

Ch. 1 – Introduction to Physiology

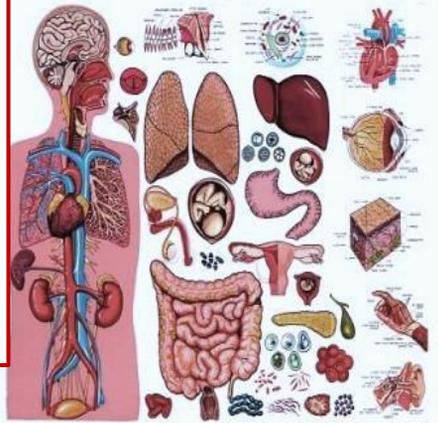
Ch 1 Objectives:

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*

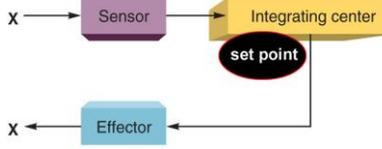
1. Nervous
2. Endocrine

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

• BP
O ₂
resp. rate
HR
• Temp.
weight

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).

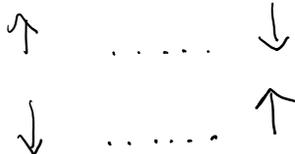
Wikitext Pg 4

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 on nipple of breast

2. Sensor = touch receptors in nipple

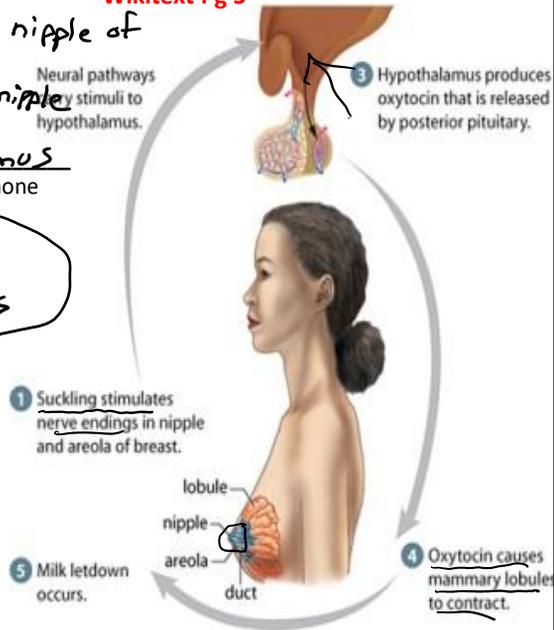
3. Integrating center Hypothalamus
(paraventricular nucleus) releases hormone Oxytocin

4. Effector = mammary glands release milk.

5. Effect = milk release

> 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 stretches cervix

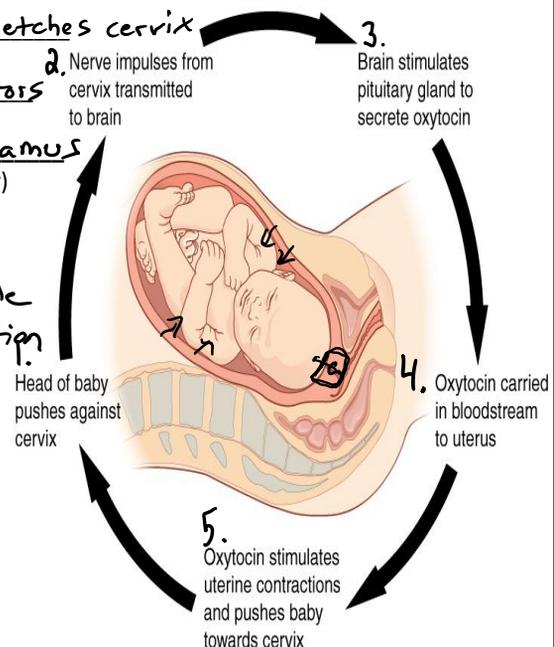
2. Sensor = Stretch receptors

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

4. Effector = uterine smooth muscle

5. Effect = uterine contraction

> 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 setpoint

Sensors = thermoreceptor

Integrating center = Hypothalamus (anterior nucleus)

Effectors = Sweat glands - sweat

Effect =  body temperature back to normal



shutterstock.com • 120823501

Stimulus =  body temp:

Sensors = thermoreceptors

Integrating center = Hypothalamus

Effectors = Skeletal muscles (shiver)

Effect =  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 = Pancreas
 beta cells secrete insulin - tells body cells
to take in glucose from blood.

