Chapter 1: An Introduction to the Human Body

Read pages 1 through 11

TOPIC OUTLINE AND OBJECTIVES NAME: _____

A. Anatomy and physiology defined

1. Define anatomy with its subdivisions, and physiology.

B. Levels of structural organization

2. Define each of the following levels of structural organization that make up the human body: chemical, cellular, tissue, organ, system, and organism.
3. Identify the principle systems of the human body, list representative organs of each system, and describe the function of each system.

C. Life Processes

4. List and define several important life processes of the human body.

D. Homeostasis

5. Define homeostasis and explain its relation to interstitial fluid (ICF).

E. Control of Homeostasis

6. Define a feedback system and explain its role in homeostasis.
7. Contrast the operation of negative and positive feedback systems.
8. Homeostatic imbalances.

F. Clinical Applications

A. Anatomy and physiology defined (page 2)

AI. Contrast each of the following pairs of terms.

a. Anatomy/physiology

b. Gross anatomy/histology

c. Systemic anatomy/regional anatomy

d. Developmental anatomy/embryology

e. Immunology/pathophysiology

A2. Look at the two items in each of the following pairs. Tell how their <u>structural differences</u> explain their <u>functional differences</u>.

a. Spoon/fork

b. Hand/foot

c. Incisors (front teeth)/molars

B. Levels of structural organization (pages 3 - 5)

B1. Arrange the terms listed in the left box from highest to lowest in level of organization by writing the terms on the lines provided at the left below. One is done for you. Now, match the terms in the right box with the related level of organization by writing those terms on the lines to the right.

Cell	**Organism**
Chemical	**System**
Organ	**Tissue**

Levels of Organization:

a. _____ (highest)

b. ____system_____

c. _____

d. _____

e. _____

f. _____ (lowest)

DNA	**Smooth muscle tissue**
Reproductive System	**Uterus**
Smooth muscle cell	**21-year-old woman**

Examples:

a. _____ (highest)

b. _____

c. _____

d. _____

e. _____

f. _____ (lowest)

B2. Complete the following table describing systems of the body. Name <u>two or more organs</u> in each system. Then, list <u>one function</u> of each system. Some are done for you!

System	Organs	Functions
a.	**Skin, hair, nails, sweat glands**	
b. Skeletal		
c. Muscular		
d.		**Regulates body by nerve impulses**
e.	**Glands that produce hormones, eg. ovaries, adrenal gland**	
f.	**Blood, heart, blood vessels**	
g. Lymphatic/Immune		
h.		**Supplies O_2, removes CO_2, and helps regulate acid-base balance**
i.		**Breaks down food and eliminates solid wastes**
j.	**Kidney, bladder, urethra**	
k. Reproductive		

C. Characteristics of the living human organism (pages 5 - 8)

C1. Six characteristics distinguish you from nonliving things. List these characteristics below and a brief definition.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

C2. Refer to the list of life processes in the box. Match the life process with the activities in your own body. One will not be used.

D.	**Differentiation**	**Move.**	**Movement**
G.	**Growth**	**Repro.**	**Reproduction**
Meta.	**Metabolism**	**Resp.**	**Responsiveness**

_____a. Your **hunger** at 8:00 A.M. **prompts you** to eat breakfast.

_____b. During breakfast you **chew** your toast and an egg; your **stomach** and **intestine** then **contract** to help break apart the food and **propel** it through the digestive tract.

_____c. Your **body utilizes the starch**, **sugars and protein** in your breakfast foods to **provide energy** to your eyes and brain for studying anatomy and physiology.

_____d. After you work out four days a week for one month, you note that your **arm and thigh muscles are larger**.

_____e. As you work out, **"stem cells" in your bone marrow are stimulated to undergo changes** to become mature red blood cells (RBC) so you experience a healthy increase in your RBC count.

D. Homeostasis and body fluids (page 8). For more information on body fluids and homeostasis see chapter 27, page 1037 for extra help!

