.

Wikitext Pg 11

1. Stimulus = change in blood glucose

*Depending on blood glucose levels pancreas secrete:*

1. Stimulus: If blood glucose too high

2. Sensor, 3. integrating center, & 4. effector = \_\_\_\_\_  
beta cells secrete \_\_\_\_\_

5. Effect =

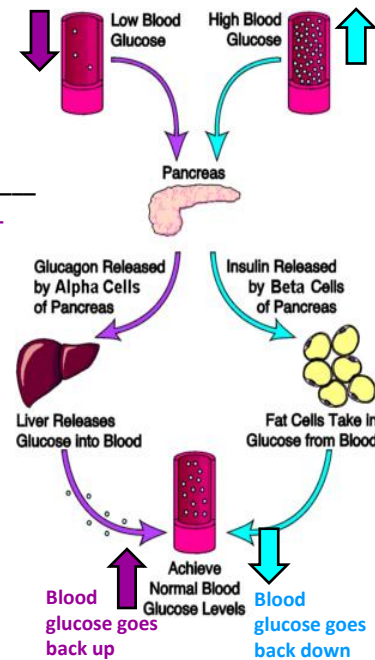
**VERSUS**

1. Stimulus: If blood glucose too low

2. Sensor, 3. integrating center, & 4. effector = \_\_\_\_\_

alpha cells secrete \_\_\_\_\_

5. Effect = increased blood glucose



9

See practice flow diagram on [negative feedback regulation of blood glucose](#)

(blank and KEY both found in online syllabus)

10

## Disorder of glucose metabolism – Diabetes mellitus

**Type 1 Diabetes** (also known as \_\_\_\_\_)

What is the problem?

**Type 2 Diabetes** (also known as \_\_\_\_\_)

What is the problem?

11

## Pharmaceutical treatments for diabetes



How does semaglutide work? (What is the physiology of its action?)

Both can lower A1C. What is A1C? \_\_\_\_\_

Click [HERE](#) for reference

And  
injectable  
Wegovy –  
more for  
weight loss  
than treating  
type 2  
diabetes

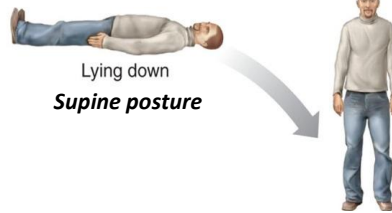
12

### Ex. C) Negative Feedback Loop = Blood Pressure change w/ Posture

Pg 5 of Wiki text

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display

- Sensor
- Integrating center
- Effector



When you stand up after lying down your blood pressure briefly drops. Medulla responds to correct by neg feedback.



Negative feedback response





13

### Ex. C) Negative Feedback Loop = Blood Pressure changes

Pg 5 of Wiki text

1. Stimulus = BP too low  (Systolic BP below 80 mmHg)
2. Sensors = \_\_\_\_\_
3. Integrating center = \_\_\_\_\_ (cardiac & vasomotor centers)
4. Effectors = 1: \_\_\_\_\_  
2: \_\_\_\_\_
5. Effect = 

**VERSUS**

1. Stimulus = BP too high  (Systolic BP over 160 mmHg)
2. Sensors = \_\_\_\_\_
3. Integrating center = \_\_\_\_\_
4. Effectors = 1: \_\_\_\_\_  
2: \_\_\_\_\_
5. Effect = 

14

**See practice flow diagram on negative feedback regulation of high and low blood pressure (blank and high BP KEY and low BP KEY both found in online syllabus)**

15

## **Review**

- **Physiology**
- **Homeostasis**  
**Dynamic constancy of internal environment despite external changes**
- **Feedback Loops**  
**Positive Feedback (breast feeding & milk let-down, and childbirth)**  
**Negative Feedback (body temp, blood glucose, blood pressure)**

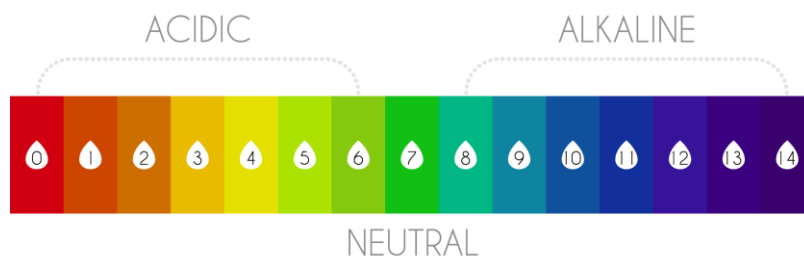
See **syllabus** for practice flow diagrams:

16



## Part 2: Basics of Physiological Chemistry

### 1. Understand physiology of pH



17

### 1. pH

= logarithmic scale of:  $\text{pH} = -\log_{10} [\text{H}^+]$   
 Hydrogen ions ( $\text{H}^+$ )  
 Hydroxide ions ( $\text{OH}^-$ )

**Numerical scale 0 – 14**

< 7 = acidic (has more  $\text{H}^+$  ions)

7 = neutral

> 7 = alkaline (has fewer  $\text{H}^+$  ions and more  $\text{OH}^-$  ions)

#### Importance of pH:

- shapes/functions of molecules
- Enzyme activity
- Most chemical reactions in body
- Ability of molecules to dissolve in water

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.  
**Table 2.3 | The pH Scale**

