Human Anatomy and Physiology Society (HAPS)

Anatomy & Physiology Learning Outcomes Revision 2019

White paper presented by

HAPS Anatomy and Physiology Learning Outcomes Task Force

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HAPS A&P LEARNING OUTCOMES REVISION

Background and the need for the HAPS A&P Learning Outcomes revision

In 1992, the members of HAPS and its Board of Directors (BOD) recognized the need for a standardized set of guidelines that instructors of anatomy and physiology could utilize when creating or preparing their classes. A set of guidelines subsequently was developed by a committee and adopted by the BOD. These early guidelines served as the basis for questions in the first HAPS Comprehensive Anatomy and Physiology (A&P) Exam in 1993.

Over the next decade the guidelines were revised several times. In 2007 members of the HAPS Curriculum and Instruction Committee, composed of HAPS members representing a variety of institutions across the U.S (https://www.hapsweb.org/page/Outcomes_participant), undertook a major update of the guidelines. This 3-year project produced the first iteration of the HAPS A&P Learning Outcomes (LOs), published in 2010. The learning outcomes are designed to "provide a set of goals and learning outcomes for a two-semester course sequence in human anatomy and physiology (A&P) and are intended to prepare students for a variety of clinical and academic programs." (https://www.hapsweb.org/page/AP_Outcomes_home)

The HAPS A&P learning outcomes continue to guide question writing for the HAPS Comprehensive A&P Exam. Over the years, the HAPS A&P Comprehensive Exam has developed into a secure, validated online test designed to serve as an end-of-course assessment for a two-semester A&P sequence. In addition to being a standardized assessment tool to gauge student success in individual courses or institutions, the HAPS A&P Comprehensive Exam also provides "a means for schools to compare their students' collective performance with the normalized data accumulated from the results of all students that have taken the same exam." (https://www.hapsweb.org/page/ComprehensiveAPExam)

In 2018, the HAPS Board of Directors and the HAPS Curriculum & Instruction Committee determined that the HAPS A&P Learning Outcomes needed to be reviewed and revised. The joint leads of the HAPS Exam program were tapped to create a task force for revision of the A&P LOs, given the close link between the learning outcomes and the HAPS A&P Comprehensive exam. They selected individuals to be part of the task force based on their A&P content knowledge, teaching experience, and leadership experience within HAPS. The task force included several anatomy and physiology textbook authors, past-presidents of HAPS, and members of past Exam Program task forces, and they represented instructors of anatomy and physiology from various institutional levels, including two-year schools (community colleges), four-year colleges and universities, and professional schools (see appendix A for a complete list of task force members).

The mission of the HAPS A&P Learning Outcomes task force was to review the organizational structure of the 2010 document as well as the clarity and accuracy of each LO, with the understanding that every HAPS Comprehensive Exam question needs to be clearly linked to a unique outcome. The HAPS A&P LOs are organized into system-based modules that were named and categorized based on the original HAPS Guidelines. During the current revision, the

Module topic names were not revised, with the exception of Module O, whose name was expanded from "Metabolism" to "Nutrients and Metabolism." In addition, one new module on embryology was added (Module T).

Within each module the content is organized into a set of numbered **topics** (in bold font) with a series of numbered Learning Outcomes (indented, regular font) under each topic. Each learning outcome can be referenced using a module.topic.LO system. For example, the third LO under topic 1 of module F would be F.1.3.

Revisions for clarity and accuracy included updating terminology in the LOs to align with Terminologia Anatomica (TA). Eponyms were removed as primary terms and replaced with the appropriate Terminologia Anatomica vocabulary. We strongly suggest instructors switch to the accurate terms. Unclear verbiage was revised, and all HAPS A&P LOs now use active verbs describing assessable behaviors. Duplication of concepts in multiple modules was eliminated so that concepts appear only once in the document.

Work commenced on the learning outcome revision in Spring 2018. Members of the task force met in person over the course of 5 days (split into two sessions scheduled 6 months apart), and they finished the remaining work via videoconference calls, with completion of the project in April 2019.

