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.
- Get your textbook!

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

**Physiology** = study of how body maintains homeostasis.

**Homeostasis** = all the changes that occur in body to keep functions within normal ranges (*constant internal environment*)

**2 Systems that regulate homeostasis:**

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:

<table>
<thead>
<tr>
<th>Vital Sign</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>98.6°F (37°C)</td>
</tr>
<tr>
<td>Pulse rate</td>
<td>60-100 bpm</td>
</tr>
<tr>
<td>Respiration</td>
<td>12-20 breaths/min</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>120/80 mmHg</td>
</tr>
<tr>
<td>Oxygen saturation</td>
<td>95-100%</td>
</tr>
<tr>
<td>Blood glucose</td>
<td>70-110 mg/dL</td>
</tr>
</tbody>
</table>

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

1. Stimulus = ___________________
2. Sensor = ___________________
3. Integrating center & effector = ___________________
   (supraoptic & paraventricular nuclei) release oxytocin.
4. Effect = release oxytocin.
5. Effect = ___________________
   ________________________________
   > As long as baby nurses, oxytocin is released.
   > When nursing stops, oxytocin release stops.

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

1. Stimulus = ___________________
2. Sensor = ___________________
3. Integrating center & effector = ___________________
   hypothalamic nuclei (supraoptic & paraventricular)
4. Effect = 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)
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 = ________________________

Effectors = ________________________

Effect = ________________________

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**Stimulus** = body temp:

Sensors = _____________________________

Integrating center = ________________________

Effectors = ________________________

Effect = ________________________

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

1. **Stimulus** = change in blood glucose

2. **Sensor, integrating center, & effector** = pancreas,
   (islets of langerhans)

*Depending on blood glucose levels pancreas secrete:*

**Stimulus:** If blood glucose too high

Sensor, integrating center, & effector = ____________

Beta cells secrete **Insulin**

Effect = ________________________

**VERSUS**

**Stimulus:** If blood glucose too low

Sensor, integrating center, & effector = ____________

Alpha cells secrete **Glucagon**

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

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

Ex. C) Negative Feedback Loop = Blood Pressure changes

1. **Stimulus** = BP too high \( (\text{Systolic BP over 160 mmHg}) \)

2. **Sensors** = _____________________________

3. **Integrating center** = _____________________________

4. **Effectors** = _____________________________
   _____________________________

5. **Effect** = _____________________________

**VERSUS**

1. **Stimulus** = BP too low \( (\text{Systolic BP below 80 mmHg}) \)

2. **Sensors** = _____________________________

3. **Integrating center** = _____________________________

4. **Effectors** = _____________________________
   _____________________________

5. **Effect** = _____________________________
Review

• Physiology

• Homeostasis
  Dynamic constancy of internal environment despite external changes

• Feedback Loops
  Positive Feedback
  Negative Feedback

Part 2: Basics of Physiological Chemistry

1. Understand physiology of pH (Pg 10)
   (We are skipping Pgs 7 – 9, atoms and chemical bonds, as you’ve had already had chem 101 & 102).

The 4 major organic molecule groups will be covered in Ch 14 (Digestive Physiology)

See Supplements Page! > Chemistry!
1. pH

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

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)?
**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.
2. Kidneys
3. Liver

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**Review**

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