

# Instructor's Answer Key

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## Chapter 1: The Study of Body Function

### Answers to Test Your Understanding of Concepts and Principles

1. Epithelial membranes may be simple or stratified, and may be squamous, cuboidal, or columnar. Simple membranes are adapted for diffusion (such as the simple squamous epithelia of the lungs and of the blood capillaries); simple columnar membranes are also adapted for transport (such as the simple columnar membrane that lines the gut). The transitional epithelium of the urinary bladder is adapted for distension. Stratified squamous epithelia are adapted to provide protection. This is the most evident in the epidermis of the skin, where the surface layer is dead and impregnated with keratin. [Note: This question is also answered in the Student Study Guide.]
2. These are all connective tissues with abundant extracellular material. They differ mainly in the nature of this extracellular material. The dermis of the skin is loose connective tissue, somewhat flexible with a ground substance of mucopolysaccharides and scattered collagen fibers. The extracellular material of bone is hard (calcified) while that of blood is an aqueous fluid (plasma).
3. Antagonistic processes provide a finer degree of control than could be provided by a single unopposed regulatory process. If two antagonistic mechanisms are involved, a change in one direction from the set point of a given value of the internal environment stimulates that regulatory process which causes a change in the opposite direction; while this change from the set point inhibits the antagonistic process that promotes the same direction of change.
4. The secretion of a hormone is regulated by negative feedback inhibition. Thus, if insulin promotes a lowering of blood glucose concentrations, a rise in blood glucose stimulates secretion of insulin while a fall in blood glucose inhibits secretion of insulin.
5. The process begins in basic physiological research often at the cellular or molecular level. Once a drug is developed, then it is tested in research animals. Primarily laboratory rats and mice models that are genetically susceptible to particular diseases that resemble human diseases are used for testing. If the toxicity of the drug in animals is low enough, then the drug will be tested in human clinical trials. Only after several years of testing, using quantitative measurements, unbiased statistical analysis of experimental and control groups; and after passing through four stringent phases, will a drug be approved. Without animal research, drugs could not be tested for toxicity and new drug discovery in the treatment of diseases would be severely curtailed.
6. Claude Bernard observed that the “milieu interior” remains remarkably constant despite changing conditions in the external environment. This idea of internal constancy is fundamental to understanding the processes of the body. It is when the body cannot maintain this internal constancy that illness occurs and the role of medicine as a science is to intervene in the attempt to return to homeostasis.

## Answers to Test Your Ability to Analyze and Apply Your Knowledge

1. Positive feedback operation of physiological regulatory mechanisms would result in the action of effectors *amplifying* the original changes from the set point rather than correcting or compensating for the original change. In the case of body temperature, an increase in temperature would result in a further increase in temperature. In the case of pH changes, positive feedback would amplify the change with drastic consequences. It seems our orderly controls in life would not be possible if positive replaced negative feedback.
2. Following an injection of insulin, the blood glucose levels dropped sharply from its initial level (~ 90 mg/dl) and continued to fall over the ensuing 40 minutes. At this point, compensatory responses of other hormones began operating. The initial set point of blood glucose concentration was reestablished after another 80 minutes (120 minutes from time 0). Quantitative measurements must be used to study physiological mechanisms, including the determination of such values as the set point, normal range, and deviations, in order to differentiate between normal and abnormal values.
3. The body tissues, organs, and systems are divided into intracellular (cytoplasm) and extracellular (blood plasma and interstitial fluid) compartments that must be able to communicate in the appropriate distribution of water and solute materials present in these aqueous phases. For example, the molecules and ions necessary for life are delivered to all cells by traveling between these compartments. Furthermore, intracellular wastes are removed and eliminated in the aqueous phase with the help of such organs as the kidneys and the liver.