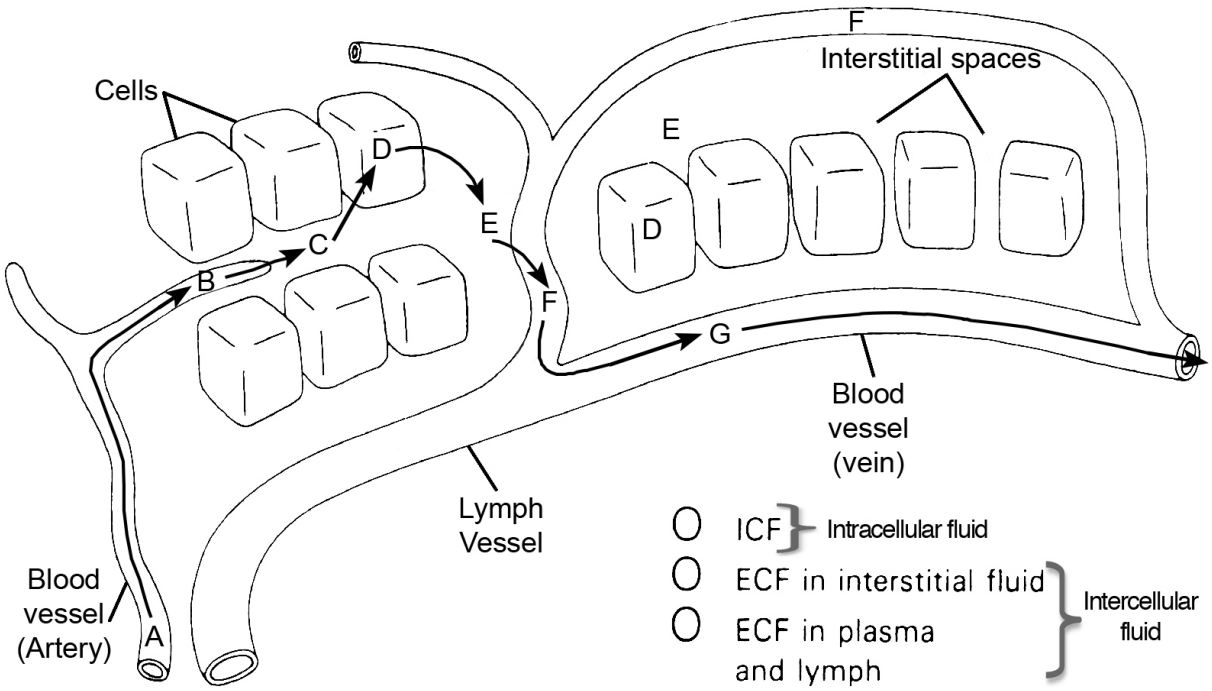


Figure 1: Internal environment of the body – types of body fluids.

D1. Describe the types of fluid in the body and their relationships to homeostasis by completing these statements and **Figure 1**.

a. Fluid inside the cell is known as _____ fluid (ICF). Color the areas containing this type of "straw-colored" fluid. Use the color **yellow** and color the corresponding color-code oval too!

b. Fluid in spaces between cells is called _____. It surrounds and bathes cells and is one form of *(intracellular? extracellular?)* fluid. Color the spaces containing this fluid **light green**.

Don't forget the color-code oval.

c. Another form of <u>extracellular fluid</u> is that located in **blood vessels** and _____ vessels. Color these areas **dark green**. Don't forget the color-code oval.

d. The body's "internal environment" or "sea within" is generally referred to as *(extra? intra?)* –cellular fluid, (all the light and dark green areas in your figure).

e. The <u>condition that is being maintained</u> when the ECF is in relative constancy is known as _____.

D2. Refer to Figure 1. Show the pattern of circulation of body fluids by drawing arrows connecting the letters in the figure in alphabetical order (A→ B→ C , etc.). Now, fill in the blanks below describing this lettered pathway:

A (_____) → **B** (blood capillaries) → **C** (_____) → **D** (_____)

→ **E** (_____) → **F** (_____) → **G** (_____)

D3. <u>List seven</u> qualities (conditions) of ECF that are maintained under optimal conditions when the body is in homeostasis.

