Anatomy and Physiology I

CREDIT HOURS: 3
LEVEL: LOWER

EXAM CODE: 104
CATALOG NUMBER: BIOx104

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Before You Choose
This UExcel Exam

Uses for the Examination

• Excelsior College recommends granting three (3) semester hours of lower-level undergraduate credit to students who receive a score equivalent to a letter grade of C or higher on this examination. This examination may be used to help fulfill a science requirement or as a free elective for all Excelsior College degree programs that allow free electives. It also partially fulfills the anatomy and physiology core requirement for the Excelsior College nursing degrees.

• Other colleges and universities also recognize this exam as a basis for granting credit or advanced standing.

• Individual institutions set their own policies for the amount of credit awarded and the minimum acceptable grade.

Exam-takers who have applied to Excelsior College should ask their academic advisor where this exam fits within their degree program.

Exam-takers not enrolled in an Excelsior College degree program should check with the institution from which they wish to receive credit to determine whether credit will be granted and/or to find out the minimum grade required for credit. Those who intend to enroll at Excelsior College should ask an admissions counselor where this exam fits within their intended degree program.

Examination Length and Scoring

The examination consists of approximately 120 questions, most of which are multiple choice; for samples of all the item types on this exam, see the sample items in the back of this guide. Some items are unscored, pretest items. The pretest items are embedded throughout the exam and are indistinguishable from the scored items. You will have two (2) hours to complete the examination. Your score will be reported as a letter grade.

UExcel Exam Resources

Excelsior College Bookstore

The Excelsior College Bookstore offers recommended textbooks and other resources to help you prepare for UExcel exams.

The bookstore is available online at (login required): www.excelsior.edu/bookstore

UExcel Practice Exams

The official UExcel practice exams are highly recommended as part of your study plan. Once you register for your UExcel exam, you are eligible to purchase the corresponding practice exam, which can be taken using any computer with a supported Web browser. Each practice exam includes two forms that you may take within a 180-day period.
Excelsior College Library

Enrolled Excelsior College students can access millions of authoritative resources online through the Excelsior College Library. Created through our partnership with the Sheridan Libraries of The Johns Hopkins University, the library provides access to journal articles, books, websites, databases, reference services, and many other resources. Special library pages relate to the nursing degree exams and other selected exams. To access it, visit www.excelsior.edu/library (login is required).

Our library provides:

- 24/7 availability
- The world’s most current authoritative resources
- Help and support from staff librarians

Online Tutoring

Excelsior College offers online tutoring through SMARTTHINKING™ to connect with tutors who have been trained in a variety of academic subjects. To access SMARTTHINKING, go to www.excelsior.edu/smartthinking. Once there, you may download a copy of the SMARTTHINKING Student Handbook as a PDF.

Preparing for UExcel Exams

How Long Will It Take Me to Study?

A UExcel exam enables you to show that you’ve learned material comparable to one or more 15-week college-level courses. As an independent learner, you should study and review as much as you would for a college course. For a 3-credit course in a subject they don’t know, most students would be expected to study nine hours per week for 15 weeks, for a total of 135 hours.

Study Tips

Become an active user of the resource materials. Aim for understanding rather than memorization. The more active you are when you study, the more likely you will be to retain, understand, and apply the information.

The following techniques are generally considered to be active learning:

- **preview or survey** each chapter
- **highlight or underline text** you believe is important
- **write questions or comments** in the margins
- **practice re-stating content** in your own words
- **relate what you are reading** to the chapter title, section headings, and other organizing elements of the textbook
- **find ways to engage** your eyes, your ears, and your muscles, as well as your brain, in your studies
- **study with a partner or a small group** (if you are an enrolled student, search for partners on MyExcelsior Community)
- **prepare your review notes** as flashcards or create recordings that you can use while commuting or exercising

When you feel confident that you understand a content area, review what you have learned. Take a second look at the material to evaluate your understanding. If you have a study partner, the two of you can review by explaining the content to each other or writing test questions for each other to answer. Review questions from textbook chapters may be helpful for partner or individual study, as well.

Using UExcel Practice Exams

We recommend taking the first form of the practice exam when you begin studying, to see how much you already know. After taking the first practice exam,
check your performance on each question and find out why your answer was right or wrong. This feedback will help you improve your knowledge of the subject and identify areas of weakness that you should address before taking the exam. Take the second form of the practice exam after you have finished studying. Analyze your results to identify the areas that you still need to review.

Although there is no guarantee, our research suggests that students who do well on the practice exams are more likely to pass the actual exam than those who do not do well (or do not take advantage of this opportunity).

About Test Preparation Services

Preparation for UExcel® exams and Excelsior College® Examinations, though based on independent study, is supported by Excelsior College with a comprehensive set of exam learning resources and services designed to help you succeed. These learning resources are prepared by Excelsior College so you can be assured that they are current and cover the content you are expected to master for the exams. These resources, and your desire to learn, are usually all that you will need to succeed.