Caveats

These Learning Outcomes have been created and revised to cover core educational concepts that the task force members agreed should be included in a typical two-semester undergraduate A&P course. However, the task force recognizes that institutions vary widely in their student populations, curricular goals, and number of contact hours allocated for lecture and lab, and we respect the right of faculty to academic freedom. The A&P LOs presented in this revision are not intended as a mandate, nor are they meant to be an all-encompassing standard that must be attained in every course. These LOs should be used only as a benchmark or guide to assist faculty in developing their own course objectives.

In this revision we use an asterisk (*) to indicate LOs that the task force committee agreed are important but more advanced than the recommended core concepts. We encourage instructors to include these (or other outcomes) as they see fit. The HAPS A&P Comprehensive Exam does not directly address these optional starred learning outcomes.

For consistency, the most appropriate anatomical term from the *Terminologia Anatomica* is referenced as the primary term, with other commonly used terms, based on review of multiple undergraduate human A&P textbooks and discussion among task force members, included in parentheses.

HAPS exam questions based on the HAPS A&P LOs will be drawn from the core concepts (non-asterisk). Additionally, HAPS exam questions may only use the primary term listed in the LO

and not all of the parenthetical terms. HAPS exam questions are linked to one major topic (numbered and in bold), but may cover more than one numbered learning outcome within that topic.

Task Force rationale for specific HAPS A&P Learning Outcome modifications

Module H – Nervous System

LO H.7.7

The preferred term for the mechanism by which an action potential moves down the axon is action potential (AP) *conduction*, not AP *propagation*. We have put *propagation* as the secondary term because we recognize that many A&P authors use it as the primary term. Conduction is the more appropriate term when describing the mechanism by which an action potential moves down the axon. Propagation is a more generic term that refers to spreading of the signal, and it can be used both for single neurons and when describing electrical activity moving through multiple neurons along neural pathways or circuits.

LO H.7.11

We intentionally omitted the term *continuous conduction* to describe an action potential in an unmyelinated neuron because technically, *all* AP conduction is continuous. Therefore, we have used the more descriptive phrase "*AP conduction in an unmyelinated neuron*" in this LO. Saltatory conduction in a myelinated axon is a continuous flow of depolarizing voltage change along the membrane surface: the action potential only appears to jump from node to node.

LO H.9.1

In reviewing multiple A&P textbooks as well as reviewing terminology used in the literature, there appears to be some inconsistency in the use of the term *neural (or neuronal) pool*. Therefore, we intentionally use the term *neural circuit* as the preferred term to describe the anatomical patterns of functional groupings of neurons

LO H.10.1 – H.10.24

We intentionally created a single topic for the brain (**Structural and functional organization of the brain)** to make it possible to write distractors for a HAPS exam question on the structure (or function) of the brain that would all come from a single topic within the Nervous System module.

LO H.12.3

While we designated *funiculus* as the primary term and *column* parenthetically as a secondary term for the white matter of the spinal cord, the Terminologia Anatomica (TA) states the term *funiculus* is the primary term, whereas *column* refers to gray matter structures of the cord. We

kept the term *column* related to white matter because we recognize the prevalence of its use within A&P resources.

Module K – Cardiovascular System

LO K.3.1

Hematopoiesis is used as the primary term with *hemopoiesis* in parentheses as the secondary term. Hematology and medical books define *hematopoiesis* as the production/formation of all blood cells beginning in the embryo, and *hemopoiesis* as the formation of new cellular components of blood in myeloid and lymphoid tissue. Therefore, hematopoiesis is inclusive of hemopoiesis, (but not vice versa).

LO K.10.2

The terms *isovolumic ventricular contraction* and *isovolumic relaxation* are being used instead of *isovolumetric* (although we have included that term in parentheses for reference). The term isovolumetric is inaccurate as ventricular cardiomyocyte contractions are not isometric contractions. The accurate term is *isovolumic:* the volume of blood in the ventricles does not change, but the length (shape) of the muscle cells does change.

