Course: Human Biology **Unit #:1 Advanced Cellular Processes: Homeostasis and Feedback**	**Year of Implementation:** 2025-2026
Curriculum Team Members: Kellie Balkus (kbalkus@lrhsd.org), Kelly Banks (kbanks@lrhsd.org), **Nicole Lum (nicolelum@lrhsd.org) , Dana Matusov (dmatusov@lrhsd.org)**	
Stage One - Desired Results	
Link(s) to New Jersey Student Learning Standards for this course: https://www.nj.gov/education/standards/	

- **Unit Standards:**

Content Standards

LS1.A: Structure and Function

- Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)
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- Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)
- Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

LS1.B: Growth and Development of Organisms

- In multicellular organisms, individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each

parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)

LS1.C: Organization for Matter and Energy Flow in Organisms

- The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)
- As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6), (HS-LS1-7)

LS3.A: Inheritance of Traits

- Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA . The instructions for forming species' characteristics are carried in DNA . All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1) (SEP 1, 2, 3, 4)

LS3.B: Variation of Traits

- In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2) (SEP 1, 2, 3, 4)

Science and Engineering Practices

The content of this unit will strengthen student skills in the following SEPs.

- Practice 1 Ask Questions
- Practice 2 Developing and Using Models
- Practice 3 Planning and Carrying Out Investigations
- Practice 4 Analyzing and Interpreting Data
- Practice 5 Using Mathematics and Computational Thinking

- Practice 6 Constructing Explanations and Designing Solutions
- Practice 7 Engaging in Argument from Evidence
- Practice 8 Obtain, Evaluate and Communicate Information

21st Century Life & Career Standards

- 9.4.12.CI.1 - Demonstrate the ability to reflect, analyze and use creative skills and ideas
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.
- 9.4.12.IML.3 - Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).

All curriculum writers/revisionists need to include standards that apply to "Career Readiness, Life Literacies, and Key Skills". This should include a brief description of the standard and the standard number. Document only those standards and practices that apply to each unit. Use the following link to assist you [see pages of 31-36; 41-42; 53-56 for specific standard #'s and strands]

https://www.state.nj.us/education/cccs/2020/2020%20NJSLS-CLKS.pdf

English Companion Standards

- **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS1- 1),(HS-LS1-6) (SEP 3, 4, 6)
- **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS4-6) (SEP 1, 4, 6,7,8)
- **WHST.11-12.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-LS1-3) (SEP 4, 6, 8)
- **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS1-1),(HS-LS1-6) (SEP 4)
- List grade-level appropriate companion standards for History, Social Studies, Science and Technical Subjects (CTE/Arts) 9-12. English Companion Standards are required only in these subject/content areas. This section can be deleted for all other content areas.

- Grade 9-10 Companion Standards:
  https://www.nj.gov/education/standards/ela/Docs/2016NJSLS-ELA_Companion9-10.pdf
- Grade 11-12 Companion Standards:
  https://www.nj.gov/education/standards/ela/Docs/2016NJSLS-ELA_Companion11-12.pdf

Interdisciplinary Content Standards

- MP.2 - Reason abstractly and quantitatively.
- MP.4 - Model with mathematics.
- HSN-Q.A.1 - Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- HSN-Q.A.2 - Define appropriate quantities for the purpose of descriptive modeling.
- HSN-Q.A.3 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- **Engineering** -
  - **Standard: 9.3.12.AC.6** Read, interpret and use technical drawings, documents and specifications to plan a project.
  - **Standard: 9.3.12.AC-DES.6** Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
  - **Standard: 9.3.12.AC-DES.1** Justify design solutions through the use of research documentation and analysis of data.
  - **Standard: 9.3.12.AC-DES.2** Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues]

- ***NJ Statutes:*** NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

  Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: ***https://www.nj.gov/education/amistad/about/***

Diversity and Inclusion: ***https://www.nj.gov/education/standards/dei/index.shtml***

- *(Sample Activities/ Lessons):* ***https://www.nj.gov/education/standards/dei/samples/index.shtml***

Asian American and Pacific Islanders:

- ***Asian American and Pacific Islander Heritage and History in the U.S.***
  A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to develop and use a model based on evidence to illustrate the relationships between structures and their function in a system.