There are test-preparation companies that will offer to help you study for our examinations. Some may imply a relationship with Excelsior College and/or make claims that their products and services are all that you need to prepare for our examinations.

Excelsior College is not affiliated with any test preparation firm and does not endorse the products or services of these companies. No test preparation vendor is authorized to provide admissions counseling or academic advising services, or to collect any payments, on behalf of Excelsior College. Excelsior College does not send authorized representatives to a student’s home nor does it review the materials provided by test preparation companies for content or compatibility with Excelsior College examinations.

To help you become a well-informed consumer, we suggest that before you make any purchase decision regarding study materials provided by organizations other than Excelsior College, you consider the points outlined on our website at www.excelsior.edu/testprep.

Preparing for This Exam

Prior Knowledge

A familiarity with basic terms of biology and with concepts such as basic cell structure and function is assumed.

Using the Content Outline

Each content area in the outline includes (1) the recommended minimum hours of study to devote to that content area and (2) the most important sections of the recommended resources for that area. These annotations are not intended to be comprehensive. You may need to refer to other chapters in the recommended textbooks. Chapter numbers and titles may differ in other editions.

This content outline contains examples of the types of information you should study. Although these examples are numerous, do not assume that everything on the exam will come from these examples. Conversely, do not expect that every detail you study will appear on the exam. Any exam is only a broad sample of all the questions that could be asked about the subject matter.

Using the Sample Questions and Rationales

Each content guide provides sample questions to illustrate those typically found on the exam. These questions are intended to give you an idea of the level of knowledge expected and the way questions are typically phrased. The sample questions do not sample the entire content of the exam and are not intended to serve as an entire practice test.

Recommended Resources for the UExcel Exam in Anatomy and Physiology I

The resources and materials listed below were used by the examination development committee to verify all the questions on the exam. Excelsior College recommends you use these resources as the most
appropriate information when ordering textbooks from the college's bookstore (see page 1 of this content guide). You should allow ample time to obtain resources and to study sufficiently before taking the exam, so plan appropriately and systematically.

A word about textbook editions: Textbook editions listed in the UExcel content guides may not be the same as those listed in the bookstore. Textbook editions may not exactly match up in terms of table of contents and organization, depending upon the edition. However, our team of exam developers checks exam content against every new textbook edition to verify that all subject areas tested in the exam are still adequately available in the study materials. If needed, exam developers will list supplemental resources to ensure that all topics in the exam are still sufficiently covered. Public libraries may have the textbooks you need, or may be able to obtain them for you through interlibrary loan to reduce textbook costs. You may also consider financial aid, if you qualify, to further help defray the steep cost of textbooks. A section on OER has been included in this guide to help you locate additional resources to augment your study.

Textbooks

The following textbook was used by the examination development committee to verify all questions on the exam. These study materials may be purchased from the Excelsior College Bookstore.

www.excelsior.edu/bookstore


NOTE: The textbook edition offered at the Excelsior College Bookstore is packaged with the following supplements:

- Foundations of Anatomy and Physiology–Access
- Human Anatomy and Physiology: Interactive Physiology 10 System Suite features narrated flash animation tutorials, quizzes, and glossary.
- Martini’s Atlas of the Human Body

Reducing Textbook Costs

Many students know it is less expensive to buy a used textbook, and buying a previous edition is also an option. The Excelsior College bookstore includes a buyback feature and a used book marketplace, as well as the ability to rent digital versions of textbooks for as long as students need them. Students are encouraged to explore these and the many other opportunities available online to help defray textbook costs.

A Word About Open Educational Resources

Open educational resources (OER) are educational materials available for study at no cost on the Web. Some OER are available for anyone to access any time. Others, such as Massive Open Online Courses (MOOCs), require sign-up and are only available during certain windows. Please note that some MOOC providers offer certificates of completion or other products or services for a fee. No MOOC or other OER is a complete substitute for the content guide and officially Recommended Resources listed here in this content guide. However, by definition, MOOCs are essentially free of charge and include access to a main body of learning materials that may help you in your learning.

Being an independent learner preparing for credit by exam, you may not need any of the fee-based options that are offered elsewhere online. But if you are looking for a coherent academic course for self-study, lectures on specific topics, or audio or visual materials that fit your learning style better than print materials alone, a MOOC or other type of OER may be your answer. Keep in mind that none of these OER were designed by Excelsior, nor are they guaranteed to match the exam content outlines completely. They are simply another tool available in your study kit.

We highly encourage using the Recommended Resources. In the content outline, you will see that the topics in the exam are referenced to specific portions of recommended textbooks. Using OER alone will not ensure you’ve completely covered the content in the exam, or it may not cover some topics in sufficient-enough depth without the use of the formal, recommended textbooks.

