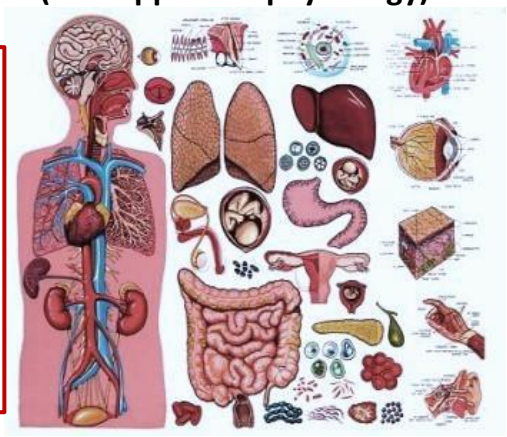
Ch. 1 – Introduction to Physiology

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.



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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:

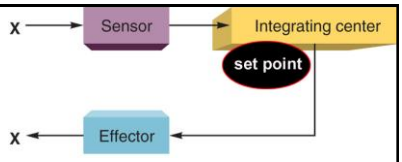
1.

2.

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

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).

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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!

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Ex. A) Positive Feedback Loop = Nursing & Oxytocin release

1. Stimulus =

2. Sensor =

3. Integrating center & 4. effector =

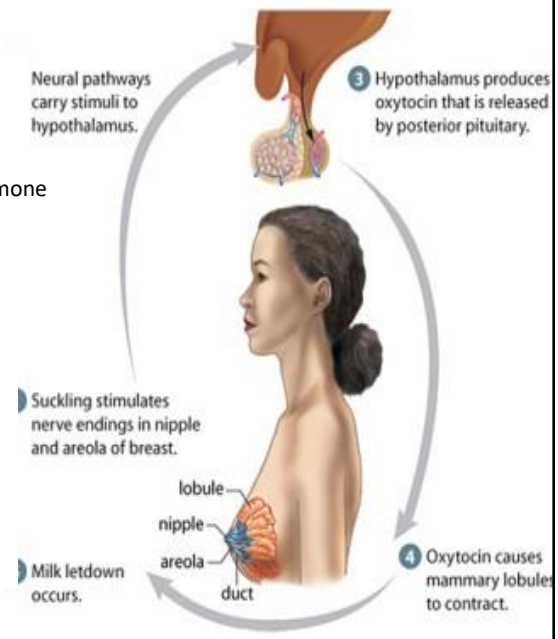
_____

(paraventricular nucleus) releases hormone

_____

5. Effect =

> As long as baby nurses, oxytocin is released.
> When nursing stops, oxytocin release stops.



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Ex. B) Positive Feedback Loop = Birth & Oxytocin release

1. Stimulus = _____

2. Sensor = _____

3. Integrating center & 4. effector =

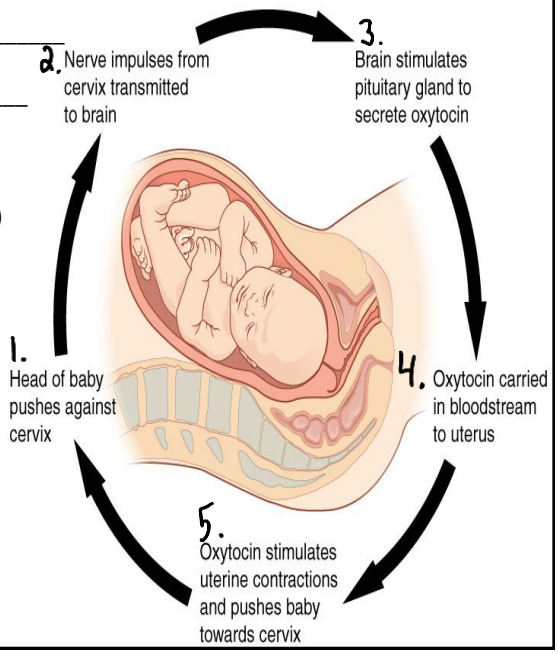
_____

hypothalamic nucleus (paraventricular) release **oxytocin**

5. Effect = _____

_____

> 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)



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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 = _____

Integrating center = _____ **(anterior nucleus)**

Effectors = _____

Effect = ↓ **body temperature**

Stimulus = ↓ **body temp:**

Sensors = _____

Integrating center = _____

Effectors = _____

Effect = ↑ **body temperature**

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See practice flow diagram on negative feedback regulation of body temperature

(blank and KEY both found in online syllabus)