As aligned with LRHSD Long Term Learning Goal(s): https://www.lrhsd.org/academics/program-of-studies/curriculum

- design, critique, and carry out experiments in order to investigate scientific questions and/or propose solutions
- collect, interpret, and analyze data in order to solve a defined problem
- apply mathematics to express relationships efficiently and accurately
- draw evidence-based conclusions from data in order to make informed decisions;
- construct, interpret, and refine models (scientific and mathematical) to explain the physical and natural world
- effectively communicate scientific ideas and evidence-based arguments to an appropriate audience through written and oral means
- evaluate for their validity arguments that rely on scientific reasoning presented in the popular press and informational sources

Enduring Understandings Students will understand that. . . *EU 1* *living systems, ranging from the molecular level to the organismal hierarchy, exhibit the interdependent relationship between structure and function.* *EU 2* *normal cell reproduction is vital for organism growth, development, and the continuity of life, as it ensures proper development and maintenance through accurate genetic control.*	*Essential Questions* ● *How does the structure relate to function in living systems from the molecular level to the organismal level?* ● *How does accurate reproduction of cells, regulated by genetic information, ensure proper growth, development, and maintenance of living systems?*
Knowledge *Students will know . . .*	*Skills* *Students will be able to. . .*

EU 1 ● that systems of specialized cells within organisms help them perform the essential functions of life. (LS1.A) ● molecules maintain body homeostasis. (LS1.A) ● each major macromolecule has a function related to its structure. (LS1.C) *EU 2* ● that information flows from DNA to RNA to direct the synthesis of proteins. (LS1.A**,** LS3.A) ● errors in cell division lead to abnormalities in cellular processes. (LS1.B) ● meiosis is the basic process for sexual reproduction. (LS3.A, LS3.B) ● stem cells lead to cell specialization and allow for the body to function in sophisticated ways. (LS1.A)	*EU1* ● describe the relationship between structure and function in a cell. (LS1.A; WHST.9-12.2) (SEP 1,4) (CCC: Structure & Function HS-LS1-1) ● model the formation of molecules based upon the chemical bonding rules in atoms. (LS1.A) (SEP 2,4) (CCC: System & System Models HS-LS1-2 HS-LS1-4) ● use models to demonstrate dehydration synthesis and hydrolysis. (LS1.A) (SEP 2,4) (CCC: System & System Models HS-LS1-2 HS-LS1-4) ● demonstrate how water, salts, and enzymes maintain body homeostasis by designing and carrying out an experiment. (SEP 1,2,3,4,5) (CCC: Stability & Change HS-LS-1-3) ● analyze each macromolecule and predict its function as it relates to its structure. (SLS1.C) (SEP 1,2,3,4,5) (CCC: Structure & Function HS-LS1-1) ● develop and use a model based on evidence to illustrate the relationships between systems or between components of a system*(LS1.A,* WHST.9-12.7; RST.11-12.1) (SEP 1,2,3,4,5,8) (CCC: System & System Models HS-LS1-2 HS-LS1-4) *EU2* ● use microscopes to study cells (LS3.A, LS3.B) (SEP 1, 2, 3, 4, 5) ● model how information flows from DNA to RNA to direct the synthesis of proteins

	(LS1.A**,** LS3.A) (SEP 2,4) (CCC: System & System Models HS-LS1-2 HS-LS1-4) ● design investigations, collect evidence, analyze data and evaluate evidence to determine how errors in cell division lead to abnormalities in cellular processes. (LS1.A, LS3.A, LS3.B; WHST.11-12.8) (SEP 1, 2, 3, 4, 5) ● model how meiosis is the basic process for sexual reproduction. (LS3.A, LS3.B) (SEP 1, 2, 3, 4, 5) (CCC: System & System Models HS-LS1-2 HS-LS1-4) ● design a model to demonstrate how stem cells lead to cell specialization which allows for the body to function in sophisticated ways. (LS1.A) (SEP 1, 2, 3, 4, 5)(CCC: System & System Models HS-LS1-2 HS-LS1-4)
Stage Two - Assessment	
Performance Task Situation:	
Other Evidence: ● Laboratory activities ● Lab reports and notebooks ● Quizzes and tests ● Concept maps, graphic organizers, charts, tables, and graphs ● Presentations	

- Class discussion

Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.** *{place A, M and/or T along with the applicable EU number in parentheses after each statement} All knowledge and skills must be addressed in this section with a corresponding lesson/activity which teaches each concept. The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection*

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: *A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.*

PHENOMENON: How does drinking too much water affect homeostasis?

Link: Video (Jennifer Strange Case Study): https://www.youtube.com/watch?v=A4C8s4a-ch0

GOAL: Students will explore a real life case study about a woman involved in a radio station's contest to win a Wii gaming system.