	$\text{H}^+$ Concentration (Molar)*	pH	$\text{OH}^-$ Concentration (Molar)*
Acids	1.0	0	$10^{-14}$
	0.1	1	$10^{-13}$
	0.01	2	$10^{-12}$
	0.001	3	$10^{-11}$
	0.0001	4	$10^{-10}$
	$10^{-5}$	5	$10^{-9}$
	$10^{-6}$	6	$10^{-8}$
Neutral	$10^{-7}$	7	$10^{-7}$
Bases	$10^{-8}$	8	$10^{-6}$
	$10^{-9}$	9	$10^{-5}$
	$10^{-10}$	10	0.0001
	$10^{-11}$	11	0.001
	$10^{-12}$	12	0.01
	$10^{-13}$	13	0.1
	$10^{-14}$	14	1.0

\*Molar concentration is the number of moles of a solute dissolved in one liter. One mole is the atomic or molecular weight of the solute in grams. Since hydrogen has an atomic weight of one, one molar hydrogen is one gram of hydrogen per liter of solution.

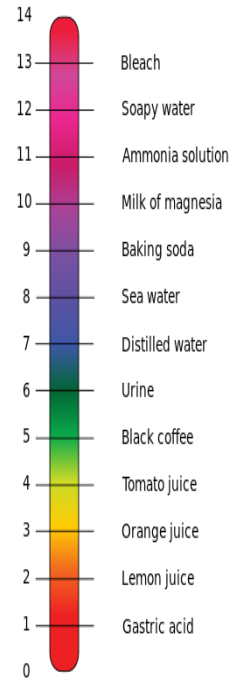
18

## Determining acidity or alkalinity w/pH scale

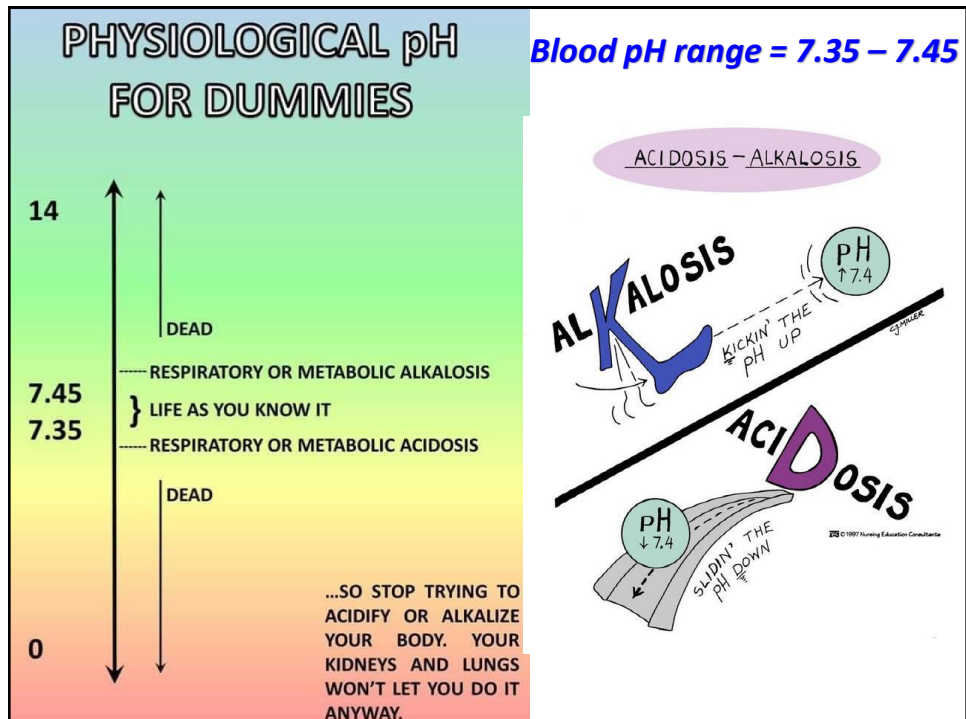
Ex: How much more acidic is urine (pH 6) than baking soda (pH 9)?

Ex: How much more acidic is stomach acid (pH 1) than distilled water (pH 7)?

Ex: How much more acidic is stomach acid (pH 1) than soap (pH 12)?



19



20

## Blood pH range = 7.35 – 7.45

\_\_\_\_\_ = blood pH < 7.35.

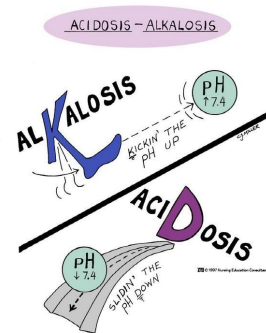
\_\_\_\_\_ = blood pH > 7.45.

### **\*\*Blood pH outside normal range interferes with:**

- > hemoglobin's oxygen carrying capacity
- > Functions of enzymes
- > Chemical reactions involved in homeostasis

### **Organ systems that regulate blood pH:**

1. Lungs fastest to regulate blood pH. (Pg 10 of Wiki text)
2. Kidneys (pg 186 of Wiki text)
3. Liver



21

## Altered pH and medical problems – slide updated 8/19

Diabetes

Respiratory illnesses

Kidney disease or failure

Antibiotics and vaginosis

Click [here](#) to read more about respiratory and metabolic acidosis and alkalosis. Click [here](#) to read about antibiotics and vaginosis.

22

## Review

- **pH Scale**
  - Acids
  - Bases
- **Organ systems that regulate blood pH**
- **Acidosis & alkalosis**

**Next Chapter is Ch 2 part 1 – cell metabolism**