If the OER course you choose does not include a textbook for reference and you do not have significant practical theory-based experience in the field of study, use a college textbook to ensure adequate preparation for the exam, and use the exam’s content outline as a guide.
Combined with comparable college textbooks, OER provides you with a variety of choices in knowledge sources and learning experiences, to enhance your understanding of the subject matter.

Choosing Open Educational Resources

Most sites for university-based OER can be searched through www.ocwconsortium.org and/or www.oercommons.org.

Sites that specialize in Web courses designed by college professors under contract with the website sponsor, rather than in Web versions of existing college courses, include:

- www.education-portal.com
- www.opencourselibrary.org (abbreviated as OCL)

We have included specific courses that cover material for one or more UExcel® exams from the sites in the listings above. It’s worth checking these sites frequently to see if new courses have been added that may be more appropriate or may cover an exam topic not currently listed.

In addition, sites like Khan Academy (www.khanacademy.com) and iTunes U feature relatively brief lessons on very specific topics rather than full courses. Full courses are also available on iTunes U (http://www.apple.com/education/ipad/itunes-u/).

We have chosen a few courses and collections for this listing.

Other Online Resources

This section of the OER Guide is provided to allow learners to independently search for resources. Send an e-mail to OER@excelsior.edu if you have questions about a resource’s credibility.

Open Online Textbooks

Boundless open textbooks
  https://www.boundless.com/open-textbooks/

BookBoon
  http://bookboon.com/en/textbooks-ebooks

Flatworld Knowledge
  http://catalog.flatworldknowledge.com/#our-catalog

College Readiness

Khan Academy
  http://www.khanacademy.org/

Hippocampus
  http://www.hippocampus.org/

Open Course Library
  http://opencourselibrary.org/collg-110-college-success-course/

Study Aids

Education Portal
  http://education-portal.com/

Khan Academy
  http://www.khanacademy.org/

Annenberg Learner
  http://www.learner.org/

OpenCourseWare
  http://ocwconsortium.org/en/courses/search

OER Commons
  http://www.oercommons.org/

Open Course Library
  http://www.opencourselibrary.org/
General Description of the Examination

The UExcel Anatomy and Physiology I examination is based on material typically taught in the first semester of a lower-level undergraduate two-course sequence in anatomy and physiology.

The examination measures knowledge and understanding of the basic principles of anatomy and physiology and the integrative mechanisms that contribute to the functioning of the human body. Topics include levels of organization of the body, chemical and cellular organization, fundamental body tissues, the skeletal system and articulations, muscle structure and physiology, divisions of the nervous system, neural integration and the senses and special senses, and endocrine control and regulation.

Those beginning to study for this exam should be familiar with basic terms of biology and with concepts such as cell structure and function.

Learning Outcomes

Upon successful completion of this examination, the student should be able to demonstrate the following learning outcomes:

1. Explain the fundamental concepts of anatomy and physiology, the organizational scheme, and standard terminology of the body.
2. Describe atomic structure and the major organic and inorganic molecules and their chemical interactions.
3. Describe the cellular and tissue levels of organization.
4. Describe the integumentary system, skeletal system, articulations, and muscular system.
5. Describe the nervous system, endocrine system, classification of sensory receptors, and structure and function of each special sense organ.
6. Understand homeostatic mechanisms.
7. Understand the relationship between body systems and underlying structures.
Content Outline

The content outline describes the various areas of the test, similar to the way a syllabus outlines a course. To fully prepare requires self-direction and discipline. Study involves careful reading, reflection, and systematic review.

The major content areas on the Anatomy and Physiology I examination, the percent of the examination devoted, and the hours to devote to each content area are listed below.

<table>
<thead>
<tr>
<th>Content Area</th>
<th>Percent of the Examination</th>
<th>Hours of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. The Basic Concepts of Anatomy and Physiology</td>
<td>10%</td>
<td>13</td>
</tr>
<tr>
<td>II. The Chemical and Cellular Basis of Life</td>
<td>15%</td>
<td>20</td>
</tr>
<tr>
<td>III. Tissues and Integument</td>
<td>10%</td>
<td>13</td>
</tr>
<tr>
<td>IV. Bones and Joints</td>
<td>15%</td>
<td>20</td>
</tr>
<tr>
<td>V. The Muscular System</td>
<td>15%</td>
<td>20</td>
</tr>
<tr>
<td>VI. The Nervous System</td>
<td>15%</td>
<td>20</td>
</tr>
<tr>
<td>VII. Neural Integration and the Special Senses</td>
<td>10%</td>
<td>13</td>
</tr>
<tr>
<td>VIII. The Endocrine System</td>
<td>10%</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Occasionally, examples will be listed for a content topic to help clarify that topic. However, the content of the examination is not limited to the specific examples given.

