NGSS MS-LS1-2 Rubrics: User Version 4

The following learning goals were unpacked from NGSS Standard MS-LS1-2. Each learning goal has a rubric that is independent of the assessment task and help text that is specific to the assessment task. Teachers can record students' scores in the manner of their choosing.

MS-LS1-2 From Molecules to Organisms: Structures and Processes

NGSS Performance Expectation: MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.] (Source: NGSS Standards)

MS-LS1-2 Discrete Learning Goals:

Identify Cell Structures (DCI) This learning goal is a broader goal that can be broken down into the following learning goals. Recording student attainment at the level of each cell structure will help identify student misconceptions. For example students may confuse the cell wall with the cell membrane.
Identify Cell Nucleus (DCI) 1: Correctly identifies nucleus 0: No evidence of attainment.
Identify Cell Membrane (DCI) 1: Correctly identifies cell membrane 0: No evidence of attainment.
Identify Cell Wall (DCI) 1: Correctly identifies cell wall 0: No evidence of attainment.
Identify Mitochondria (DCI) 1: Correctly identifies mitochondria 0: No evidence of attainment.
Identify Chloroplast (DCI) 1: Correctly identifies chloroplast 0: No evidence of attainment.

Help Text: For Identifying cell structures.

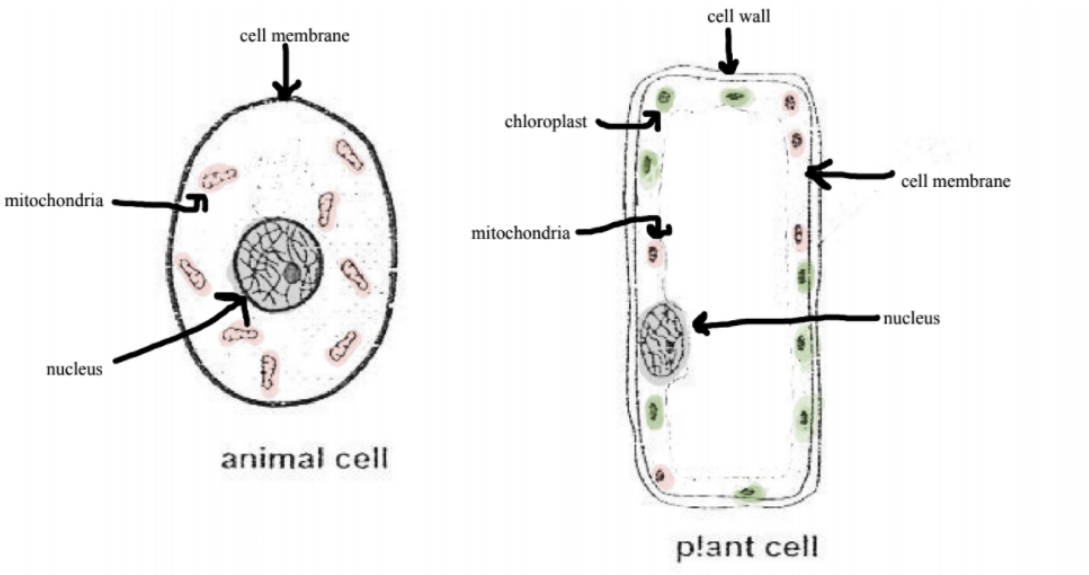
A. The structure must be correctly identified in each cell type in a drawing, image, or model of a cell. For example the cell membrane must be correctly labeled in both the plant and animal cell for a (1).

Example of Student Work:

In the example of student work below all structures are labeled correctly. This student would receive a 1 for each of the ID learning goals. Note that the student only needs to identify one of each structure in each cell. Also note that the student work below differentiates between plant and animal cells by labeling the cell wall and chloroplast on the plant cell only while labeling the mitochondria, nucleus, and cell membrane in both cells.

Part 1: Label the following cell parts in the diagram below. If parts are found in more than one cell, they should be labeled in each cell.

1. Cell Wall
2. Cell Membrane
3. Nucleus
4. Mitochondria
5. Chloroplast



Describe the relationship of each cell structure to the functioning of the cell as a whole. (DCI)

Like the identification of cell structures, the function of cell structures can be broken down to the level of individual cell structures. Again, the benefit of recording student attainment of these more specific learning goals is that it will pinpoint student misconceptions. Notice that each cell structure has a different rubric based on the level of knowledge required by the NGSS evidence statement.

The function of the nucleus (DCI)

1: The nucleus maintains (controls, regulates) a cell's internal processes.

0: no evidence of attainment.

Examples of Student Work:

Level 1: "The nucleus controls cell functions."

"The nucleus regulates the cell as a brain figure."

Level 0: "The nucleus is the center of the cell."

" The nucleus is a cell structure."

The function of the cell membrane (DCI)

2: Correctly states how the structure of the cell membrane as a membrane with gate and channel molecules contributes to its function of controlling what enters and leaves the cell.

1: States that the cell membrane controls what enters and leaves the cell.

0: no evidence of attainment

Examples of Student Work:

Level 2: "The cell membrane is a layer that surrounds the cell with molecules that let things in and out."

"The cell membrane surrounds the cell like a bag but it has parts that control what gets in and out of the bag"

Level 1: "The cell membrane determines what gets in and out of the cell."

Level 0: "The cell membrane surrounds the cell."

The function of the cell wall (DCI)

2: Correctly states how the structure of the cell wall as a woven web of molecules contributes to its fu of providing structure and protection to the cell.

1: The cell wall provides structure and/or protection for the cell.

0: no evidence of attainment

Examples of Student Work:

Level 2: "The cell wall is made of fiber molecules woven like a basket that give structure and protection to the cell."