5. Effect = blood glucose ↓

VERSUS

1. Stimulus: If blood glucose too low ↓

2. Sensor, 3. integrating center, & 4. effector = Pancreas
 alpha cells secrete Glucagon - tells liver to
break down glycogen into glucose & release it into blood

5. Effect = increased blood glucose ↑

The diagram includes the following components and labels:

- High Blood Glucose:** Indicated by a red arrow pointing up to a test tube. The pancreas releases **Insulin Released by Beta Cells of Pancreas**.
- Low Blood Glucose:** Indicated by a red arrow pointing down to a test tube. The pancreas releases **Glucagon Released by Alpha Cells of Pancreas**.
- Insulin Pathway:** Insulin causes **Fat Cells Take In Glucose from Blood** and **Liver Releases Glucose Into Blood** (storing it as **glycogen is storage form of glucose in liver**).
- Glucagon Pathway:** Glucagon causes **Liver Releases Glucose Into Blood** (breaking down **glycogen is storage form of glucose in liver**) and **release it into blood**.
- Outcome:** Both pathways lead to **Achieve Normal Blood Glucose Levels**. A note says **Blood glucose goes back up** (with a red arrow) and **Blood glucose goes back down** (with a red arrow).

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 insulin-dependent diabetes)

What is the problem? pancreas does not produce enough insulin.

insulin-independent diabetes

Type 2 Diabetes (also known as or insulin resistance)

What is the problem? Pancreas produces insulin but cells ignore insulin.

11

Pharmaceutical treatments for diabetes



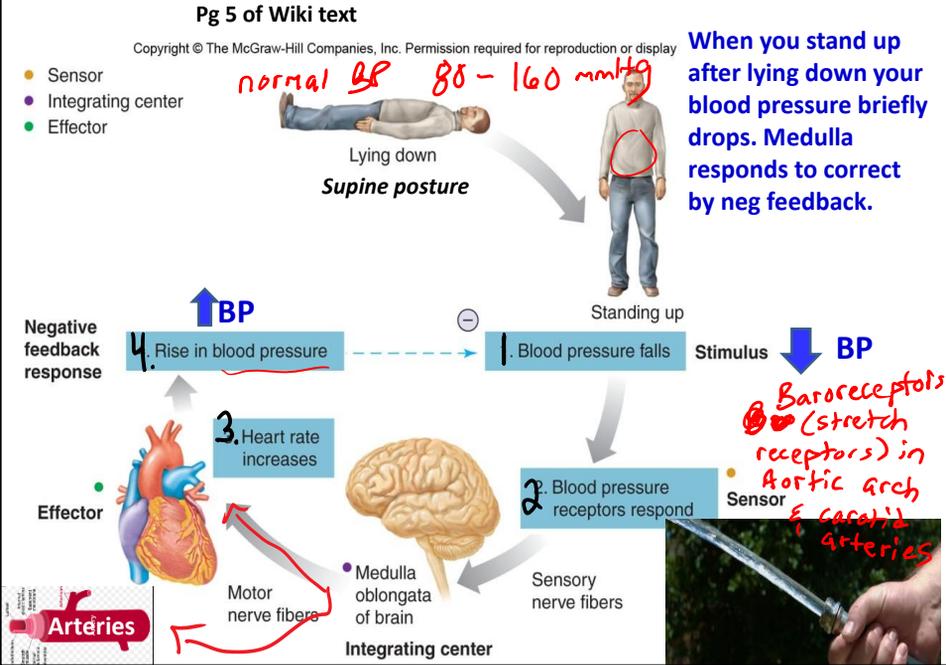
How does semaglutide work? (What is the physiology of its action?)