I. The Basic Concepts of Anatomy and Physiology

1. Principles of anatomy and physiology
2. Anatomical position, planes, and directional terms

B. Basic anatomical terminology
   1. Body cavities and regions

II. The Chemical and Cellular Basis of Life

15 PERCENT OF EXAM | 20 HOURS OF STUDY

Martini (2015)

Ch. 1, An Introduction to Anatomy and Physiology

A. Chemistry
   1. Atomic structure
      a. Elements and isotopes
b. Atomic weights

2. Chemical bonds
   a. Ionic bonds
   b. Covalent bonds
   c. Hydrogen bonds

3. Types of reactions
   a. Decomposition
   b. Synthesis
   c. Reversible reactions
   d. Enzymes and chemical reactions

4. Inorganic compounds
   a. Water and its properties
   b. Aqueous solutions
   c. Colloids and suspensions
   d. Hydrogen ions in body fluids
   e. Inorganic acids and bases
   f. Salts
   g. Buffers and pH control

5. Organic compounds
   a. Carbohydrates
      1) Monosaccharides
      2) Disaccharides
      3) Polysaccharides
   b. Lipids
      1) Fatty acids
      2) Glycerol
      3) Steroids
      4) Phospholipids
   c. Proteins
      1) Structure of proteins
      2) Protein shape
      3) Enzyme function
   d. Nucleic acids
      1) Structure of nucleic acids
      2) RNA and DNA
      3) ATP

B. Cellular Level
   1. Plasma membrane
   2. Nucleus
   3. Cytoplasm
      a. Cytosol
      b. Cytoskeleton
      c. Organelles and functions
         (for example: mitochondria, endoplasmic reticulum, Golgi apparatus, ribosomes)
   4. Cellular fluid dynamics
      a. Osmosis and tonicity
      b. Filtration
      c. Diffusion
      d. Active transport
      e. Endocytosis and exocytosis
   5. Protein synthesis from DNA to protein
   6. The cell cycle

III. Tissues and Integument

| 10 PERCENT OF EXAM | 13 HOURS OF STUDY |

Martini

Ch. 4, The Tissue Level of Organization
Ch. 5, The Integumentary System

A. Fundamental body tissues
   1. Epithelial
      a. Classification
      b. Location
      c. Function
      d. Glands (for example: endocrine vs. exocrine)
      e. Intercellular connections (for example: gap junctions)
   2. Connective
      a. Types (for example: cartilage, dense regular, adipose, blood)
      b. Location
      c. Function
d. Fibers (for example: collagen, reticular, elastic)

3. Muscle
   a. Skeletal (striated, voluntary)
   b. Cardiac (striated, involuntary)
   c. Smooth (nonstriated, involuntary)

4. Nervous
   a. Neurons
   b. Neuroglia

5. Tissue membranes (for example: mucous, serous, cutaneous, synovial)

B. Skin (Integument)

1. Epidermis (for example: strata, cell types)
2. Dermis (for example: receptors, glands, hair follicles, nails)
3. Hypodermis

IV. Bones and Joints

15 PERCENT OF EXAM | 20 HOURS OF STUDY

Martini

Ch. 6, Osseous Tissue and Bone Structure
Ch. 7, The Axial Skeleton
Ch. 8, The Appendicular Skeleton
Ch. 9, Articulations

A. Supporting tissue

1. Bone functions
   a. Support
   b. Storage
   c. Blood cell production
   d. Protection
   e. Leverage

2. Bone anatomy
   a. Shapes
      1) Long
         a) Definition and examples
   b. Structure (for example: medullary cavity, diaphysis)

   2) Short
   3) Flat
   4) Irregular
   5) Sesamoid

   b. Markings
      1) Elevations
      2) Processes
      3) Depressions
      4) Openings

   c. Bone cells (for example: osteoblasts)

   d. Types of bone
      1) Compact bone (for example: osteon (Haversian) system, periosteum, canaliculi)
      2) Spongy bone (for example: trabeculae and bone marrow)

3. Development and growth
   a. Intramembranous ossification
   b. Endochondral ossification
   c. Hormonal influences (for example: growth hormone, parathyroid hormone, estrogen)
   d. Other chemical influences: vitamins and minerals

B. Skeletal system

1. Divisions
   a. Axial: skull (cranial and facial bones), hyoid, vertebral column, sternum, ribs
   b. Appendicular (girdles and extremities)
      1) Upper limb: pectoral girdle (clavicles, scapulae), humerus, radius, ulna, carpals, metacarpals, phalanges
      2) Lower limb: pelvic girdle, femur, patella, fibula, tibia, tarsals, metatarsals, phalanges
3) Sex differences in the human skeleton

2. Articulations
   a. Functional classification
      1) Synarthrosis (for example: sutures)
      2) Amphiarthrosis (for example: pubic symphysis, intervertebral disks)
      3) Diarthrosis (for example: hinge joint, saddle joint, ball-and-socket joint)
   b. Structural classification
      1) Bony
      2) Fibrous
      3) Cartilaginous
      4) Synovial
   c. Movements (for example: flexion, abduction, circumduction)

