Part I. Clinical Applications

1. The hormone thyroxine is released in response to a pituitary hormone called thyroid stimulating hormone (TSH). As thyroxine levels increase in the blood, they exert negative feedback on the release of TSH by the pituitary gland. What effect will this have on the release of TSH?

2. During exercise, blood flow to skeletal muscles increases. The initial response that increases blood flow is due to changes that happen within the muscle and is independent of the nervous and endocrine systems. Which type of homeostatic regulation (intrinsic or extrinsic) is this and why?

3. Blood Pressure drops when a person goes from a lying to standing position. In order to correct the decreased drop in blood pressure the body uses mechanisms to increase blood pressure. Do these mechanisms use positive or negative feedback processes? Describe how the body responds to correct this situation.
4. Are the events of child birth a positive or negative feedback process? Describe the events that support your answer.

5. Using insulin as an example, explain how the secretion of this hormone is stimulated and the mechanism by which its secretion is turned off. Hint: Think about feedback systems.

6. Who are Claude Bernard and Walter Cannon? Why are the concepts they introduced so important in physiology and medicine?

7. Monitoring fetal development may be dangerous for the fetus if improper diagnostic techniques are used. Why is ultrasound an effective means of monitoring fetal development?
8. Gastroenterologists use X-rays to check for ulcers or other stomach and upper digestive tract disorders. Before the X-rays are taken why is it necessary for the patient to drink large quantities of a solution that contains barium ions?

9. The following are advanced imaging techniques have been discussed in lecture: CT, DSA, PET, ultrasound, and MRI. Which of these techniques uses X-rays? Which uses radio waves and magnetic fields? Which uses radioisotopes? Which displays body regions in sections? Your may have more than one answer for each question.

10. You are studying for your first physiology exam and want to know which areas of your brain are working hardest as you study. Your classmate suggests that you could have a computed tomography (CT) scan done to assess your brain activity. Would this be the best way to determine brain activity?

11. Certain bacterial infections can cause a fever to develop. Describe the bases for fever formation and dissipation and how antipyretics such as aspirin work.
The following statements refer to homeostatic control systems. Complete each statement by inserting your answers in the answer blanks.

1. There are three essential components of all homeostatic control mechanisms: control center, receptor, and effector. The \((1)\) senses changes in the environment and responds by sending information (input) to the \((2)\) along the \((3)\) pathway. The \((4)\) analyzes the input, determines the appropriate response, and activates the \((5)\) by sending information along the \((6)\) pathway. When the response causes the initial stimulus to decline, the homeostatic mechanism is referred to as a \((7)\) feedback mechanism. When the response enhances the initial stimulus, the mechanism is called a \((8)\) feedback mechanism. \((9)\) feedback mechanisms are much more common in the body.

The structures of the body are organized into successively larger and more complex structures. Fill in the answer blanks with the correct terms for these increasingly larger structures.

Chemical (atoms, molecules) \(\rightarrow\) \(10.\) \(\rightarrow\) \(11.\) \(\rightarrow\) Organism

\(12.\) \(\rightarrow\) \(13.\) \(\rightarrow\) Organism

Complete the following statements by filling in the answer blanks with the correct term.

14. The abdominopelvic and thoracic cavities are subdivisions of the \((14)\) body cavity; the cranial and spinal cavities are parts of the \((15)\) body cavity. The \((16)\) body cavity is totally surrounded by bone and provides very good protection to the structures it contains.

Using the key choices, identify the body cavities where the following body organs are located. Enter the appropriate term in the answer blanks.

