# Anatomy and Physiology for Paramedic Providers

Throughout this course students will begin to understand how the human body is organized, how its systems function, and why those functions matter in prehospital care. This self-paced course moves from cells and tissues to major body systems, then brings those systems together through selected EMS-relevant observations. It teaches foundational anatomy and physiology while practice activities help you apply the ideas as you learn.

The course has nine modules. Each combines a Prehospital Academy learning guide, assigned sections of OpenStax *Anatomy and Physiology 2e*, figures, short instructor lectures, practice activities, and a module knowledge check. A midterm follows Module 5, and a final assessment follows Module 9. Lectures introduce key mechanisms and connections; they do not replace the assigned reading or practice.

**Course presenter:** Austin Mandeville, MHS, NRP. The recorded lectures introduce selected concepts and connect foundational physiology to prehospital practice.

## Student learning outcomes

By the end of the course, you should be able to:

1. **Explain foundational physiology:** describe homeostasis, basic chemistry, membrane transport, cellular energy, and how cells perform specialized work.
2. **Use anatomical structure to explain function:** apply anatomical language and relate tissues, skin, bones, joints, and muscles to protection, support, and movement.
3. **Trace control and communication:** explain how nervous and endocrine signals travel, produce responses, and contribute to regulation.
4. **Connect circulation and respiration to tissue delivery:** trace blood and gas movement and explain how cardiac activity, flow, pressure, and exchange affect what tissues receive.
5. **Explain defense and fluid return:** describe the roles of lymphatic circulation and major immune defenses.
6. **Explain fluid, acid–base, and nutrient regulation:** trace renal processing and relate breathing, kidneys, digestion, absorption, and metabolism to the internal environment.
7. **Describe reproduction and development:** relate hormonal regulation to reproductive function, explain major developmental and maternal changes, describe newborn circulatory transition, and apply a basic inheritance concept.

## Course sequence and recommended time

| Module | Focus | Recommended study time |
|---|---|---|
| 1 | Foundations of anatomy, physiology, and chemistry | 5–7.5 hours |
| 2 | Cells, cellular metabolism, and tissues | 7–10 hours |
| 3 | Skin, skeletal support, and joints | 12–16 hours |
| 4 | Muscle function and nervous tissue | 10–14 hours |
| 5 | Nervous system integration and the senses | 12–16 hours |
| | **Midterm after Module 5** | **Up to 75 minutes** |
| 6 | Blood, the heart, and circulation | 12–16 hours |

| Module | Focus | Recommended study time |
|---|---|---|
| 7 | Endocrine regulation, immunity, and respiration | 14–18 hours |
| 8 | Renal function, fluid balance, digestion, and nutrition | 16–20 hours |
| 9 | Reproduction, development, and inheritance | 12–16 hours |
| | **Final assessment after Module 9** | **Up to 75 minutes** |

The module estimates add to **approximately 100–134 hours of study**. They include reading, figure study, activities, practice, and feedback; the two cumulative assessments allow up to **2.5 additional hours combined**. Your time may vary, especially if you revisit material or repeat practice. These are planning estimates, not minimum seat-time requirements or deadlines.

## Module outline

### Module 1 — Foundations of anatomy, physiology, and chemistry

**Assigned reading:** OpenStax Chapters 1–2, selected Sections 1.1–1.6 and 2.1–2.5. **Recommended time:** 5–7.5 hours.

- **AP-M01-01:** Use anatomical terminology to describe a structure or location accurately.
- **AP-M01-02:** Explain a feedback loop using stimulus, receptor, control, and response.
- **AP-M01-03:** Relate basic chemical properties to the functions of biological molecules.
- **AP-M01-04:** Explain why the internal environment must remain within functional limits.

Practice includes anatomical relationships and a homeostasis case before the module check.

### Module 2 — Cells, cellular metabolism, and tissues

**Assigned reading:** OpenStax Chapters 3–4 and selected Sections 24.1–24.2. **Recommended time:** 7–10 hours.

- **AP-M02-01:** Compare membrane-transport mechanisms and predict movement under a stated condition.
- **AP-M02-02:** Connect organelle function and gene expression to cellular activity.
- **AP-M02-03:** Explain how cells obtain and use energy at an introductory level.
- **AP-M02-04:** Distinguish the four major tissue classes using structure, location, and function.

Practice connects membrane movement, tissue images, and cellular energy to their underlying mechanisms.

### Module 3 — Skin, skeletal support, and joints

**Assigned reading:** Selected sections of OpenStax Chapters 5–9. **Recommended time:** 12–16 hours.

- **AP-M03-01:** Relate skin and accessory structures to protection and regulation.
- **AP-M03-02:** Explain bone growth, remodeling, and repair at the required course depth.
- **AP-M03-03:** Identify specified axial and appendicular landmarks and describe their relationships.
- **AP-M03-04:** Compare joint types and use appropriate movement terminology.

Image and movement activities support structural identification and reasoning.

### Module 4 — Muscle function and nervous tissue

**Assigned reading:** Selected sections of OpenStax Chapters 10–12. **Recommended time:** 10–14 hours.

- **AP-M04-01:** Compare the structure and function of the three muscle types.
- **AP-M04-02:** Trace the sequence from neural stimulation to skeletal muscle contraction.
- **AP-M04-03:** Relate selected regional muscles to movement and body function.

- **AP-M04-04:** Explain the basic propagation and transfer of neural signals.