V. The Muscular System

1. Sliding filaments and muscle contraction
   a. Excitation-contraction coupling
   b. The contraction cycle
   c. Relaxation
2. Frequency of stimulation (for example: muscle twitch, complete tetanus, wave summation)
3. Motor units and tension production
   a. Motor unit
   b. Recruitment
   c. Muscle tone
   d. Isometric vs. isotonic contractions
4. Types of skeletal muscle fibers

D. Muscle energetic
   1. ATP and creatine phosphate reserves
   2. Aerobic metabolism
   3. Anaerobic metabolism
   4. Oxygen debt and fatigue

E. A comparison of skeletal, cardiac, and smooth muscle tissues

VI. The Nervous System

1. Cell types
   a. Neuron structure (for example: cell body, dendrites, axon)
      1) Structural classification: unipolar, bipolar, multipolar
      2) Functional classification: afferent (sensory), efferent (motor), association (interneuron)
b. Neuroglia
   1) Central nervous system (CNS): astrocytes, oligodendrocytes, microglia, ependymal cells
   2) Peripheral nervous system (PNS): Schwann and satellite

2. Channel types (leak vs gated channels)
3. Resting potential
4. Graded potential
5. Action potential
   a. Depolarization
   b. Repolarization
   c. Hyperpolarization
   d. All-or-none principle
   e. Refractory periods

6. Propagation of action potentials
   a. Continuous
   b. Saltatory
   c. Factors affecting propagation rate

7. Synapses: events at a chemical synapse
   a. Excitatory post-synaptic potential (EPSP)
   b. Inhibitory post-synaptic potential (IPSP)
   c. Neurotransmitters
   d. Temporal and Spatial Summation

B. Spinal Cord and Spinal Nerves
   1. Gross Anatomy
   2. Meninges
   3. Gray and white matter
   4. Spinal Nerves
      a. Thirty-one pairs
      b. Plexuses: cervical, brachial, lumbar, sacral
   5. Reflexes (patellar, stretch, withdrawal)

C. Brain and Cranial Nerves
   1. Development and growth
      a. Ectoderm: neural plate, neural tube (brain and spinal cord)
   b. Brain developmental regions (for example: prosencephalon, telencephalon)

2. Gray and white matter
3. Major structures and functions
   a. Cerebrum (for example: Broca’s area, parietal lobe, occipital lobe)
   b. Diencephalon (for example: thalamus, pineal gland)
   c. Brain stem (for example: medulla oblongata, pons)
   d. Cerebellum (for example: vermis, arbor vitae)
   e. Limbic system

4. Surface anatomy (for example: longitudinal fissure, central sulcus, precentral gyrus)
5. Meninges
6. Ventricles and cerebrospinal fluid (formation, flow, reabsorption, function)
7. Cranial nerves (12 pairs): name, number, type, function

VII. Neural Integration and the Special Senses

| 10 PERCENT OF EXAM | 13 HOURS OF STUDY |

Martini

Ch. 15, Neural Integration I: Sensory Pathways and the Somatic Nervous System

Ch. 16, Neural Integration II: The Autonomic Nervous System and Higher-Order Functions

Ch. 17, The Special Senses

A. The senses
   1. General senses
      a. Nociceptors
      b. Thermoreceptors
      c. Mechanoreceptors
         1) Tactile receptors
            a) Free nerve endings
            b) Root hair plexus
            c) Tactile discs
d) Tactile corpuscles  
e) Lamellated corpuscles  
f) Ruffini corpuscles  
2) Baroreceptors  
3) Proprioceptors  
d) Chemoreceptors  

2. Somatic sensory pathways  
a. Ascending tracts (sensory) (for example: posterior columns, spinothalamic pathways, spinocerebellar pathways)  
b. Descending tracts (motor) (for example: pyramidal pathways [corticospinal tracts], extrapyramidal pathways [rubrospinal and reticulospinal])  

B. Autonomic nervous system (visceral efferent system)  
1. Sympathetic division (thoracolumbar)  
2. Parasympathetic division (craniosacral)  
3. Anatomical and functional aspects  
a. Preganglionic (white rami root) and postganglionic (gray rami root) fibers (for example: adrenergics, cholinergics)  
b. Autonomic plexus  
c. Receptor types (for example: alpha receptors, muscarinic)  
d. Dual innervations  
e. Autonomic tone  
f. Visceral reflex arc  

C. Special senses  
1. Visual  
a. Anatomy of eye (for example: retina, aqueous humor, cornea)  
b. Photoreceptors  
c. Physiology of vision and errors of refraction  
2. Auditory  
a. Anatomy of ear  
1) external ear (for example: tympanic membrane, pinna)  