Activity 1: **Jennifer Strange Case Study** - Show video link: https://www.youtube.com/watch?v=A4C8s4a-ch0
(EU1, EU2)

a. Paired discussion about observations from video (A/M)

b. Use QFT (Question Formulation Technique) to generate a class discussion to determine driving questions for the lesson based upon observations from the video (A/M) - for more detailed information on the QFT technique please click this link: http://rightquestion.org/what-is-the-qft/
c. Research other similar case studies and present other examples to the class (T)

Activity 2: Homer-o-stasis: Students will maintain homeostasis in a fictional patient.
a. Students will create KWL charts about resources (A,M)

Activity 3: Osmosis/Diffusion Lab (Carolina Biological Lab Link provided, or equivalent osmosis/diffusion lab that applies knowledge of the cellular process) (A,M,T) (EU1, EU2)

Activity 4: Daphnia Heart Rate Lab (EU1, EU2) (Carolina Biological Lab Link provided, or equivalent lab activity) (A,M,T)

Activity 5: Culminating Activity: Synthesis and Reflection (M/T) (EU1, EU2)
a. Complete the Case study on glucose regulation and insulin. (M,T)
b. Assign an individual or group project where students synthesize their learning from the previous activities (M,T)
c. Incorporate reflective prompts to encourage students to analyze their own perspectives and insights gained throughout the learning process.

Supporting Instructional Framework:

- Discussion on the chemistry of life, to include bonding, water, pH (acids, bases, buffers) -(A) (EU1)
- Use micropipetting to transfer small volumes of fluid -(M) (EU1)
- Use a spectrophotometer to analyze fluids - (M) (EU1)
- Discussion on the 4 major macromolecules (carbohydrates, lipids, proteins, nucleic acid) - (A) (EU1)
- Run a Gel Electrophoresis for Proteins - (M,T) (EU1)
- Use model kits to show dehydration synthesis and hydrolysis -(M) (EU1)
- Experiment to show enzymatic activity - (M,T) (EU1)
- Discussion of Cell Transport - passive and active - (A) (EU1)
- Experiment to show cellular transport - (M) (EU1)
- Discussion on the stages of the cell cycle - normal vs abnormal - (A) (EU2)
- The Cell Cycle POGIL - (A,M) (EU2)

- HHMI The Eukaryotic Cell Cycle and Cancer Click and Learn (EU2)
- EDVOTEK Cancer Gene Detection experiment 115 - (M,T) (EU2)
- EDVOTEK Morphology of Cancer Cells #990 - (M,T) (EU2)
- Development of Chemotherapy Drug trial - (M,T) (EU2)
- Discussion on DNA, RNA and protein synthesis - gene expression - (A,M) (EU2)
- Develop a model to demonstrate DNA replication - (A,M) (EU2)
- Create a Model to display DNA, RNA and protein synthesis (poster project - one-on-one oral presentation / act it out) - (A, M) (EU2)
- DNA to Protein online interactive module https://concord.org/stem-resources/dna-protein (M) (EU2)
- Cheek cell DNA Extraction - (M) (EU2)
- Estimate the mass of DNA - standard curve - (A, M) (EU2)
- Polymerase Chain Reaction - D1S80 - (M, T) (EU2)
- DNA Goes to the Races activity for restriction enzymes - (M) (EU2)
- Discuss Meiosis, oogenesis, spermatogenesis, fertilization - (A) (EU2)
- Use model kits to demonstrate meiosis; Cut and Paste review of the steps of meiosis; Bead lab; One-on-one oral presentation - (A,M) (EU2)
- Discuss stem cells, embryological development - (A) (EU2)
- HHMI Classroom Activities: Stem Cells and Diabetes - (M,T) (EU2)
- Compare the stages of embryological development - (A) (EU2)
- Compare/Contrast the types of stem cells - embryonic, pluripotent, mesenchymal - (A) (EU2)
- Explore research in current technologies in stem cells including cutting edge technology/regenerative medicine -(A,T) (EU2)
- Create a public service announcement on stem cells -where do they come from, what are they, how are they being used? - (T) (EU2)

Pacing Guide

Unit #	*Title of Unit*	*Approximate # of teaching days (135 total)*
1	Advanced Cellular Processes	40
2	Anatomy and Physiology	65
3	Pathology	30

Instructional Materials

- *Micropipettes and tips (various sizes)*
- *Gel electrophoresis machine(s) and consumables*
- *PCR/thermal cyclers and PCR tubes*
- *Microwave*
- *Melt & pour agarose*
- *Buffer(s)*
- *Graduated cylinders*
- *Microscopes*
- *Prepared slides*
- *Building Model Kits*
- *Various lab kits/perishables (*see learning plan for specific kit numbers/vendors)*

- *Large Post-It Note Presentation boards*
- *Daphnia homeostasis lab kit and cultures*

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.
Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.
English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.
Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.
Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.