E. Control of homeostasis: Components of a feedback mechanism (pages 8 - 12)

E1. Are you seated right now? For safety, hold on to the back of your chair or desk and then stand up quickly. As you do, conceptualize what happens to your blood as you change position, i.e. in response to gravity, the blood tends to fall to the lower part of your body. If nothing happened to offset that action, your blood pressure (BP) would drop and you would likely faint because of insufficient blood supply to the brain. This usually does not happen because homeostatic mechanisms act to quickly elevate blood pressure back to normal.

*__Match the answers in the box__ with the factors and functions that helped maintain your blood pressure when you stood up quickly. (Hint: Figure 1.3, page 10 in your text is the opposite situation of this one!)

CCent.	**Control center**	**O.**	**Output**
CCond.	**Controlled condition**	**Recep.**	**Receptors**
E.	**Effector**	**Respo.**	**Response**
I.	**Input**	**S.**	**Stimulus**

_____a. Your blood pressure (BP): **a factor that must be maintained** homeostatically.

_____b. **Standing up**; blood flowed by gravity to lower parts of your body.

_____c. **Pressure-sensitive nerve cells** in large arteries in your neck and chest.

_____d. **Nerve impulses sent to the brain bearing the message "BP is too low"** (since less blood remained in the upper part of your body as you were standing).

_____e. Your **brain**.

_____f. **Nerve impulses from your brain** to your heart, bearing the message "beat faster!"

_____g. Your **heart "beats faster!"**

_____h. **Elevated BP**.

E2. Consider how your internal environment is affected by your external environment. Which of the seven qualities of your ECF listed in **D3** would be altered if you were subjected to the following conditions? Compare your answers with those of a study partner.

a. Taking a two-day hike at high altitude without appropriate food or clothing

b. Invasion of your body by an infectious microorganism that causes fever and diarrhea over a prolonged period of time.

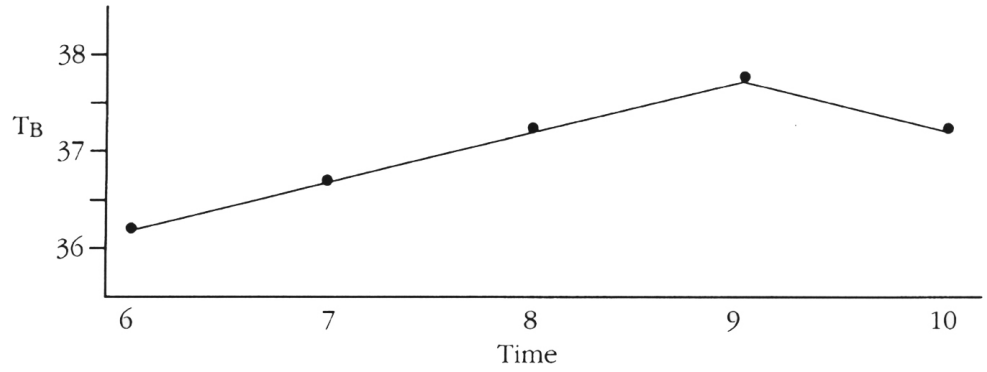
E3. Consider an example of a feedback system. Ten workers on an assembly line are producing hand-made shoes. As shoes come off the assembly line, they pile up around the last worker, Worker Ten. When this happens, Worker Ten calls out, "We have hundreds of shoes piled up here." This information (input) is heard by (fed back to) Worker One who determines when more shoes should be begun. Worker One is therefore the ultimate controller of output. This controller could respond in either of two ways. In a *negative feedback system,* Worker One says, "We have an excess of unsold shoes. Let us slow down or stop production until the excess (stress) is relieved – until these shoes are sold." **What might Worker One's response be if this were a *positive feedback system?***

E4. Most feedback systems of the body are *(positive? negative?)*. **Why do you think this might be advantageous and directed toward maintenance of homeostasis?**

E5. For each of the following sets of data, graph the provided data as shown in the example just below. Then, determine whether the data show negative or positive feedback operating.