VIII. The Endocrine System  

| 10 PERCENT OF EXAM | 13 HOURS OF STUDY |

Martini  
Ch. 18, The Endocrine System  

A. Hormones  
1. Amino acid derivatives  
2. Peptide hormones  
3. Proteins  
4. Steroids  

B. Mechanisms of hormonal action: first and second messengers  
1. Plasma membrane receptors: adenyl cyclase mechanisms, CAMP  
2. Intracellular receptors: nuclear membrane receptor mechanism  

C. Endocrine glands: structure and function  
1. Pituitary  
a. Neurohypophysis (Posterior lobe): Antidiuretic hormone, oxytocin  
b. Adenohypophysis (Anterior lobe): (for example adrenocorticotropic hormone, growth hormone, thyroid stimulating hormone)
c. Relationship to hypothalamus (hypothalamic-hypophyseal portal system and tract)

2. Thyroid: thyroxine (T4), triiodothyronine (T3), calcitonin

3. Parathyroid: parathyroid hormone (PTH)

4. Adrenal (suprarenal)
   a. Medulla: epinephrine, norepinephrine, relationship to the sympathetic division of the autonomic nervous system
   b. Cortex: glucocorticoids, mineralocorticoids, sex hormones

5. Pancreas: islets of Langerhans, insulin, glucagon

6. Gonads
   a. Ovaries: estrogens and progesterone
   b. Testes: androgens (testosterone)

7. Thymus

8. Pineal gland: melatonin

9. Placenta: estrogens, progesterone, human chorionic gonadotropin (hCG)

D. Other secretory tissue
   1. Gastrointestinal mucosa (enteroendocrine cells): gastrin, secretin cholecystokinin (CCK)
   2. Kidney (for example: renin, erythropoietin)
   3. Heart: Atrial natriuretic peptide
   4. Adipose: Leptin

E. Hypothalamus
   1. Releasing factors and inhibiting factors
   2. Posterior pituitary hormones (ADH, oxytocin)
The sample questions give you an idea of the level of knowledge expected in the exam and how questions are typically phrased. They are not representative of the entire content of the exam and are not intended to serve as a practice test.

Rationales for the questions can be found on pages 17–20 of this guide. In that section, the correct answer is identified and each answer is explained. The number in parentheses at the beginning of each rationale refers to the corresponding section of the content outline.

For any questions you answer incorrectly, return to that section of the content outline for further study.

1. What is the name given to an imaginary plane that divides the body into right and left halves?
   1) coronal
   2) frontal
   3) sagittal
   4) transverse

2. In what type of homeostatic regulation is the stimulus enhanced by the effector?
   1) negative feedback
   2) positive feedback
   3) intrinsic regulation
   4) extrinsic regulation

3. Which statement best explains what happens when oxygen and hydrogen combine to form water (H₂O)?
   1) Hydrogen becomes weakly negative.
   2) Oxygen remains in an unstable state.
   3) Oxygen loses its high electronegativity.
   4) There is unequal sharing of electrons.

4. During which process is an enzyme’s three-dimensional shape disrupted?
   1) denaturation
   2) hydrolysis
   3) addition polymerization
   4) dehydration synthesis

5. Which type of tissue forms glands?
   1) connective
   2) epithelial
   3) muscle
   4) nervous

6. What is the most superficial layer of the epidermis?
   1) stratum basale
   2) stratum corneum
   3) stratum lucidum
   4) stratum spinosum

7. What type of membrane lines the medullary cavity?
   1) articular cartilage
   2) endosteum
   3) perichondrium
   4) periosteum
8. Which skeletal component is composed of trabeculae?
   1) spongy bone
   2) compact bone
   3) elastic cartilage
   4) hyaline cartilage

9. Which type of joint is located between the flat bones of the skull?
   1) suture
   2) symphysis
   3) synchondrosis
   4) syndesmosis

10. Which of the following is not a function of skeletal muscle?
    1) support of posture
    2) movement of limbs
    3) contraction of small intestines
    4) maintenance of body temperature

11. Which cordlike structure attaches muscle to bone?
    1) aponeurosis
    2) fascicle
    3) ligament
    4) tendon

12. Which characteristic of cardiac muscle prevents titanic contractions?
    1) sliding of actin and myosin
    2) branching muscle fibers
    3) long refractory period
    4) low extracellular calcium

13. Which neuron in the spinal reflex arc is responsible for delivering an efferent impulse to either a muscle or a gland?
    1) association
    2) postganglion
    3) motor
    4) sensory

14. What results from herniation of the intervertebral disc between the L4 and L5 spinal nerves?
   (Select the 2 that apply.)
   1) pain in the lower limb
   2) loss of bowel control
   3) loss of bladder control
   4) numbness of the perineal area
   5) muscle weakness in large lower limb muscles

15. What results from sectioning the corpus callosum?
    1) The brain ceases to function and death occurs.
    2) The capacity for abstract thought is lost.
    3) Information transfer between the cerebral hemispheres is lost.
    4) Control of autonomic functions is lost.