**Key Choices**

Abdominopelvic Cranial Spinal Thoracic

17. Stomach \(\quad\) 23. Bladder

18. Small intestine \(\quad\) 24. Trachea

19. Large intestine \(\quad\) 25. Lungs

20. Spleen \(\quad\) 26. Pituitary gland

21. Liver \(\quad\) 27. Rectum

22. Spinal cord \(\quad\) 28. Ovaries
Identify which systems in the box match descriptions listed

<table>
<thead>
<tr>
<th>Digestive</th>
<th>Lymphatic and immune</th>
<th>Skeletal</th>
</tr>
</thead>
<tbody>
<tr>
<td>. Endocrine</td>
<td>Reproductive</td>
<td>Urinary</td>
</tr>
<tr>
<td>. Integumentary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

29. Produces hormones
30. Includes kidneys, ureters, bladder, and urethra
31. Includes ovaries and uterus (females), prostate and penis (males)
32. Returns proteins to blood; protects against disease
33. Supports the body, stores calcium, and serves as site of blood cell formation
34. Consists of skin, hair, nails, and some glands
35. Includes esophagus, stomach, intestine, liver, gallbladder, and pancreas

Fill in the blanks in this definition of homeostasis.

36. Homeo means ____________________ and stasis means ____________________.

37. Homeostasis is the condition in which the fluid around body cells, called ____________________ fluid or the body’s ____________________ environment, remains relatively stable so that it stays within certain limits.

38. List at least five qualities of your interstitial fluid that are maintained under the optimal conditions when your body is in homeostasis.

Are you seated right now? For safety, hold on to the chair or desk, and then stand up quickly. Describe the homeostatic mechanism that follows as an effort to maintain your blood pressure (BP) at a normal level.

39. The effect of gravity as you stand up causes blood to flow to the (upper? lower?) parts of your body, ______-creasing BP in your upper body. This change is called a(n) (stimulus? output?), which causes (effectors? receptors?) in blood vessels of your neck to sense the decreased BP. As a result, nerve impulses, called (input? output?), are sent to your brain, known as the ____________________ center.

40. Your brain then conveys nerve impulses, called (effectors? output? response?), to your heart and blood vessels. These organs serve as (effectors? output? response?) and cause the desired (effectors? output? response?): an elevation of your BP back to normal.

41. The homeostatic mechanism just described is a (positive? negative?) (or opposite) feedback mechanism because the slight decrease in BP (upon your standing) triggered mechanisms to ______-crease BP back to normal. If mechanisms had caused your blood pressure to drop even further as you stood, this would have been a (positive? negative?) (or same direction) feedback mechanism.

42. Most of the body’s homeostatic mechanisms are (positive? negative?). Write an example of one that is positive.

43. Suppose an individual’s body temperature is 37.3° C, which is outside the “normal” range. This variation from the “normal” range may represent:

a. an illness that has not been identified
b. individual variation rather than a homeostatic malfunction
c. the need to see a physician immediately
d. a variability that is abnormal
Match the terms in Column B to the appropriate descriptions provided in Column A. Enter the correct corresponding term in the answer blanks.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The branch of biological science that studies and describes how body parts work or function</td>
<td>Anatomy</td>
</tr>
<tr>
<td>2. The study of the shape and structure of body parts</td>
<td>Homeostasis</td>
</tr>
<tr>
<td>3. The tendency of the body's systems to maintain a relatively constant or balanced internal environment</td>
<td>Metabolism</td>
</tr>
<tr>
<td>4. The term that indicates all chemical reactions occurring in the body</td>
<td>Physiology</td>
</tr>
</tbody>
</table>

Using the key choices, identify the organ systems to which the following organs or functions belong. Insert the correct term in the answer blanks.

**Key Choices**

Cardiovascular  Integumentary  Nervous  Skeletal
Digestive       Lymphatic/Immune  Reproductive  Urinary
Endocrine       Muscular        Respiratory

5. Rids the body of nitrogen-containing wastes
6. Is affected by the removal of the thyroid gland
7. Provides support and levers on which the muscular system can act
8. Includes the heart
9. Protects underlying organs from drying out and mechanical damage
10. Protects the body; destroys bacteria and tumor cells
11. Breaks down foodstuffs into small particles that can be absorbed
12. Removes carbon dioxide from the blood
13. Delivers oxygen and nutrients to the body tissues
14. Moves the limbs; allows facial expression
15. Conserves body water or eliminates excesses
16. Provides for conception and childbearing
17. Controls the body with chemicals called hormones
18. Is damaged when you cut your finger or get a severe sunburn
**BODY TREK:**

Using the terms below, fill in the blanks to complete the trek through the levels of organization in the human body.