EXAMPLE:

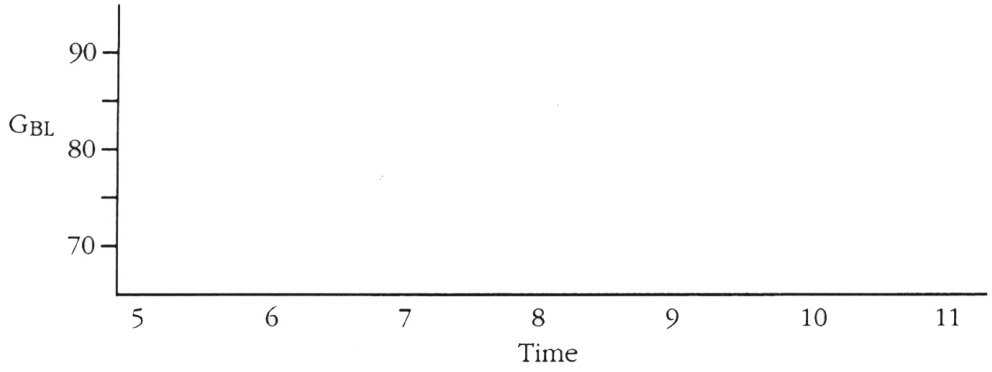
Body temperature (T_B), °C:	36.5	37.0	37.5	38.0	37.5
Time, hours, A.M.:	6	7	8	9	10



Type of feedback: negative

1. Blood glucose (G_{BL}), mg/100 ml:

Blood glucose (G_{BL}), mg/100 ml:	70	73	78	87	90	88	76
Time, hours, A.M.:	5	6	7	8	9	10	11

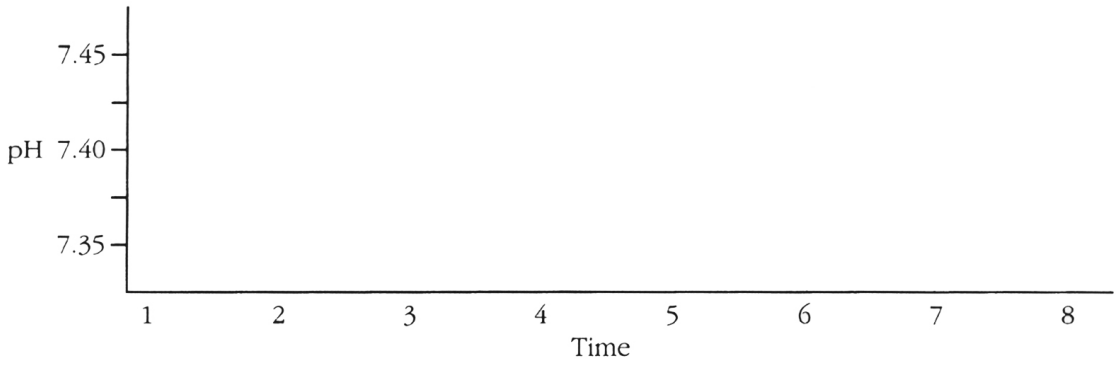


Type of feedback: _____

2. Blood pH:

7.36	7.38	7.42	7.43	7.41	7.39	7.37	7.40
1 P.M.	2 P.M.	3 P.M.	4 P.M.	5 P.M.	6 P.M.	7 P.M.	8 P.M.