Practice uses muscle comparisons and the sequence of contraction and signaling.

### Module 5 — Nervous system integration and the senses

**Assigned reading:** Selected sections of OpenStax Chapters 13–16. **Recommended time:** 12–16 hours.

- **AP-M05-01:** Trace a sensory–integration–motor pathway through the nervous system.
- **AP-M05-02:** Relate major CNS/PNS structures to their functions.
- **AP-M05-03:** Compare autonomic divisions and their roles in regulation.
- **AP-M05-04:** Explain the anatomical or physiological basis of a selected sensory or neurological finding.

Practice connects pathways and findings to underlying physiology. The midterm follows this module and covers Modules 1–5.

### Module 6 — Blood, the heart, and circulation

**Assigned reading:** Selected sections of OpenStax Chapters 18–20. **Recommended time:** 12–16 hours.

- **AP-M06-01:** Relate blood components to transport, defense, and hemostasis.
- **AP-M06-02:** Trace blood through pulmonary and systemic circulations.
- **AP-M06-03:** Connect cardiac electrical activity to the cardiac cycle.
- **AP-M06-04:** Explain relationships among flow, pressure, resistance, and exchange.

Practice traces circulation and asks how changes in flow or resistance affect exchange.

### Module 7 — Endocrine regulation, immunity, and respiration

**Assigned reading:** Selected sections of OpenStax Chapters 17 and 21–22. **Recommended time:** 14–18 hours.

- **AP-M07-01:** Explain hormone signaling and a major endocrine feedback relationship.
- **AP-M07-02:** Compare major innate/adaptive defenses and the functions of lymphatic circulation.
- **AP-M07-03:** Distinguish ventilation, gas exchange, and gas transport.
- **AP-M07-04:** Explain how multiple systems contribute to a selected physiological response.

Endocrine, immune, and respiratory activities give each strand its own practice before the module check.

### Module 8 — Renal function, fluid balance, digestion, and nutrition

**Assigned reading:** Selected sections of OpenStax Chapters 23–26. **Recommended time:** 16–20 hours.

- **AP-M08-01:** Trace fluid through the nephron and explain the major processing steps.
- **AP-M08-02:** Explain how the body regulates fluid volume and electrolyte composition.
- **AP-M08-03:** Relate respiratory and renal mechanisms to acid–base regulation.
- **AP-M08-04:** Connect digestion and absorption to nutrient use and metabolic state.

Practice follows nephron processing, fluid and acid–base regulation, and digestion through to nutrient use.

### Module 9 — Reproduction, development, and inheritance

**Assigned reading:** Selected sections of OpenStax Chapters 27–28, with related review from Chapters 17 and 20. **Recommended time:** 12–16 hours.

- **AP-M09-01:** Relate reproductive anatomy and hormonal regulation to function.
- **AP-M09-02:** Describe the major stages and physiological relationships of development.
- **AP-M09-03:** Explain selected maternal changes and the transition from fetal to newborn physiology.
- **AP-M09-04:** Apply basic inheritance concepts to a clearly specified example.

Practice compares development and fetal/newborn circulation and includes inheritance interpretation. The final assessment follows Module 9 and draws on the full course.

## Academic alignment

The crosswalk shows how the seven course outcomes are developed and where students demonstrate their understanding. Module outcome codes above identify the more specific expectations.

| Course outcome | Supporting module outcomes | Representative learning evidence |
|---|---|---|
| SLO 1 · Foundational physiology | AP-M01-02–04; AP-M02-01–03 | Feedback-loop and chemistry practice; transport and cellular-energy activities; Modules 1–2 checks |
| SLO 2 · Structure and function | AP-M01-01; AP-M02-04; AP-M03-01–04; AP-M04-01–03 | Anatomical-language and tissue-image activities; skeletal/joint and muscle applications; Modules 1–4 checks |
| SLO 3 · Control and communication | AP-M04-04; AP-M05-01–04; AP-M07-01, 04 | Neural signaling and pathway activities; autonomic/endocrine cases; Modules 4–5 and 7 checks |
| SLO 4 · Circulation and respiration | AP-M06-01–04; AP-M07-03 | Blood-flow tracing, cardiac-cycle and perfusion questions, respiratory application; Modules 6–7 checks |
| SLO 5 · Defense and fluid return | AP-M07-02 | Lymphatic and immune comparison activities; Module 7 check |
| SLO 6 · Fluid, acid–base, and nutrients | AP-M08-01–04 | Nephron, fluid/acid–base, and digestive activities; Module 8 check |
| SLO 7 · Reproduction and development | AP-M09-01–04 | Development and fetal/newborn comparisons, inheritance practice; Module 9 check |

The midterm assesses learning from Modules 1–5, and the final assesses the course as a whole. Both are separate from the practice activities. Course content addresses normal anatomy and physiology and selected EMS applications; it does not substitute for a clinical treatment course.

## Textbook credit and attribution

The assigned textbook is J. Gordon Betts, Kelly A. Young, James A. Wise, Eddie Johnson, Brandon Poe, Dean H. Kruse, Oksana Korol, Jody E. Johnson, Mark Womble, and Peter DeSaix, *Anatomy and Physiology 2e* (OpenStax, 2022). Access it free at OpenStax textbook. The textbook is licensed under Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0): CC BY-NC-SA 4.0 license. Prehospital Academy learning guides, lectures, practice, and assessments are separately authored course materials; textbook sections and figures retain their own source credits in the course.