- \uparrow insulin production by pancreas
- \downarrow glucagon production by pancreas

Click [HERE](#) for reference

12

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



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 = Baroreceptors in Aortic arch & carotid arteries
3. Integrating center = medulla (cardiac & vasomotor centers)
4. Effectors = 1: cardiac muscle HR ↑
 2: artery smooth muscle vasoconstricts
5. Effect = ↑ BP

VERSUS

1. Stimulus = BP too high (Systolic BP over 160 mmHg)
2. Sensors = Baroreceptors (same)
3. Integrating center = Medulla (same)
4. Effectors = 1: cardiac muscle ↓ HR
 2: artery smooth muscle - vasodilate
5. Effect = ↓ BP

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

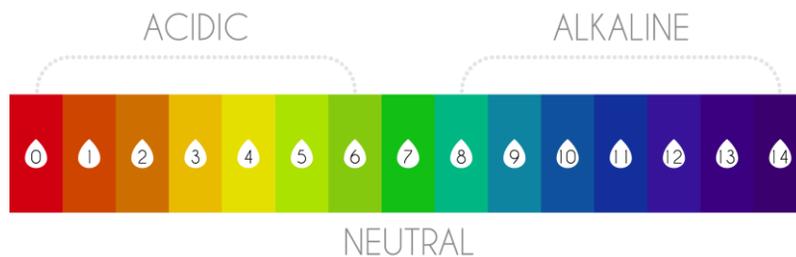
- **Physiology**
- **Homeostasis**
Dynamic constancy of internal environment despite external changes
- **Feedback Loops**
Positive Feedback (breast feeding & milk let-down, and childbirth)
Negative Feedback (body temp, blood glucose, blood pressure)

See **syllabus** for practice flow diagrams:

16

Part 2: Basics of Physiological Chemistry

1. Understand physiology of pH



17

1. pH

= logarithmic scale of:
Hydrogen ions (H⁺)
Hydroxide ions (OH⁻)

$$\text{pH} = -\log_{10} [\text{H}^+]$$

Numerical scale 0 – 14

< 7 = acidic (has more H⁺ ions)

7 = neutral

> 7 = alkaline (has fewer H⁺ ions and more OH⁻ ions)

Importance of pH:

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

Table 2.3 | The pH Scale

	H ⁺ Concentration (Molar)*	pH	OH ⁻ Concentration (Molar)*
<i>Acids</i>	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
<i>Neutral</i>	10 ⁻⁷	7	10 ⁻⁷
<i>Bases</i>	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)?

$$9 - 6 = 3$$

$$1,000$$

$$1 \times 10^3$$

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

$$7 - 1 = 6$$

$$1,000,000$$

Ex: How much more acidic is stomach acid (pH 1) than soap (pH 12)? Do this one on your own.

14 Bleach
13 Soapy water
12 Ammonia solution
11 Milk of magnesia
9 Baking soda
8 Sea water
7 Distilled water
6 Urine
5 Black coffee
4 Tomato juice
3 Orange juice
2 Lemon juice
1 Gastric acid
0

19

PHYSIOLOGICAL pH FOR DUMMIES

...SO STOP TRYING TO ACIDIFY OR ALKALIZE YOUR BODY. YOUR KIDNEYS AND LUNGS WON'T LET YOU DO IT ANYWAY.

Blood pH range = 7.35 – 7.45

ACIDOSIS - ALKALOSIS

© 1997 Huming Education Consultants

20

Blood pH range = 7.35 – 7.45

acidosis = blood pH < 7.35.

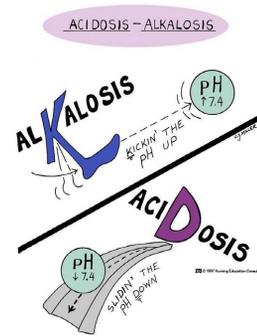
alkalosis = blood pH > 7.45.

**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
3. Liver *slowest*



21

Review

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

Next Chapter is Ch 2 part 1 – cell metabolism

22