<table>
<thead>
<tr>
<th>Tissues</th>
<th>Organelles</th>
<th>Cells</th>
<th>Organism</th>
<th>Subatomic particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protoplasm</td>
<td>Atoms</td>
<td>Systems</td>
<td>Molecules</td>
<td>Organs</td>
</tr>
</tbody>
</table>

Robo, the micro-robot, is introduced into the body by way of the mouth where immediate contact is made with the lining of the mouth, which consists of a mucous epithelium. Immediate feedback to Mission Control gives information about the chemical interactions taking place, resulting in the formation of cells. Robo discloses that protons, neutrons, and electrons, which are (32) ________ , are combining in specific numbers and arrangements to form (33) ________ . There, forms, invisible to the naked eye but revealed by Robo’s advanced detection system, seem to be sharing and/or giving and taking electrons and forming bonds which hold them together to make (34) ___________. The chemical conglomeration of the bonded forms results in a complex living, somewhat colloidal, substance called (35) ___________. The living matter contains some organized structures called (36) ___________. The living matter is surrounded by a double phospholipid-protein layered enclosure known as a membrane. The enclosed living substance along with its organized microscopic forms comprises the makeup of the individual units of structure and function in all living things called (37) ___________. As Robo’s trek continues it is quite evident that there are many of the individual units which are combining with one another to form (38) ___________. Four kinds are detected as Robo treks into other areas of the body. Epithelial was rather plentiful in the mouth, while other areas of the body include the presence of muscular, nervous, and connective types. The complex, multi-unit types form more organized and complex structural and functional units called (39) ___________, which, when performing in a similar capacity, make up the eleven body (40) ___________. The complex, complete, living being is referred to as an (41) ___________.

With the completion of Robo’s investigation, Mission Control programs a convenient exit by way of the mouth, and preparations will be made for the next body trek.
11. A hormone called parathyroid hormone acts to help raise the blood calcium concentration. According to the principles of negative feedback, an effective stimulus for parathyroid hormone secretion would be:

A. a fall in blood calcium
B. a rise in blood calcium
C. a decrease in blood pH
D. an increase in blood pH

2. The hormone calcitonin is released from the thyroid gland in response to increased levels of calcium ions in the blood. If this hormone is controlled by negative feedback, what effect would calcitonin have on blood calcium levels?

Choose the organ system to which each of the following sets of organs belongs. Enter the correct term in the answer blanks.

3. Blood vessels, heart
4. Pancreas, pituitary, adrenal glands
5. Kidneys, bladder, ureters
6. Testis, vas deferens, urethra
7. Esophagus, large intestine, rectum
8. Breastbone, vertebral column, skull
9. Brain, nerves, sensory receptors

11. A hormone called parathyroid hormone acts to help raise the blood-calcium concentration. According to the principles of negative feedback, an effective stimulus for parathyroid hormone secretion would be:

A. a fall in blood calcium
B. a rise in blood calcium
C. a decrease in blood pH
D. an increase in blood pH

12. The subdivisions of the ventral body cavity include the:
   a. pleural and pericardial cavity
   b. thoracic and abdominopelvic cavity
   c. pelvic and abdominal cavity
   d. cranial and spinal cavity

12. The subdivisions of the dorsal body cavity include the:
   a. thoracic and abdominal cavity
   b. abdominal and pelvic cavity
   c. pericardial and pleural cavity
   d. cranial and spinal cavity
13. **Anatomy** is the study of _____ and **physiology** is the study of _____.

a. function, structure  
b. animals, plants  
c. cells, microorganisms  
d. structure, function

14. The scientist who studies the effects of **diseases** on organ or system functions would be classified as a:

a. histophysiological  
b. cell physiologist  
c. system physiologist  
d. pathological physiologist

