**Paper 3:**

# The Promise and Challenge of Eliciting and Measuring Evidence of Three-Dimensional Learning

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# Objective

To develop and pilot new assessment items/tasks that:

- Probe students' developing proficiency of each NGSS dimension for formative uses;
- Gather evidence of how well students are able to integrate the three dimensions for summative purposes.

# Research Questions

- Are we measuring what we think we are measuring (i.e., are they items or tasks valid measures)?
- How do these tasks provide evidence of students' learning on three dimensions—both holistically and discretely?

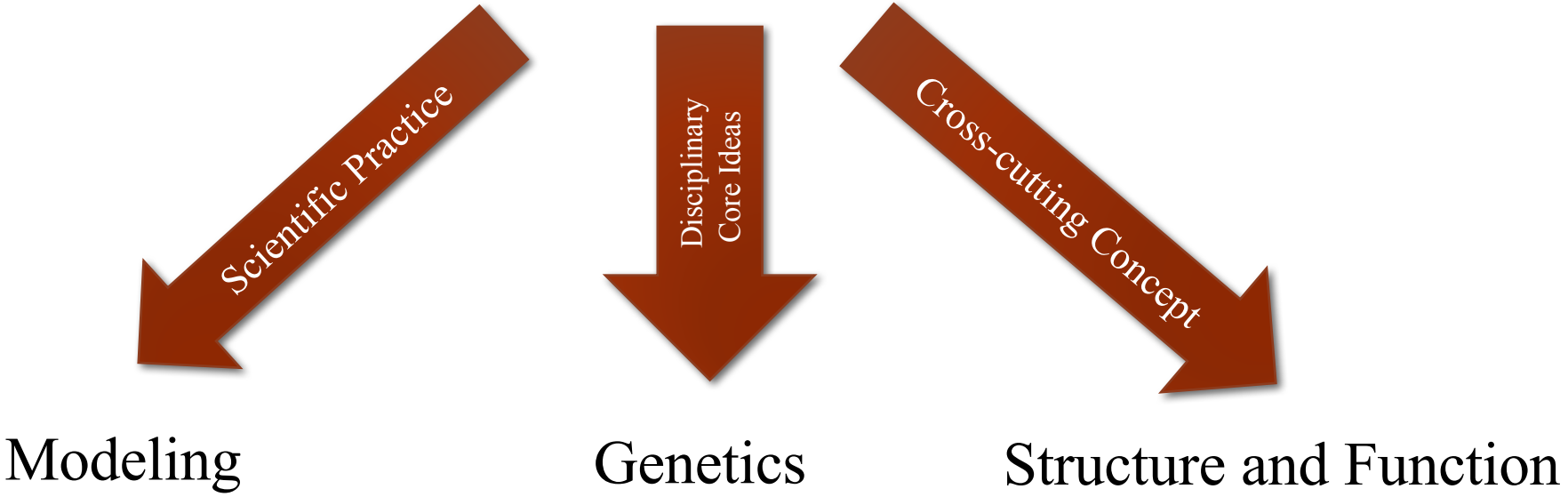
# Process of Development

Process of ECD

- Unpack the Performance Expectations (PEs)
- Define modeling for the task
  - -Broadly defined in NGSS
  - -Relevant to the task
  - -Familiar method to students
- Identify characteristics of a proficient level of content (DCI and CCC) and modeling
- Brainstorm prompts to elicit proficient level
- Discuss expected students' response

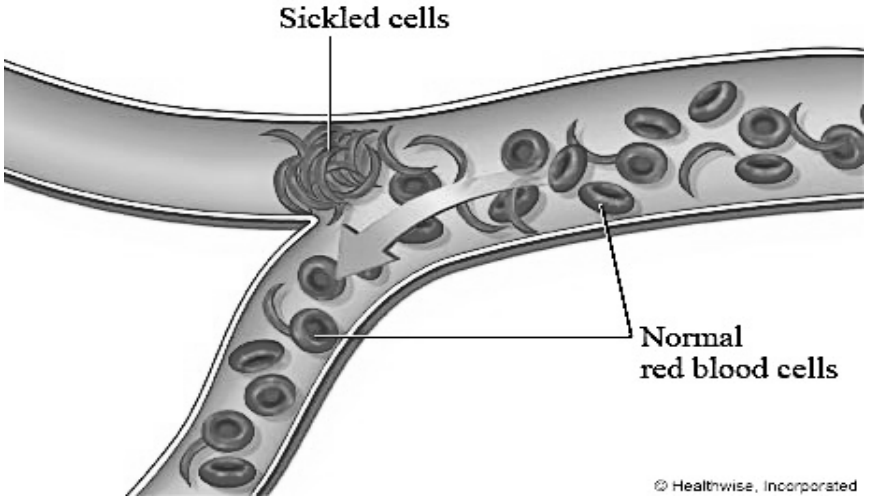
# Performance expectation: MS-LS3-2

Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.