16. Which is a function of the cerebellum?
    1) control of voluntary scanning movements of the eyes
    2) production of coordinated movement
    3) regulation of autonomic body functions
    4) regulation of emotions

17. Which receptors are proprioceptors?
    1) muscle spindles
    2) Ruffini corpuscles
    3) Pacinian corpuscles
    4) free nociceptors

18. Which ability would be impaired by damage to hair cells at the basal end of the cochlea?
    1) discriminating loudness
    2) discriminating the direction of sound
    3) hearing high-frequency sounds
    4) hearing low-frequency sounds

19. Which compensatory response is likely to occur when the blood calcium level is low?
    1) Fecal calcium will be higher than normal.
    2) Urine calcium will be higher than normal.
    3) Osteoclast activity will be greater than normal.
    4) Calcium deposition in bone will be greater than normal.
20. Which cells in the islets of Langerhans produce insulin?
   1) alpha cells
   2) beta cells
   3) delta cells
   4) F cells

21. Which condition may result from the hypersecretion of gastric juices?
   1) acute pancreatitis
   2) cirrhosis
   3) peptic ulcers
   4) peritonitis
4. (IIA5c)

1) Denaturation is the loss of an enzyme's activity level because its secondary, tertiary, and quaternary structures are altered.

2) Hydrolysis is a process that occurs when water reacts with a compound to produce other compounds.

3) Addition polymerization occurs when simple molecules are combined to form long-chain molecules or polymers without the formation of any bi-product.

4) Dehydration synthesis is the formation of a complex molecule by the elimination of a water molecule.

5. (IIIA1d)

1) Connective tissue connects the epithelium to the rest of the body.

2) Glands are either attached to or derived from epithelia tissue.

3) The three types of muscle tissue (skeletal, cardiac, and smooth) are not involved in gland formation.

4) Nervous system (neural) tissue conducts electrical impulses throughout the body.
6. (IIIB1)
1) The stratum basale is the innermost epidermal layer.

2) At the exposed surface of both thick skin and thin skin is the stratum corneum. It is the outermost layer of the epidermis and provides a protection barrier for underlying tissues.

3) In the thick skin of the palms and soles, the stratum lucidum covers the stratum granulosum.

4) Each time a stem cell divides, one of the daughter cells is pushed superficial to the stratum basale into the stratum spinosum. This consists of eight to 10 layers of keratinocytes bound together by desmosomes.

7. (IVA2d)
1) Articular cartilage prevents bone-to-bone contact within the epiphyses.

2) The endosteum is an incomplete cellular layer that lines the medullary cavity consisting of osteoblasts, osteoprogenitor cells, and osteoclasts.

3) Cartilage is set apart from surrounding tissue by a fibrous perichondrium.

4) The periosteum is the superficial layer of compact bone covering all bones except joint cavities.

8. (IVA2d)
1) The matrix in spongy bone forms a meshwork of supporting fibers called trabeculae. This framework of trabeculae supports and protects the cells of bone marrow.

2) The primary functional unit of compact bone is the osteon. Within the osteon there are osteocytes that are organized in concentric layers around a central canal, known as the Haversian canal. The main function of compact bone is to support the body and protect its organs.

3) Cartilage is a connective tissue that provides the body with structure and strength comparable to bone. Elastic cartilage consists of numerous elastic fibers and is present in the outer ear, Eustachian tube, and epiglottis.

4) Hyaline cartilage is the most abundant cartilage in the body and consists of tiny collagen fibers. It is present where joints and bones meet, the nasal cartilages, and the elbow and knee.

9. (IVB2a)
1) A suture is a type of synarthrosis joint located between the flat bones of the skull. A synarthrosis joint is a very strong joint that is situated where movement between bones must not occur.

2) A symphysis is a type of amphiarthrosis joint connecting bones by collagen fibers or cartilage. The joint between the two pubic bones is a symphysis joint.

3) A synchondrosis is a type of synarthrosis joint connecting immovable bones by a cartilaginous bridge. The epiphyseal cartilage that connects the diaphysis to the epiphysis in a growing long bone is a synchondrosis joint.

4) A syndesmosis is a type of amphiarthrosis joint connecting bones by a ligament of connective tissue. The distal joint between the tibia and fibula is a syndesmosis joint.

10. (VA)
1) Support of posture is a function of skeletal muscles.

2) Movement of limbs is a function of skeletal muscles.

3) Smooth muscle rather than skeletal muscle is responsible for contractions of the intestines.

4) Maintenance of body temperature is a function of skeletal muscles.

11. (VB2)
1) An aponeurosis is a broad, sheet-like tendon that connects muscle to other muscle or to bone.

2) A fascicle is a bundle of muscle or nerve cells surrounded by a connective tissue membrane.

3) A ligament is composed of dense regular collagen fibers with some elastin. A ligament connects bone to bone.

4) A tendon is a cordlike structure composed of dense regular collagen fibers. A tendon connects muscle to bone.
12. (VC1)
1) Actin and myosin interact to promote muscle contraction in all muscle tissue.
2) Branching muscle fibers allow for sequential and rhythmic contraction associated with cardiac muscle.
3) The refractory period is the period during which muscle contraction cannot be initiated.
4) Low extracellular calcium inhibits proper muscle contraction.

13. (VIA1a)
1) Association neurons connect sensory and motor neurons.
2) Postganglionic neurons transmit impulses from preganglionic fibers to the target organ.
3) Motor neurons carry impulses from the central nervous system to a series of effectors such as muscles or glands.
4) Sensory neurons transmit impulses from sense organs to the central nervous system.

14. (VIB4b)
1) Sensation of pain would travel via the afferent fibers in these nerves.
2) Loss of bowel control would not occur due to this condition.
3) Spinal nerves S2-S4 innervate the external urethral sphincter; parasympathetic fibers from the sacral region innervate the internal urethral sphincter and bladder smooth muscle.
4) Spinal nerves S2-S4 innervate the perineum.
5) Control of muscle activity would be via the efferent fibers in these nerves.

15. (VIC2)
1) Brain function depends upon adequate blood supply and not on the corpus callosum.
2) Abstract thought is controlled by higher centers in the cerebral cortex.
3) The corpus callosum consists of commissural fibers carrying information between the right and left cerebral hemispheres. It contains more than 200 million axons, carrying 4 billion impulses per second. Sectioning the corpus callosum would result in the information transfer being lost.
4) Autonomic function is associated with brain stem activity.

16. (VIC3d)
1) Voluntary eye movements are controlled by the oculomotor and trochlear cranial nerves.
2) The cerebellum coordinates motor function with the cerebrum through three paired bundles of nerve fibers known as the cerebellar peduncle.
3) Regulation of autonomic body functions is controlled by the autonomic nervous system comprised of the sympathetic and the parasympathetic divisions.
4) Regulation of emotions is largely in the domain of the hypothalamus and limbic system.

17. (VIIA1c)
1) Muscle spindles are a type of proprioceptor that monitor skeletal muscle length and initiate stretch reflexes. Proprioceptors do not adapt to constant stimulation and each receptor continuously sends information to the central nervous system.
2) Ruffini corpuscles are tactile receptors that are sensitive to pressure on the skin. They are located in the deep dermis and are tonic (always active) and show little adaptation.
3) Pacinian corpuscles (also known as lamellated corpuscles) are tactile receptors that are sensitive to deep pressure. Sensory information is provided by lamellated corpuscles throughout the dermis.
4) Free nociceptors are very common in superficial skin, but deep tissues and organs have few nociceptors. Free nociceptors are tonic receptors.

*correct answer
18. (VIIIC2b)
1) Loudness is dependent upon sound intensity. The greater the sound intensity, the greater the vibration of the basilar membrane, which leads to increased transmission of nerve impulses to the brain.
2) Each ear receives the vibrating signal from slightly different positions. Discriminating the direction of sound is done by the temporal lobes of the brain.
*3) The basilar membrane is narrower and stiffer at the base of the cochlea where high-frequency (high-pitched) sounds produce maximum vibration and greater transmission of nerve impulses to the brain.
4) Low-frequency sounds cause maximum vibration at the apex of the cochlea where the basilar membrane is wider and more flexible.

19. (VIIIA)
1) Less calcium will be lost in the feces.
2) Less calcium will be excreted in the urine.
*3) Osteoclasts are bone-dissolving cells that release calcium into the bloodstream.
4) Bone will be broken down in an attempt to raise blood calcium levels.

20. (VIIIC5)
1) Alpha cells produce glucagon which raises blood sugar.
*2) Endocrine clusters, known as pancreatic islets, or the islets, of Langerhans, contain four types of cells: alpha, beta, delta, and F cells. Beta cells produce insulin which lowers blood sugar.
3) Delta cells secrete somatostatin which inhibits the secretion of insulin and glucagon.
4) F-cells secrete hormones which regulate the release of pancreatic digestive enzymes.

21. (VIIID1)
1) Acute pancreatitis results from severe insults to the pancreas.
2) Cirrhosis is a hardening of the liver tissue.
*3) Gastric juices are rich in hydrochloric acid. They cause irritation in the gastric mucosa and may lead to peptic ulcers.
4) Peritonitis is an inflammation of the peritoneum and is usually the result of infection.

*Correct answer
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Anatomy and Physiology I

Exam Development Committee

Melissa K. Boles, PhD
(Baylor College of Medicine, Cell and Molecular Biology, 2009)
Lecturer, The Sage Colleges

Stephanie M. Hutchins, PhD
(Capella University, Human Services, 2012)
Instructor, Maria College

Brian H. Jensen, PhD
(University of Delaware, Biology, 2001)
Associate Professor of Biology, College of St. Rose