

BIOLOGY (Biochemistry and Molecular and Cellular Biology)
SUPPLEMENTAL EDUCATIONAL OUTCOMES
BASED on CAPE 2004

PHARMACEUTICAL CARE Provide pharmaceutical care in cooperation with patients, prescribers, and other members of an interprofessional health care team based upon sound therapeutic principles and evidence-based data, taking into account relevant legal, ethical, social, economic, and professional issues, emerging technologies, and evolving biomedical, sociobehavioral, and clinical sciences that may impact therapeutic outcomes.

1. Describe the structure, function and metabolic pathways for carbohydrates, amino acids and lipids.
 - a. Identify the biochemical class (lipid, carbohydrate, amino acid) to which a monomeric compound belongs.
 - b. Outline the general primary biochemical pathway by which such a compound is oxidized in the cell.
 - c. Predict pathological consequences of blockages or regulatory errors in these pathways. Note points where drug therapeutic intervention may be possible.
 - d. Describe how foods vary in nutritional value, relating this to the chemical composition of the foodstuff.
 - e. Relate energy generation, storage, and mobilization in the body to the function of adipose tissue, liver, and kidney.
 - f. Distinguish essential from nonessential nutrients, including lipids, amino acids, vitamins, and minerals, and explain why they are essential.
2. Discuss the alterations in lipid and carbohydrate metabolism that occur as a result of diabetes.
 - a. Distinguish among the types of diabetes in terms of their underlying causes.
 - b. Relate differences in causes of different types of diabetes to upsets in metabolic pathways for lipids and carbohydrate, and connect these upsets to symptoms of the various types of diabetes. Note where drug therapeutic intervention may be possible.
3. Discuss the metabolism of lipoproteins, medical problems associated with abnormal lipoprotein levels and therapeutic agents used to treat lipid disorders.
 - a. For lipids taken in the diet, outline the process of digestion and transport within the body, noting the role of lipoproteins, triglycerides, and cholesterol.
 - b. Outline the mechanisms of storage and mobilization of lipids for energy production in the body.
 - c. Predict pathological consequences of blockages or regulatory errors in these mechanisms and processes. Note points where drug therapeutic intervention may be possible.
4. Describe the metabolism of arachidonic acid and discuss the therapeutic implications related to the mechanism of NSAIDs and asthma therapy.
 - a. Relate the structure of arachidonic acid to its biochemical role as a precursor of prostaglandins, thromboxanes, and leukotrienes.
 - b. Describe the reactions performed by cyclo-oxygenases and outline the connections to the inflammatory process and to asthma.

- c. Employ knowledge of NSAID structural features to predict and rationalize their therapeutic effects and adverse effects.
 - d. Relate dietary intake of polyunsaturated fatty acids to cyclo-oxygenase action and production of mediators of inflammation.
 - e. Employ knowledge of leukotriene modifiers to predict and explain their action in treating asthma.
5. Describe how enzyme activity is regulated through second messengers and hormones.
 - a. List common second messengers and the biochemical pathways they play a role in. Note enzymes that produce or are regulated by these second messengers.
 - b. List common protein and peptide hormones and relate them to physiological systems such as the immune system, digestion, blood pressure regulation, and others. Do the same for common lipid-based hormones. Note enzymes that produce or are regulated by these hormones.
 - c. Note points in these pathways where drug therapeutic intervention may be possible.
6. Describe the processes involved in replication, transcription and translation of genetic information.
 - a. Describe the enzymatic reactions involved in the processes of replication, transcription, and translation.
 - b. Relate the action of antibiotics to these processes, describing the basis for selective inhibition of microbial processes over mammalian processes.
 - c. Explain how changes in genes and their expression can lead to altered biochemical function, and contribute to pathologies such as cancer and inborn errors in metabolism. List biochemical mechanisms leading to such genetic changes.
 - d. Outline the processes by which nucleotides are synthesized biochemically, and relate these to pathologies such as gout, Lesch-Nyhan disease, and immunodeficiencies. Note points in these pathways where drug therapeutic intervention may be possible.
 - e. Outline forensic and diagnostic uses of DNA amplification and hybridization technology. Describe the biochemical reactions that form the basis for this technology.
7. Describe the role of vitamin and minerals in metabolism and identify reactions utilized by these compounds.
 - a. List the vitamins and minerals needed for human health, and describe the amounts needed in the diet.
 - b. List dietary sources of the various vitamins and minerals, noting their relative richness as sources.
 - c. Identify the structure of vitamins and the related enzymatic cofactors, and note characteristic features. Relate the structure and chemical features to their function in enzymatic catalysis.
 - d. Note characteristic chemical properties of the required minerals, and relate these to their function in enzymatic catalysis.
8. Describe the biochemistry of membranes.
 - a. List the general biological functions performed by membranes.

BIOLOGY (Biochemistry and Molecular and Cellular Biology)
SUPPLEMENTAL EDUCATIONAL OUTCOMES
BASED on CAPE 2004

- 1) List lipids commonly found in biological membranes.
 - 2) Describe the leaflet structure of lipid bilayers and relate this to the chemical features of lipids commonly found in biological membranes.
-
- b. Relate the lipid composition of biological membranes to differences in physical properties of the membrane, and hence to differences in biological function. Note pathologies associated with membrane lipid biosynthesis and turnover.
 - c. Describe how proteins are associated with biological membranes, and relate the type of association (peripheral, integral) to the biological functioning of the protein.
 - d. Describe the role of biological membranes in drug absorption, distribution, and action.
-
9. Describe DNA recombination and discuss the impact it has on production of proteins as drugs.
 - a. Describe the general process of expression cloning of proteins, and note differences in such protein production by bacteria, yeast, and animal cells.
 - b. List examples of proteins produced by recombinant DNA technology for therapeutic and diagnostic uses.
 - c. Compare such artificially-produced proteins to those derived from traditional natural sources, noting differences in purity, cost, effectiveness, and safety.

The supplemental outcomes were developed by Educational Outcomes and Objectives Supplements Task Force Members: Marc W. Harrold, Duquesne University (chair); and others.