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

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

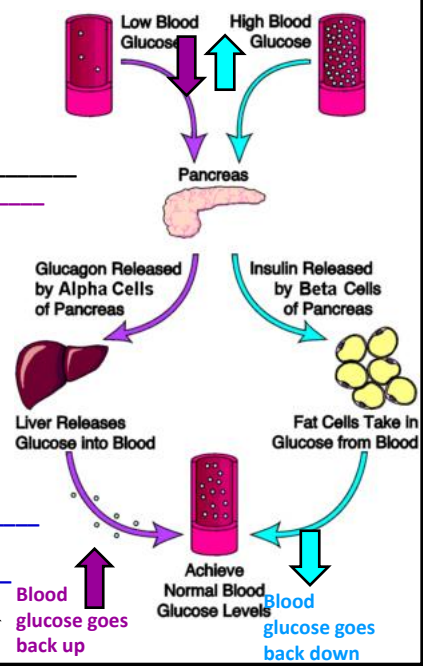
2. Sensor, 3. integrating center, & 4. effector =

_____

alpha cells secrete _____

_____

5. Effect = increased blood glucose



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See practice flow diagram on negative feedback regulation of blood glucose

(blank and KEY both found in online syllabus)

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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?

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Pharmaceutical treatments for diabetes *new slide 1/8/25*

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

Click **HERE** for reference

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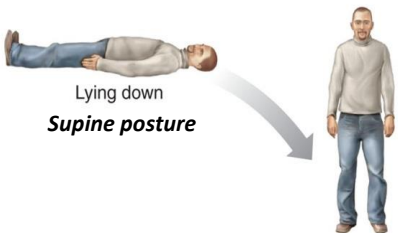
Ex. C) Negative Feedback Loop = Blood Pressure change w/ Posture

Pg 5 of Wiki text

- 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

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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 = ↓

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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)

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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:

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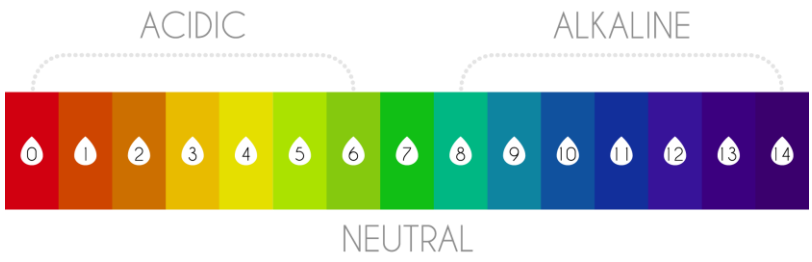
Part 2: Basics of Physiological Chemistry

1. Understand physiology of pH



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1. pH

= logarithmic scale of: $pH = -\log_{10}[H+]$

Hydrogen ions (H+)
Hydroxide ions (OH-)

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)*
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.

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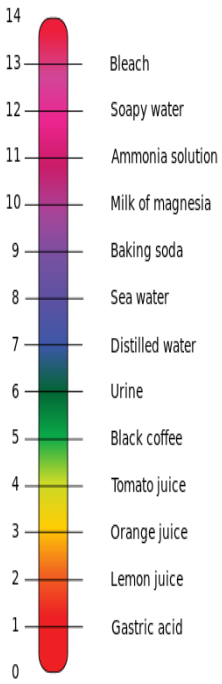
Determining acidity or alkalinity w/pH scale

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)?



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PHYSIOLOGICAL pH FOR DUMMIES

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DEAD

----- RESPIRATORY OR METABOLIC ALKALOSIS

7.45
7.35 } LIFE AS YOU KNOW IT

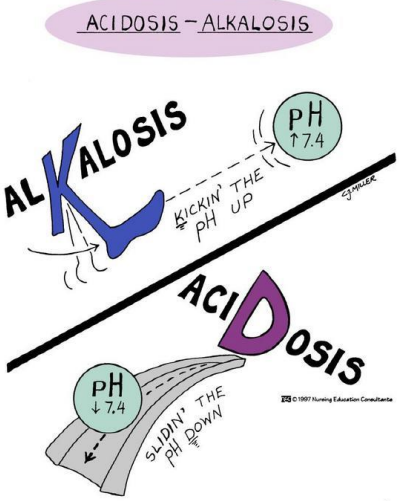
----- RESPIRATORY OR METABOLIC ACIDOSIS

DEAD

0

...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



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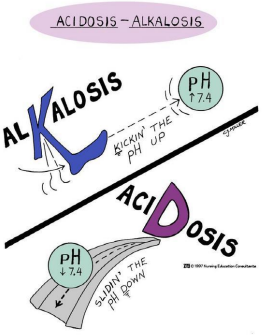
Blood pH range = 7.35 – 7.45



_____ = 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

3. Liver

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Review

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

Next Chapter is Ch 2 part 1 – cell metabolism

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