Science
Honors Human Anatomy and Physiology
Unit 12: The Endocrine System

Essential Understandings	▪ The endocrine system maintains homeostasis by releasing chemicals called hormones, and it controls prolonged or continuous processes such as growth and development, reproduction, and metabolism. ▪ Negative feedback regulates many of the hormones in the body. ▪ The endocrine system is made of multiple endocrine organs distributed throughout the body. ▪ Hypersecretion or hyposecretion of hormones leads to homeostatic imbalance.
Essential Questions	▪ How do hormones bring about their effects in the body? ▪ What is negative feedback and what is its role in regulating blood levels of various hormones? ▪ What are the major endocrine glands and tissues? ▪ What hormones are produced by each endocrine gland and what is the function of each hormone? ▪ What is the functional relationship between the hypothalamus and the pituitary gland? ▪ What are the major pathological consequences of hypersecretion and hyposecretion of the hormones produced by the endocrine system? ▪ How does aging effect the endocrine system and body homeostasis?
Essential Knowledge	▪ Hormones are chemicals that travel through the bloodstream and bind to specific chemical receptors on target cells. ▪ Heating and cooling systems controlled by thermostats are examples of mechanical feedback systems. The hormones of the endocrine system are biological examples of the same process. ▪ The pituitary gland secretes nine hormones that directly regulate many body functions and controls the actions of several other endocrine glands. For this reason it is often referred to as the master gland. ▪ The hypothalamus controls the secretions of the pituitary gland. ▪ The pineal gland releases melatonin which regulates sleep-wake cycles. ▪ The thyroid gland has the major role in regulating the body's metabolism. ▪ The thyroid gland and parathyroid glands work together to maintain homeostasis in blood calcium levels. ▪ The adrenal glands help the body prepare for and deal with stress. ▪ Insulin and glucagon released from the pancreas help to keep the level of glucose in the blood stable.

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	▪ The gonads serve two important functions: the production of gametes and the secretion of sex hormones. ▪ Many disorders are the result of hypersecretion or hyposecretion of hormones released by the endocrine glands.
Vocabulary	Hormone target cell gland exocrine gland endocrine gland steroid hormones nonsteroid hormones prostaglandins feedback mechanism thyroid-releasing hormone (TRH) thyroid-stimulating hormone (TSH) antidiuretic hormone (ADH) calcitonin parathyroid hormone (PTH) pituitary gland antidiuretic hormone (ADH) oxytocin follicle-stimulating hormone (FSH) luteinizing hormone (LH) thyroid-stimulating hormone (TSH) adreno-corticotropic hormone (ACTH) growth hormone (GH) prolactin melanocyte-stimulating hormone (MSH) hypothalamus pineal gland melatonin thyroid thyroxine hyperthyroidism hypothyroidism goiter cretinism parathyroid glands parathyroid hormone (PTH) thymus thymosin adrenal glands epinephrine (adrenaline) norepinephrine (noradrenaline)

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	"fight or flight" response pancreas islets of Langerhans insulin glucagon diabetes mellitus gonad ovary eggs estrogen progesterone testes sperm testosterone
Essential Skills	▪ Locate and label endocrine glands in the human body. ▪ Name the hormones made by each endocrine gland and describe the effect of each hormone on the body. ▪ Be able to explain the disorders caused in the body by the hypersecretion or hyposecretion of hormones.
Related Maine Learning Results	<u>Science</u> A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. A3.Constancy and Change Students identify and analyze examples of constancy and chang that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. B. The Skills and Traits of Scientific Inquiry and Technological Design B1.Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations.

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	b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations and models using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement. b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design process, and solution to a design problem including models, diagrams, and demonstrations. C. The Scientific and Technological Enterprise C1.Understandings of Inquiry Students describe key aspects of scientific investigations: that they are guided by scientific principles and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly. a. Describe how hypotheses and past and present knowledge guide and influence scientific investigations. b. Describe how scientists defend their evidence and explanations using logical argument and verifiable results. C2.Understanings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving

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	technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. C3.Science, Technology, and Society Students describe the role of science and technology in creating and solving contemporary issues and challenges. b. Explain how ethical, societal, political, economic, and cultural factors influence personal health, safety, and the quality of the environment. c. Explain how ethical, societal, political, economic, religious, and cultural factors influence the development and use of science and technology. C4.History and Nature of Science Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society. a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public. b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society. c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists. d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. D. The Physical Setting D2.Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems. D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. h. Describe radioactive decay and half-life.

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	E. The Living Environment E1.Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. a. Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. b. Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. c. Analyze the relatedness among organisms using structural and molecular evidence. d. Analyze the effects of changes in biodiversity and predict possible consequences. E2.Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. a. Explain why ecosystems can be reasonably stable over hundreds or thousands of years, even though populations may fluctuate. b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. E3.Cells Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals. a. Describe the similarities and differences in the basic functions of cell membranes and of the specialized parts within cells that allow them to transport materials, capture and release energy, build proteins, dispose of waste, communicate, and move. b. Describe the relationship among DNA, protein molecules, and amino acids in carrying out the work of cells and how this is similar among all organisms. c. Describe the interactions that lead to cell growth and division

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	(mitosis) and allow new cells to carry the same information as the original cell (meiosis). d. Describe ways in which cells can malfunction and put an organism at risk. e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment. f. Describe the process of metabolism that allows a few key biomolecules to provide cells with necessary materials to perform their functions. g. Describe how cells differentiate to form specialized systems for carrying out life functions. E4.Heredity and Reproduction Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells, and in evolving new species. c. Explain how the instructions in DNA that lead to cell differentiation result in varied cell functions in the organism and DNA. d. Describe the possible causes and effects of gene mutations. E5.Evolution Students describe the interactions between and among species, populations, and environments that lead to natural selection and evolution. a. Describe the premise of biological evolution, citing evidence from the fossil record and evidence based on the observation of similarities within the diversity of existing organisms. b. Describe the origins of life and how the concept of natural selection provides a mechanism for evolution that can be advantageous or disadvantageous to the next generation. c. Explain why some organisms may have characteristics that have no apparent survival or reproduction advantage. d. Relate structural and behavioral adaptations of an organism to its survival in the environment.
Sample Lessons and Activities	▪ Locate and name endocrine glands on a model and diagram. ▪ View on line video of the effect of insulin on a goldfish. ▪ Microscope labs looking at endocrine gland tissue slides. ▪ View endocrine glands during a rat and fetal pig dissection. ▪ Read articles related to disorders caused by homeostatic imbalance in various endocrine glands.
Sample	▪ Quiz

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Classroom Assessment Methods	▪ Chapter Test ▪ Worksheets ▪ Labs
Sample Resources	▪ Publications: ○ Essentials of Human Anatomy and Physiology, 9th edition by Elaine N. Marieb ○ Anatomy and Physiology Coloring Workbook: A Complete Study Guide by Elaine N. Marieb ○ Essentials of Human Anatomy and Physiology Laboratory Manual by Elaine N. Marieb ▪ Videos: ○ National Geographic: Inside the Living Body ○ National Geographic: The Incredible Human Machine ▪ Other Resources Lab Supplies