Time:

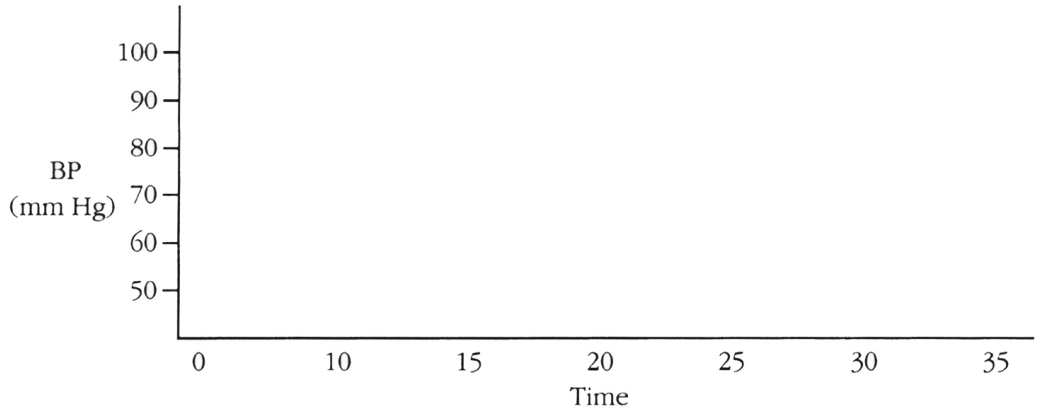


Type of feedback: _____

3. Blood pressure (BP), mm Hg:

95	89	86	80	73	66	58
0	10	15	20	25	30	35

Time, minutes:



Type of feedback: _____

E6. Dr. Jones measures her patient's blood pressure and heart rate using a blood pressure cuff and stethoscope. The patient feels light-headed and is sweating profusely during the examination.
Dr. Jones determines that the patient's low blood pressure and irregular heart rate are due to abnormal electrical activity of the heart. The patient will require surgery for a pacemaker implant. After surgery, the patient's electrical activity returns to normal values. Dr. Jones explains that most pacemaker patients live long healthy lives with regular monitoring of the artificial pacemaker.

*** Match the terms in the box with the statement from the clinical scenario above. HEY, one is not used!**

Diag.	**Diagnosis**	**Prog.**	**Prognosis**
Symp.	**Symptoms**	**Exam.**	**Examination**
Sign.	**Signs**	**Dis.**	**Disease**

_____a. **Dr. Jones measures** her patient's blood pressure and heart rate.

_____b. The patient **feels light-headed and is sweating** profusely.

_____c. The patient's **low blood pressure and irregular heart rate** are due to **abnormal electrical activity** of the heart.

_____d. The **patient will require surgery** for a pacemaker implant.

_____e. **Most pacemaker patients live long healthy lives** with regular monitoring of the artificial pacemaker.

F. Clinical Applications: Please respond in complete sentences and complete thought!

1. A jogger has stepped in a pothole and *sprained his ankle*. Which of the eleven organ systems have suffered damage? Explain.

2. A newborn baby is unable to hold down any milk. Examination reveals a developmental disorder in which the esophagus fails to connect at the stomach. Which **"survival needs"** are most immediately threatened?

3. In certain populations, such as malnourished or frail elderly, the mechanisms necessary for maintaining blood pressure occur more slowly than normal. As a result, blood pressure may drop as the person changes position (from lying to sitting or standing). This condition, *postural hypotension*, may lead to faintness and falls. What might you suggest to a person who is subject to *postural hypotension* do to minimize the chance of falling?

4. In congestive heart failure, the weakened heart is unable to pump with sufficient strength to empty its own chambers. As a result, blood backs up in the veins, blood pressure rises, and circulation is impaired. Describe what will happen as this situation worsens owing to positive feedback. Then, predict how a heart-strengthening medication will reverse the positive feedback condition.

Chapter 1: Essay Questions

1. Which two body systems function in the integration and coordination of all the other body systems; especially as it relates to regulation of feedback mechanisms? State their functions relative to feedback mechanisms. Give a specific physiological example.

2. State the Central Dogma of Physiology and how it relates to homeostasis.
   Be sure to mention the conditions that must be maintained.

3. What major regulatory or compensatory process does the body use to maintain homeostasis? Explain this regulatory process using any physiological example. Be sure to include all the specific components of a feedback system in your example. (Your textbook is very helpful)

4. Explain a positive feedback system and how it relates to maintaining homeostasis?
   Use any specific physiological example to illustrate your answer. Be sure to include all the specific components of a feedback system in your example. (Your textbook is very helpful)