BIG BEAVER FALLS
AREA SCHOOL DISTRICT
Once a Tiger, Always a Tiger

UNIT 2: OF WHAT DOES LIFE CONSIST?

Teacher Name: Rebecca Cottington
Grade/Course: Biology
Dates of Unit: ~8 weeks

Stage 1 – Desired Results
Unit Topic and Length
What is Life Made Of? ~8 weeks
Curriculum Indicators/Standards
B-LS.54: Describes the primary function of nucleic acids (DNA and RNA) as storing the directions for cell activities and protein synthesis. B-LS.55: Defines proteins as polymers made by linking together amino acid monomers and explains that a protein's structure depends on its specific conformation B-LS.56: Describes proteins as structural (hair, nails) and the function of other proteins as transport (hemoglobin), movement (muscle fibers and cytoskeletal elements), defense (antibodies), and regulation of cell functions (hormones and enzymes). B-LS.4: Explains how some structures in eukaryotic cells developed from early prokaryotic cells (e.g., mitochondria, chloroplasts) B-LS.5: Compares and contrasts the cellular structures of prokaryotic and eukaryotic organisms. B-LS.9: Lists the major chemical elements in cells (i.e., carbon, hydrogen, nitrogen, oxygen, phosphorous, sulfur, trace elements. B-LS.10: Identifies the function of the four major macromolecules (i.e., carbohydrates, proteins, lipids, nucleic acids) B-LS.27: Describes the relationship between the organelles in a cell and the function of that cell. B-LS.37: Identifies essential cell organelles and their functions (e.g., nucleus contains DNA and is the site where RNA is made, ribosome is the site of protein synthesis, mitochondria is the site of cellular respiration, chloroplast is the site of photosynthesis, cell wall provides support, cell membrane controls what enters and leaves the cell, lysosome contains digestive enzymes, Golgi is the site where cell products are packed for export.) B-LS.38: Explains how the properties of water (e.g., cohesion, adhesion, heat capacity, solvent properties) contribute to the maintenance of cells and living organisms B-LS.39: Describes how the fluid mosaic model of a membrane emphasizes the arrangement and function of a bilayer of phospholipids, transport proteins, and cholesterol. B-LS.41: Describes the structure of the primary components of representative organs in plants and animals (e.g., heart – muscle tissue, valves and chambers; lung – trachea, bronchial, alveoli; leaf – veins, stomata; stem – xylem, phloem, cambium; root – tip, elongation, hairs; skin – layers, sweat glands, oil glands, hair follicles). B-LS.51: Describes how carbon atoms can easily bond to other carbon atoms in chains and rings to form large complex molecules B-LS.52: Explains how cells can make a variety of macromolecules from a relatively small set of monomers B-LS.53: Describes the primary functions of carbohydrate macromolecules as providing and storing short-term energy and the primary functions of lipid macromolecules as insulation, storing energy, and the make-up of cell membranes B-LS.57: Compares and contrasts the functions and structures of proteins, lipids, carbohydrates, and nucleic acids.

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B-LS.78: Uses a model to describe the structure of DNA, including hydrogen bonding, covalent bonding, nucleotide sequencing, and overall shape.
B-LS.102: Explains DNA as a polymer consisting of nucleotides which are identified by the base it contains: adenine (A), guanine (G), and cytosine (C) or thymine (T)
B-LS.103: Describes DNA as a double-stranded molecule in which the strands are connected by complementary nucleotide pairs (A-T and C-G) like rungs on a ladder which twist to form a double helix.
B-LS.104: Describes RNA as a single-stranded polymer of nucleotides and the RNA nucleotide as identified by the base it contains adenine (A), guanine (G), and cytosine (C) or uracil (U)
B-LS.129: Models the structural repetition found in polymers.
B-LS.130: Analyzes the structure and function of biomacromolecules