15. The smallest **living** units in the body are:

a. elements  
b. subatomic particles  
c. cells  
d. molecules

16. The level of organization that reflects the interactions between organ systems is the:

a. cellular level  
b. tissue level  
c. molecular level  
d. organism

17. The two regulatory systems in the human body include the:

a. nervous and endocrine  
b. digestive and reproductive  
c. muscular and skeletal  
d. cardiovascular and lymphatic

18. **Homeostasis** refers to:

a. the chemical operations under way in the body  
b. individual cells becoming specialized to perform particular functions  
c. changes in an organism’s immediate environment  
d. the existence of a stable internal environment

19. When a variation outside of normal limits triggers an automatic response that corrects the situation, the mechanism is called:

a. positive feedback  
b. crisis management  
c. negative feedback  
d. homeostasis

20. When the initial stimulus produces a response that exaggerates the stimulus, the mechanism is called:

a. autoregulation  
b. negative feedback  
c. extrinsic regulation  
d. positive feedback

21. The spleen, tonsils, and thymus are all organs in which system?

A. Nervous  
B. Lymphatic  
C. Cardiovascular

22. The following structures are all located in the ventral cavity except:

A. Spinal cord  
B. Urinary bladder  
C. Heart

23. A neurosurgeon orders a spinal tap for a patient. Into what body cavity will the needle be inserted?

A. Ventral  
B. Thoracic  
C. Dorsal

24. An accident victim has a collapsed lung. Which cavity has been entered?

A. Mediastinal  
B. Pericardial  
C. Pleural

25. Which body system would be affected by degenerative cartilage?

A. Muscular  
B. Nervous  
C. Cardiovascular

26. When a capillary is damaged, a platelet plug is formed. The process involves platelets sticking to each other. The more platelets that stick together, the more the plug attracts additional platelets. This is an example of:

A. negative feedback  
B. positive feedback

27. A coronal plane through the head:

A. could pass through both the nose and the occiput  
B. could pass through both ears  
C. must pass through the mouth  
D. could lie in a horizontal plane

28. Which of the following is (are) involved in maintaining homeostasis?

A. Effector  
B. Control center  
C. Receptor
### Part X: Medical Imaging

<table>
<thead>
<tr>
<th></th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A computer compares an X-ray image of a region of the body before and after a contrast dye has been introduced.</td>
</tr>
<tr>
<td>2</td>
<td>Provides information on function as well as structure.</td>
</tr>
<tr>
<td>3</td>
<td>A single barrage of X-rays passes through the body and produces a two-dimensional image of the interior of the body.</td>
</tr>
<tr>
<td>4</td>
<td>High-frequency sound waves produced by a hand-held transducer reflect back to produce an image on a video monitor.</td>
</tr>
<tr>
<td>5</td>
<td>X-ray source arcs around the body, producing a cross-sectional picture.</td>
</tr>
<tr>
<td>6</td>
<td>Noninvasive and uses no radiation, but is not indicated for pregnant women or persons with pacemakers or metal joints.</td>
</tr>
</tbody>
</table>

Number the following structures, from darkest (black) to lightest (white), as they would appear on an X-ray. Number the darkest one 1, the next darkest 2, etc.

7. Soft tissue  
8. Femur (bone of the thigh)  
9. Air in lungs  
10. Gold (metal) filling in a tooth

11. The radiographic technique used to provide information about blood flow is:
   - A. DSR  
   - B. CT  
   - C. PET  
   - D. ultrasonography  
   - E. any X-ray technique

12. The procedure used to monitor circulatory pathways using radiodense dyes produces an X-ray image known as:
   - a. an MRI  
   - b. a CT scan  
   - c. an echogram  
   - d. an angiogram

13. Checking for tumors or other tissue abnormalities is best accomplished by the use of:
   - a. computerized tomography  
   - b. X-ray  
   - c. ultrasound  
   - d. magnetic resonance imaging

14. Resistance to X-ray penetration is called radiodensity. From the following selections, choose the one that correctly shows the order of increasing radiodensity of materials in the human body.
   - a. air, liver, fat, blood, bone, muscle  
   - b. air, fat, liver, blood, muscle, bone  
   - c. air, fat, blood, liver, muscle, bone  
   - d. air, liver, blood, fat, muscle, bone
Part VII Experimental Design
For the following statements / hypothesis identify the variables, control group, and experimental group.

