The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

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<td>Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)</td>
<td>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)</td>
<td>The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)</td>
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<td>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.)</td>
<td>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)</td>
<td>The sugar molecules thus formed contain carbon, hydrogen, and oxygen from sugar molecules, which are then used to form new cells. (HS-LS1-6)</td>
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<tr>
<td>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)</td>
<td>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)</td>
<td>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)</td>
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*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

# Connections to Nature of Science

## Scientific Investigations Use a Variety of Methods
- Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. (HS-LS1-3)
- 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)
- As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7)

### Connections to other DCIs in this grade-band
- **HS.PS1.B** (HS-LS1-5),(HS-LS1-6),(HS-LS1-7); **HS.PS2.B** (HS-LS1-7)
- **HS.LS3.A** (HS-LS1-1); **HS.PS3.B** (HS-LS1-5),(HS-LS1-7)

### Articulation to DCIs across grade-bands
- **MS.PS1.A** (HS-LS1-6); **MS.PS1.B** (HS-LS1-5),(HS-LS1-6),(HS-LS1-7); **MS.PS3.D** (HS-LS1-5),(HS-LS1-6),(HS-LS1-7); **MS.LS1.A** (HS-LS1-1),(HS-LS1-2),(HS-LS1-3),(HS-LS1-4); **MS.LS1.B** (HS-LS1-4); **MS.LS1.C** (HS-LS1-5),(HS-LS1-6),(HS-LS1-7); **MS.LS2.B** (HS-LS1-5),(HS-LS1-7); **MS.ESS2.E** (HS-LS1-6); **MS.LS3.A** (HS-LS1-1),(HS-LS1-4); **MS.LS3.B** (HS-LS1-1)

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**ELA/Literacy**

**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)

**WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/expiriments, or technical processes. (HS-LS1-1),(HS-LS1-6)

**WHST.9-12.5** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS1-6)

**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-LS1-3)

**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 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)

**WHST.9-12.9** Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS1-1),(HS-LS1-6)

**SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2),(HS-LS1-4),(HS-LS1-5),(HS-LS1-7)

**Mathematics**

**MP.4** Model with mathematics. (HS-LS1-4)

**HSF-IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (HS-LS1-4)

**HSF-BF.A.1** Write a function that describes a relationship between two quantities. (HS-LS1-4)

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