Reading Standards

B.R.1: Locates and explains explicitly stated information in the text or portion of the text using own words and includes supporting key details from the text as evidence.
B.R.2: Locates and explains what is not directly stated in the text by drawing inferences based on implied information, using text structure, text features, and graphic aids as evidence.
B.R.3: Analyzes several portions of a text to determine and explain explicit information in the text and make inferences using relevant evidence from the text to make connections, draw conclusions, and generalize what is read.
B.R. 17: Identifies evidence the author uses to support his/her viewpoint or purpose and conflicting evidence or viewpoints presented in a given text
B.R.18: Compares and contrasts the author's evidence and/or viewpoints to the conflicting evidence and/or viewpoints in one or more texts.
B.R.19: Recognizes and locates information from different media and formats, and is able to identify the topic or issue from the different sources.
B.R.21: Interprets information presented visually, orally, or quantitatively and explains how each presentation contributes to an understanding of a topic.
B.R. 22: Integrates information taken from various media, formats, or texts to demonstrate understanding of a topic or issue.
B.R. 28: Identifies experiments, simulations, videos, or multimedia sources on a topic from a scientific or technical text
B.R. 31: Analyzes information gained from videos and compares and contrasts with a written text on the same subject
B.R. 32: Analyzes information gained from multimedia and compares and contrasts with a written text on the same subject
B.R. 33: Supports a comparison/contrast of information gathered from experiments, simulations, videos, or other multimedia sources and that from texts using evidence from each source.

Writing Standards

B.W.16: Establishes a topic that has been narrowed to create a specific purpose for writing that establishes a controlling idea, theme, or thesis about the topic.

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B.W.17: Composes an engaging introduction (e.g. vivid, detailed description, historical/cultural background, contrasting situation) to organize ideas, concepts, and information in order to make important connections and distinctions.
B.W.18: Explains topic with relevant and sufficient facts, definitions, details, quotations, or other appropriate information and examples (e.g. figures, graphs, tables).
B.W.19: Synthesizes research or a variety of information to support ideas using text-based evidence.
B.W.20: Identifies and determines when to include text features (graphics, charts, tables, multimedia), appropriate formatting, and graphics to aid in comprehension.
B.W.21: Identifies and selects an appropriate text structure (definitions, classifications, comparison/contrast, cause/effect) that is most effective to further the development of a topic.
B.W.22: Uses transitional words, phrases, and clauses within major sections of the writing to signal emphasis or show logical relationships among ideas and concepts (e.g., in fact, consequently, as a result, on the other hand, etc.)
B.W.23: Uses effective sequences between and within paragraphs by using transitions to emphasize points in an argument or to show logical connections (e.g., inasmuch as, possibly, therefore, etc.).
B.W. 24: Composes an effective conclusion (statement or section) that is more than a repetition of the introduction and both follows from and supports the ideas and concepts.
B.W.26: Maintains a consistent and formal style in informative/explanatory writing, free from slang, abbreviations, and "text" talk.
B.W. 27: Selects precise language that conveys a particular tone for a response to text that creates appropriate imagery (e.g. explicit nouns, vivid verbs, natural modifiers) and uses specialized vocabulary particular to the subject/topic to provide ease of understanding.
B.W. 28: Varies sentence patterns for meaning, reader interest, and style and maintains consistency in style and tone when writing.
B.W.29: Analyzes the reason for writing to decide on task, purpose, and audience.
B.W.30: Determines the appropriate idea development strategies.
B.W.31: Determines the appropriate organization.
B.W.32: Produces writing with clear and coherent idea development.
B.W.33: Produces writing with clear and coherent organization.
B.W.34: Produces writing with appropriate style.
B.W.35: Generates ideas prior to organizing them and adjusts prewriting strategies accordingly (e.g. brainstorm a list, selects relevant ideas/details to include in a piece of writing), with guidance and support from peers.
B.W.36: Gathers information from a range of sources, formulates questions, and uses an organizer/thinking map to analyze/or synthesize to plan writing with guidance and support from peers.
B.W.37: Determine suitable idea development strategies, organization, and style that is appropriate to the task, purpose, and audience.
B.W.38: Develops and strengthens writing by creating a plan, revising, editing, rewriting, and trying new approaches using guidance and support from peers and adults.
B.W.39: Rereads own writing several times for meaning both orally and silently checking for accuracy and detail, and with a different focus for each reading.
B.W.40: Records feedback using identified procedure and makes decisions about writing based on feedback.
B.W.41: Use multiple sources for proofreading and editing. (e.g. writing guide, rubric, peer, adult, computer, thesaurus)
B.W.42: Selects and uses appropriate word processing tools for communicating and collaborating with others.