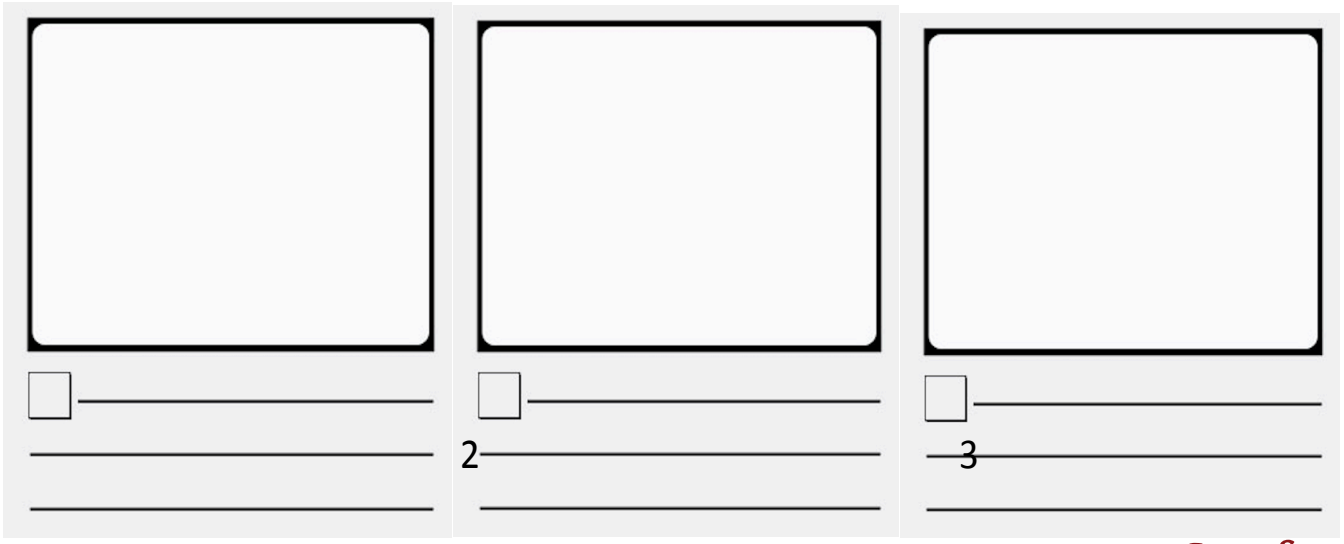
# Part 1: Background For Students

Sickle cell anemia is a genetic disease that is caused by a single change in the DNA. The disease gets its name from the sickle shape of the red blood cells that have this disease. These elongated cells get stuck in small blood vessels so that parts of the body don't get the oxygen that they need.



# PART 2: Modeling (Cont.)

Make a storyboard to show the process of how a mutated gene leads to sickle cell disease. You may use the pictures below or make your own drawings to fill in the storyboard on the next page.



# PART 2: Modeling (Cont.)

| | |
|---|---|
|  | normal red blood cell |
|  | sickle red blood cell |
|  | normal protein |
|  | abnormal protein |
|  | mutated gene |
|  | normal gene |
|  | human without disease |
|  | human with disease |

## Part 3:  Describing

Describe the process you showed in your storyboard of how a mutated gene leads to sickle cell disease.

# Part 4: Use a model

**Question 3.** Two parents are going to have a child. Neither of them have *sickle cell disease,* but each of them carries one copy of the mutated gene that causes sickle disease.

Their doctor tells them that there is a *one in four chance that their child will have sickle cell disease*. He draws a diagram to explain why this is so. **Use the space to show what diagram you think he might draw.** Write a few sentences below your diagram to explain your work.

# Findings

What evidence do we have of students ability **to make and use a model to describe the genetic process?**

- Model 1:
  - All were able to provide *something* in Model 1.
  - Many showed correct gene to protein to cell to disease.
  - Others showed a “cancer” process.
- For model 2:
  - If students had been taught punnett squares, they chose that type of mode, constructed and interpreted it accurately.

Conflicting information: Can accurately construct and interpret the Punnett square but talk about sickle cell as something more like a cancer.

# Challenges

- In the end, to what extent does it elicit students' ability to model when we have to constrain the response to one type of modeling?
- Modelling (drawing) vs description (writing)
  - What does each buy us?
  - Does the model constrain the description or does the description show more than what they did in the model?
- Scoring:  Discrete vs integrated

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