1. Cigarette smoking increases the risk of lung cancer. Hypothesis: If you smoke cigarettes, then your chances of getting cancer increases.
   
   **Independent Variable:** 
   **Dependent Variable:**

   **Control Group:**
   **Experimental Group:**

   **Answers:**
   Independent Variable: **Smoking cigarettes**
   Dependent Variable: **Whether you get cancer**
   Control Group: **People who do not smoke**
   Experimental Group: **Smokers**

2. Eating breakfast increases performance in school. Hypothesis: If you eat breakfast, then you will get better grades.

   **Independent Variable:**
   **Dependent Variable:**

   **Control Group:**
   **Experimental Group:**

3. Hummingbirds are attracted to the color red. Hypothesis: If a bird feeder is red, then it will attract hummingbirds.

   **Independent Variable:**
   **Dependent Variable:**

   **Control Group:**
   **Experimental Group:**

4. iBook batteries last for 5 hours. Hypothesis: If you use iBook batteries, then your iBook will run for 5 hours.

   **Independent Variable:**
   **Dependent Variable:**

   **Control Group:**
   **Experimental Group:**

5. You conduct an experiment on twenty 18-year-old male subjects to see how various intensities of exercise influence heart rate. Which of the following is/are considered an independent variable?

   A) age of subjects    B) sex of subjects    C) intensity of exercise    D) heart rate
6. You conduct an experiment on twenty 18-year-old male subjects to see how various intensities of exercise influence heart rate. Which of the following is/are considered a dependent variable?
   A) age of subjects   B) sex of subjects   C) intensity of exercise   D) heart rate

7. Suzie wants to know the effect of different colors of light on the growth of plants. She believes that plants can survive best in white light. She buys 5 ferns of the same species, which are all approximately the same age and height. She places one in white light, one in blue light, one in green light, one in red light and one in the closet. All of the ferns are planted in Miracle-Grow and given 20 mL of water once a day for 2 weeks. After the two weeks, Suzie observes the plants and makes measurements. Hypothesis: If plants are grown in white light, then they will grow taller.

   Independent Variable: ____________________________
   Dependent Variable: ____________________________
   Control Group: ____________________________
   Experimental Group: ____________________________

8. Place these terms in the typical sequence in which they appear in the process of scientific inquiry: collect and analyze data, theory, model, question, hypothesis, replication, experiment, observation.

   Possible terms to use for the following questions:
   Blind  Double-blind  Crossover  Retrospective  Placebo  Nocebo
   Control hypothesis  Model  Theory  Double-blind crossover
   Independent variable
   Dependent variable

9. A study in which a participant acts as an experimental subject in part of the experiment and a control in another part of the experiment is called a __________ study.

10. An inactive drug or treatment that is expected to have no pharmacological or medical effect is called a ____________.

11. Term of an educated (logical) guess as to how that event happens: _____________.

12. If a scientific model is supported or verified repeatedly by multiple investigators, it may become a ____________

13. It is an ill effect caused by the suggestion or belief that something is harmful. It is the phenomenon whereby a patient who has been informed of the side effects of a drug he is taking is more likely to experience some of the side effects than an otherwise similar patient receiving the same drug who has not been so informed. This is known as the ____________ effect.

14. The ____________ is the variable that is controlled by the experimenter, it is the variable that is altered or removed.

15. ____________ study is when a third party, not involved in the experiment, is the only one who knows which group is receiving the experimental treatment and which group is receiving the control treatment.

16. ____________ study is when the control group is the first half of the experiment becomes the experimental group in the second half, and vice versa, but no one involved (except the third party) knows who is taking the active treatment.

17. The __________ effect is where a patient taking an inactive substance thinks they are taking the actual medication and due to the power of their mind, there is a positive change in health not attributable to medication or treatment.