Teacher Name: Rebecca Cottington
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B.W.43: Publishes using a variety of technology (e.g. word processor, spreadsheet, multimedia, slideshow, publication software) and publishing options (e.g. graphic, document).
B.W.44: Uses Internet sources as a resource for information, to conduct research.
B.W.45: Publishes making purposeful decisions about format, graphics, illustrations, and other features (e.g captioned photos, maps) based on audience.
B.W.46: Publishes using a variety of technology (e.g. word processor, spreadsheet, multimedia, slideshow, publication software) and publishing options (e.g. graphic, document)
B.W.47: Applies appropriate research and inquiry methods to conduct a research project.
B.W.48: Applies multiple resources to conduct short research projects.
B.W.49: Determines sources to answer a research question.
B.W.50: Narrow or refocus the inquiry by selecting information from multiple sources which will support or justify the answer.
B.W.51: Conducts steps for research to answer a question.
B.W.52: Conducts a short research project to answer a question with appropriate information derived from research in a variety of sources.
B.W.57: Gathers relevant information from print and digital sources.
B.W.58: Paraphrases the data and conclusions of others.
B.W.62: Writes an essay by introducing the topic, providing a grade-appropriate organizational structure, concluding with a statement or section, choosing words and phrases for effect, and using grade-appropriate conventions of standard English grammar, usage, capitalization, punctuation, and spelling.
B.W.63: Demonstrates commitment to topic (e.g. sustains writing, elaborates, shows knowledge of topic)
B.W.64: Manages time and process when writing for a given purpose to produce a writing product within a set period of time.
B.W.65: Uses established criteria and rubric to reflect on quality and effort in writing.

Meaning

Enduring Understandings/Big Ideas
Students will understand that . . .

- Life emerges due to the chemical organization of matter into cells.
- Cells have organized structures and systems necessary to support chemical reactions needed to maintain the living condition.
- Structure is related to function at all biological levels.

Essential Questions
Students will continue to consider. . .

- Of what does life consist?
  - Why are we Carbon-based life forms?
  - How do molecules interact to form life?
- What do organisms need to survive?
  - Why are the four biological macromolecule types essential to life?
  - Why is water essential to life?
- Why is structure varied at all levels of life?
  - What caused the development of specialized cells/structures?

Acquisition

Know (Content and Literacy) *Students will Know…*

Teacher Name: Rebecca Cottington
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- How Carbon's unique structure makes it suited for forming complex structures
- The difference in structure and function between the four major biological macromolecules (e.g. carbohydrates, lipids, proteins, nucleic acids)
- How the biological macromolecules interact to form the basic unit of life, a cell.
- The importance of various cell structures
- The significance of cellular differentiation and the complementarity of structure and function.
- How water's unique structure gives it vital characteristics which support life on Earth

Do (Discipline and Literacy Skills) ***Students will be Skilled at…***

- Explaining the relationship between atoms, macromolecules, cellular structures, and cells.
- Justifying the importance of water in maintaining life on Earth

Vocabulary

atom covalent bond hydrogen bond ionic bond water (H_2O) cohesion adhesion capillary action specific heat	carbohydrate lipid protein nucleic acid monomer polymer macromolecule	cell organelle membrane homeostasis

Stage 2 – Assessment Evidence	
Evaluative Criteria (Rubrics or Scoring Tool)	**Assessment Evidence**
Observation: Identification of prior knowledge and misconceptions to be addressed later	**Initial/Pre-Assessment:** 1. Origin of Life warm-up: How do you think the first cell developed? 2. Properties of water warm-up and discussion: Water Pre-test and discussion 3. Cell structures Pre-test: Group sort/Venn Diagram

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1. Standardized rubric for writing and content.	**Performance Tasks:** 1. Cell Analogy Model (Standard Performance Task #1) **a. Goal:** Develop an analogy to represent either a plant or animal cell and the structures and molecules within it. **b. Role:** Textbook developer. **c. Audience:** Editor and eventually Biology teachers and students. **d. Situation:** You are a young textbook developer and have been assigned the task of developing a 2D or 3D analogy model to add to the teacher addition of a Biology book. This model should highlight the structures, organelles, and macromolecules within the cell. **e. Product:** 2D or 3D model and written rationale **f. Standards/Criteria for Success**: See rubric.
1. Rubric for content and writing 2. Rubric for writing only	**Other Constructed Response Tasks:** 1. Identifying the Role of Water: Students are given an image and asked to write an explanation of how the properties of water are involved in the scenario depicted. a. Students will also complete the peer review process before submitting their finished product. 2. Specialized Cell Exploration: Students will research a specific cell type and write an informative essay on that cell type. Students will then read their essay to a group of peers for feedback.
1. Answer Key 2. Answer Key 3. Answer Key	**Other Evidence:** 1. Macromolecules Quiz: Students will be given various macromolecule structures. They will identify the structure citing evidence and describe how the molecule's structure supports its specific function. 2. Organelle Quiz: Matching organelle to function. Open ended section where students will describe how the structure of an organelle determines its function. 3. Unit Exam (Summative Assessment): Mix of multiple choice and constructed response.
All: Are students grasping the concepts? Are they presenting any misconceptions?	**Formative Tasks/Evidence:** 1. Warm-ups 2. Class Discussions 3. Observations 4. Exit tickets

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Stage 3 – Learning Plan		
Unit Texts and Resources		

• Holt Biology: 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 8.2
• Origin of Life Video Discussion: https://youtu.be/T_IGiT41-IM
• Macromolecule Notes (Carbohydrates, Lipids, Proteins): https://youtu.be/H8WJ2KENlK0
• Nucleic Acids Notes: https://youtu.be/NNASRkIU5Fw
• Water WebQuest Links
  ○ Properties of Water (https://youtu.be/z5Vm56Pu4hU)
  ○ Capillary Action (https://water.usgs.gov/edu/capillaryaction.html)
  ○ Evaporative Cooling (https://youtu.be/_eEONOJHnEs)
  ○ The Water Cycle (https://water.usgs.gov/edu/watercycle-kids-adv.html)
• Cellular Specialization (differentiation): https://youtu.be/YtvL-LQlPrU
• Cell Theory: https://youtu.be/4OpBylwH9DU		

Lessons and Activities	**Progress Monitoring**	**Scaffolding/Supports**
Origin of Life Video Discussion: Give students the following prompts to guide their observation of the video: What did you think about this video? Be prepared to discuss whether you agreed/disagreed, found interesting/uninteresting. Watch video on what life is made of. Discuss answers as a class. **Notes:** "Why carbon?" Notes on atomic structure, bonding, bonding patterns of carbon, significance of carbon in macromolecules. Quick hands-on: model carbon bonding patterns during the discussion.		**Video Discussion**: Question sheet provided for students as needed. **Notes**: All: Free notes in class. Screencast/copy of notes available for post-class review. Accomodation: Guided notes, or notes transcripts provided as needed.
Notes: Macromolecules. Watch the videos together as a class and pause at pertinent spots for turn and class discussion of key points for each macromolecule. Information discussed		**Notes**: All: Free notes in class. Screencast/copy of notes available for post-class review. Accomodation: Guided notes, or

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should include the following: monomers, polymers, examples, functions, and elements found in each macromolecule type. (Video link in resources) **Notes**: Structure/Function Relationship: Macromolecules Discussion of monomers, polymers, dehydration synthesis (condensation), hydrolysis. Think-Pair-Share: Structure/Function Relationship with macromolecules → Practice identifying these molecules using their structure during this. **Macromolecules Practice:** Students identify macromolecules based on structures and explore various characteristics of the macromolecules. (POGIL: Macromolecules and Identification justifications) Macromolecules Quiz: Assessment of vital information about macromolecules. (i.e. elements within each, monomers, polymers, and function) **Macromolecules Stations**: Students will rotate through four stations. The starting station for each	**Macromolecules Practice:** Observational data to determine who may need more one-on-one practice with DOK1 material before the quiz. Macromolecules Quiz: Formative assessment of students' depth of understanding within the macromolecules information. Data from this quiz will help group students for the stations activity to follow. Students will be grouped based on ability. Teacher support will be provided for the lowest ability group.	notes transcripts provided as needed. **Notes**: All: Free notes in class. Screencast/copy of notes available for post-class review. Accomodation: Guided notes, or notes transcripts provided as needed. **Macromolecules Practice**: All: Ability to work with a partner. Modifications: Chunking and prompting questions to break down the tasks. Macromolecules Quiz: Modifications: Increased multiple choice with limited choices. Prompting questions for open-ended questions. **Macromolecules Stations:** Not all students need to complete all stations. Students will start at a station that meets their most pressing need based on the quiz results. Teacher support will be

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student will be determined based on the quiz results. Station 1: Tactile matching race of DOK 1 information. Station 2: Modeling dehydration synthesis and hydrolysis with carbohydrates and lipids. Station 3: Modeling structures of nucleic acids and proteins. Station 4: Foods Research on each macromolecule type.		provided to the lowest ability grouping.
Pre-Assessment: Properties of Water Pre-test and discussion. **Water Exploration Stations:** Explores the properties of water and the water cycle. Station 1: Video and lab modeling. (Universal solvent, cohesion, adhesion, surface tension, high heat capacity, lower density solid) Station 2: Article and lab modeling (Capillary action, cohesion, adhesion) Station 3: Video (Evaporative cooling) Station 4: Interactive image and diagram development. (Water cycle) **Properties of Water Summary** Students will write their own definition of each property of water and draw a visual for the term. Identifying the Role of Water: Students will analyze the role of water in a specific image. They will then	Pre-Assessment: Identify current level of understanding and misconceptions. **Properties of Water Summary**: Data from this assignment will be used to determine what students will need more one-on-one support while writing their essay for Identifying the Role of Water. Identifying the Role of Water: Data from this assignment will be used to determine who needs further	Pre-Assessment: No scaffolding. Cold evaluation. **Water Exploration Stations:** All: Provided with guided questions to direct their exploration in the various stations. Modifications: Transcripts of videos and highlighted article provided as needed. **Properties of Water Summary:** Modification: Chunked matching in groups of 5, as needed. Identifying the Role of Water: All: Students will work in groups of 2-3 to analyze the role of water in

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write an explanation of how the properties of water are involved in each scenario.	remediation on the properties of water. Also, identify students who need more writing support before the performance task.	the image, but work independently to write their explanations. Modifications: Limiting the number of properties the students must write about in their explanation, as needed.
Cell Structures Pre-test: Students work in groups of 2-3 to sort cell structures into a Venn diagram Comparing Prokaryotes to Eukaryotes and another one comparing Plants to Animals. Students also work in groups to match cell structures to their functions. **Notes:** From Macromolecules to Eukaryotes. Students discuss how macromolecules are put together to form organelles, than prokaryotic cells which according to the endosymbiotic theory became eukaryotic cells, and then how eukaryotic cells can differentiate. **Notes:** Tour of the cell. Kinesthetic notes about what each of the organelles/cell structures do. **Notes:** Cell Types (Prokaryotic, eukaryotic, bacteria, plant, animal, protist, fungi)	Cell Structures Pre-Test: This activity identifies students' prior knowledge and misconceptions.	Cell Structures Pre-test: Grouping. No modifications. **Notes**: All: Free notes in class. Screencast/copy of notes available for post-class review. Accomodation: Guided notes, or notes transcripts provided as needed. **Notes**: All: Free notes in class. Screencast/copy of notes available for post-class review. Accomodation: Guided notes, or notes transcripts provided as needed. **Notes**: All: Free notes in class. Screencast/copy of notes available for post-class review. Accomodation: Guided notes, or notes transcripts provided as needed.

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Organelle Quiz: Assessment of students' knowledge of organelle/cell structure function and structure.	Organelle Quiz: Identify students who need more support with cell structures before the performance task.	Organelle Quiz: Modifications: Increased multiple choice with 3 options. Prompting questions for open-ended questions.
Specialized Cell Exploration: Students will each explore a specific cell type and identify its specialized structures. Students will write a reflection on the resources they used and their usefulness in this research. Students will write an explanation of their research and read it to their peers for feedback.	**Specialized Cell JigSaw:** Extend student understanding of the relationship between structure and function to the cellular level. Identify students who need more support with their writing before the performance task.	**Specialized Cell JigSaw:** All: Planning sheet to organize the writing process. Small group support, as needed. Modifications: Assigned topic at a lower level. Research supports provided by the teacher as needed.
Performance Task #1: Cell Analogy Model.	Performance Task #1: Summative evaluation of depth of knowledge concerning relationship, structure, and function of macromolecules and cells. Summative evaluation of informative writing skills.	Performance Task #1: All: Planning sheets to organize the writing process. Modifications: Students are not required to include all organelles in their writing. Students must include the following (nucleus, chloroplast and/or mitochondria, ribosome, cell membrane) Accomodations: One-on-one or small group guidance through the development and writing process.
Summative Exam: Unit 2 exam.	Summative Exam: Summative evaluation to identify long term remediation needs.	Summative Exam: Chunking and modifications made as needed per IEP requirements.