LO K.15.16

Some chemical signals that cause vasoconstriction or vasodilation, such as atrial natriuretic peptide and those created by the renin-angiotensin system, are included in the Fluid/Electrolyte LOs (Module Q).

Module M – Respiratory System

LO M.1.2

We strongly encourage instructors (and textbook authors) to move away from the terms *external respiration* and *internal respiration*. In their places, this committee is recommending the use of the more specific terms *pulmonary gas exchange* and *tissue gas exchange* to avoid confusion with cellular respiration. We feel it is more accurate for instructors/authors to describe the regions of gas exchange (between alveoli/pulmonary capillaries versus systemic capillaries/body tissues). We also include gas transport in the blood as part of the global process of respiration.

Module O – Nutrients and Metabolism

The name of Module O has been changed from "*Metabolism*" to "*Nutrients and Metabolism.*" The HAPS Learning Outcome task force made a conscious decision to focus this module on nutrients rather than diet and nutrition. Hence, we limit our discussion to nutrients and renamed this module to reflect that focus.

We tried to reduce redundancy wherever possible throughout the modules, so many of the concepts related to metabolism have been addressed within other modules.

Because this learning module was completely reorganized and rewritten, we did not keep a 'track changes' document for comparing revisions.

LO O.3.6

We use 'fed' and 'fasted' (instead of 'absorptive' and 'post-absorptive') as our primary terms. The terms "absorptive" and "post-absorptive" may confuse students because anabolic processes of the fed state continue after nutrients have been absorbed.

Module P – Urinary

LO P.4.11

We have chosen to include the renal handling of hydrogen ions and bicarbonate ions in the fluid/electrolyte discussion of acid/base balance (Module Q) instead of in the Urinary System Module.

LO P.4.16

We intentionally removed all LOs on the details of the countercurrent mechanisms in urinary physiology in this document because the details are not essential for understanding renal function. At the time of this writing, details of the countercurrent mechanisms have also been removed from many medical school-level physiology courses.

Module Q – Fluid/Electrolytes and Acid/Base Balance

This learning module was completely reorganized and rewritten, so we did not keep a 'track changes' document for comparing revisions.

We note that some concepts related to this topic are covered in other modules. For example, aldosterone's effect on the nephron is covered in Module P Urinary System.

Module R – Reproductive system

We removed the *Application of homeostatic mechanisms* (original LO R.10.1 & R.10.2) common throughout the other modules with the recognition that the reproductive system does not have a direct effect on the maintenance of body homeostasis. For the same reason, we omitted *Predictions related to homeostatic imbalance, including disease states and disorders* (original LO R.11.1 & R.11.2). In their place we substituted LOs R.12.1 & R.12.2, *Predictions related to the disruption of the reproductive system*. This creates LOs based on understanding the

interrelationship between pathology/clinical application and normal reproductive anatomy and physiology.

Appendix A: HAPS A&P Learning Outcomes Revision Force Members

Jennifer Burgoon, Ph.D. Assistant Professor, Division of Anatomy Department of Biomedical Education & Anatomy College of Medicine The Ohio State University Columbus, OH *Co-Program Lead, HAPS Exam Program*	**Valerie O'Loughlin, Ph.D., FAAA** Professor of Anatomy and Cell Biology Medical Sciences Program Indiana University School of Medicine Bloomington, IN *President Emeritus, HAPS* *Co-Program Lead, HAPS Exam Program* *Fellow of the American Association of Anatomists* *McGraw-Hill textbook author of:* *McKinley/O'Loughlin/Pennefather-O'Brien: Human Anatomy 6e* *McKinley/O'Loughlin/Bidle: Anatomy & Physiology – An Integrated Approach 3e*
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John Koch, Ph.D. Professor Emeritus of Biology John Tyler Community College Chester, VA *Member of the original 2007-2010 HAPS Learning Outcomes Working Group*	**Melvin F. Simoyi, Ph.D.** Associate Professor of Biology Director, Title V STEM HU & McNair Programs Heritage University Toppenish, WA