"The basket like structure of the cell wall lets things in and out while giving the cell shape and strength"

Level 1: "The cell wall gives the cell its shape"

"The cell wall protects a plant cell."

Level 0: "The cell wall surrounds the cell."

The function of the chloroplast (DCI)

3: allows plants to make the food they need to live by using light energy to transform raw materials into food.

2: allows plants to make the food they need to live by carrying out photosynthesis.

1: allows plants to make the food they need to live

0: no evidence of attainment

Help Text:

Level 3: It should be clear that making food means storing energy by assembling organic molecules from inorganic molecules, not packaging food molecules that are already made.

Examples of Student Work:

Level 3: " The chloroplast used light energy to store energy in food molecules by building them "

"The chloroplast carries out photosynthesis by capturing light energy in the bonds of glucose molecules built from carbon dioxide and water."

Level 2: "Chloroplasts make food by doing photosynthesis."

Level 1: "Chloroplasts make food for the plant."

Level 0: "Chloroplasts are only found in plant cells."

The function of the mitochondria (DCI)

3: releases the chemical energy from food to power life processes by breaking the food down into simpler substances

2: makes energy available for the cell to carry out life functions through cellular respiration.

1: makes energy available for the cell to carry out life functions

0: no evidence of attainment

Help Text:

Examples of Student Work:

Level 3: "The mitochondria does cellular respiration. It breaks down glucose into carbon dioxide and water, releasing energy for the cell."

"The mitochondria releases energy for life processes by breaking down food molecules into smaller ones."

Level 2: "The mitochondria makes energy for the cell by respiration"

Level 1: "The mitochondria makes energy for the cell"

Level 0: "Mitochondria makes food"

"Mitochondria breaks down food"

The table below may be useful for recording student attainment of the learning goals relating to the identification and function of cell structures.

Cell Structure	LG: Student accurately identifies structure. (1,0)	LG: Student describes function of structures as it relates to the functioning of the cell as a whole. (1,0)	LG: Student describes structure/function relationship for this structure. (1,0)
Cell Wall (2,1,0)			
Cell Membrane (2,1,0)			
Nucleus			
Mitochondria (2,1,0)			
Chloroplast (2,1,0)			

Correctly distinguishes between cellular features of plants vs animals (DCI)
1: Correctly identify cell walls and chloroplasts as being part of plant cells but not animal cells.
0: No evidence of attainment.

Help Text:
This learning goal is measured by looking at the students labeled drawings. If the cell parts are labeled correctly with chloroplasts and cell wall found only in the plant cell while the remaining structures are found in both cells then the student would rate at level 1.

Examples of Student Work:
See student drawing for "identifying cell structures" above.

Developing models (SEP)
3: **All elements** of the model are internally consistent with the modeled object or system.
2: **Multiple but not all** elements of the model are internally consistent with the modeled object or system.
1: **One element** of the model is internally consistent with the modeled object or system.
0: No evidence of attainment.

Help Text:
A. For the cell assessment the modeled object is a cell.

B. As an example of internally consistent, consider the nucleus' function as regulating internal processes of the cell. In the student's analogy, the part that corresponds to the nucleus would regulate the internal processes of its system in a similar way to the nucleus of the cell.
C. Students may demonstrate misconceptions in their DCI, for example in knowing the function of a cell structure. The model should be consistent with the student's conception regardless of whether their conception is accurate/correct..
D. If the student's understanding of the chloroplast is accurate, then "Making" food in a kitchen would not be consistent with photosynthesis. That is assembling food. "Making" food would be more analogous to making electricity with a solar panel, or growing plants in a garden.
E. If the student understanding of the chloroplast and mitochondria are accurate then the chloroplast analogy should be providing the fuel for the mitochondria analogy.

Examples of student work:

Student Response: *Chloroplast Function: liquid inside the cell that holds everything together. Plantation analogy example: animal pens.* This is incorrect for DCI but correct with developing the model because the animal pens are consistent with the student's understanding.

Evaluate limitations of a model for a proposed object or tool. (Bonus SEP)
1: Identifies at least one valid limitation of the model.
0: No Evidence of attainment

Help text:

A. While this learning goal is intended for engineering models. It also applies to scientific or any model because models are an act of engineering.
B. Criterion for evaluating the analogy: The evaluation must be of the goodness of fit of the analogy to the original phenomenon or representation. Simply pointing out that the analogy is different is insufficient. The analogy will be different from the phenomenon by definition and nature. In other words: A limitation is not just a difference between a cell and your analogy. It is something that does not function in your analogy the way the corresponding part of the cell system functions.
C. Example of a valid limitation: If a house were being used as an analogy to a cell, then the kitchen may be the students analogy to the chloroplast. This is not accurate because the kitchen does not convert light energy and inorganic molecules into food the way a chloroplast does.

Help Text:

A. The following are not valid limitations: *The analogous cell structure is bigger than corresponding cell structure. The analogous cell structure is made of a difference than the analogous cell structure.* In other words it is not that there is something different about the analogy but that there is something wrong with the analogy.

Examples of Student Work:

A system can be described as a function of interactions between its parts. (CCC)
1: Describes the system as a function of interacting parts by stating that individual parts contribute to the function as a whole.
0: No evidence of attainment.

Help Text:

A. This is assessed in question four because it is specifically asking a student to explain why the cell is a system. The student's response must be related to a living system. If their response is related to their analogy, that is not sufficient.
B. Students may not show all parts contributing to the system as a whole for various reasons. For example they may not know the function of the chloroplast of a cell and therefore cannot explain its contribution to the cell as a whole. But that is a DCI issue. If they describe the cell as a system of parts that contribute to the function of the cell as a whole then that is sufficient even if they do not describe how each part contributes to the system. That is sufficient.

Examples of Student Work: