



# NHPS Science and Common Core Literacy Standards

[www.newhavenscience.org/ScienceCSSS.htm](http://www.newhavenscience.org/ScienceCSSS.htm)

See: <http://newhavenscience.org/ScienceCommonCoreNHPS.htm>

<http://www.newhavenscience.org/ScienceLiteracy.htm>





# Today's Explorations



- Update on Next Gen Science Standards
- “Unwrapping” Common Core Standards for Literacy in Gr. 6-12 Science Classes
- Quality and range of science readings
- Cognitive demand of reading assignments (tasks)
- Interacting with text
- Text dependent questions



# Next Generation Science Standards

- Frameworks:

[www.newhavenscience.org/NGSSScienceFramework.pdf](http://www.newhavenscience.org/NGSSScienceFramework.pdf)

- NHPS Science/NGSS/CommonCoreSummary:

- [www.newhavenscience.org/ScienceCommonCoreNHPS.pdf](http://www.newhavenscience.org/ScienceCommonCoreNHPS.pdf)





# NGSS

- **1 Scientific and Engineering Practices**
- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information



# NGSS

- **2 Crosscutting Concepts**
- 1. Patterns
- 2. Cause and effect: Mechanism and explanation  
Scale, proportion, and quantity
- 3. Systems and system models
- 4. Energy and matter: Flows, cycles, and conservation
- 5. Structure and function
- 6. Stability and change



# Core Ideas

- *Physical Sciences*
- PS1: Matter and its interactions PS2: Motion and stability: Forces and interactions PS3: Energy PS4: Waves and their applications in technologies for information transfer
- *Life Sciences*
- LS1: From molecules to organisms: Structures and processes
- LS2: Ecosystems: Interactions, energy, and dynamics
- LS3: Heredity: Inheritance and variation of traits LS4: Biological evolution: Unity and diversity
- *Earth and Space Sciences*
- ESS1: Earth's place in the universe
- ESS2: Earth's systems ESS3: Earth and human activity
- *Engineering, Technology, and Applications of Science*
- ETS1: Engineering design
- ETS2: Links among engineering, technology, science, and society



# Science Standards

- Out for public review May 15?
- 3-6 Performance Expectations for each endpoint paragraph (44 per grade band), integrating practice, dimension, idea.
- [nextgenscience.org](http://nextgenscience.org)
- Final Draft due December 2012
- CT State to adopt? New test in 2015?
- Science COUNTS school/district measure!





Performance Expectations

Students demonstrate understanding of how structure relates to how cells function. [Assessment Boundary: ...]

b. Using data to generate explanations that unicellular and multicellular organisms obtain food, water, and energy from the environment to survive.

c. Explaining the function of specific parts of cells (i.e., cell membrane, cell wall, nucleus, and mitochondria).

d. Generating an explanation for the way the structure of the cell membrane maintains the internal environment by controlling what enters and leaves the cell.

e. Constructing models and representations of body systems to show multiple interactions between different structures. [Assessment Boundary: The focus is on only a few body functions: nutrient provision, waste removal, and gas exchange]

f. Providing evidence that organisms respond to stimuli by sending messages to the brain to be processed and stored as long-term memories.

g. Communicating information about how the structure and function of millions of neurons and nerve cells in the brain coordinate behaviors and long-term memories.

Blue font designates a science and engineering practices concept

Orange font designates a disciplinary core idea

Green font designates a crosscutting concept.

Red font designates an assessment boundary.

Foundation Boxes

**Science and Engineering Practices**

**Developing and Using Models**

- Use models to explore relationships between variables, especially those representing input and output. (c)

**Planning and Carrying Out Investigations**

- Collect data to investigate and generate reliable evidence to answer scientific questions under a range of conditions. (a)

**Constructing Explanations and Designing Solutions**

- Generate and compare multiple solutions based on a model, simulation, or experiment to identify the most feasible and viable solution to a problem. (b),(c)

**Obtaining, Evaluating, and Communicating Information**

- Gather, read, and explain information from appropriate genre, evaluating the credibility of the publication, authors, possible bias of the source, and methods used. (a),(b)

Lowercase letters designate which of the standard statements use this practice

**Disciplinary Core Ideas**

**LS1.A: Structure and Function**

- All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (a)
- Unicellular organisms (microorganisms), like multicellular organisms, need food, water, a way to dispose of waste, and an environment in which they can live. (b)
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (c),(d)
- In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to perform a specific function. (g)

**LS1.D: Information and Communication**

- Each cell in the body receives information from the environment, such as electromagnetic waves, that travel along the cell membrane. (g)
- The structure and function of many millions of interconnected nerve cells allow combined inputs to be stored as memories for long periods of time. (g)

Lowercase letters designate which of the standard statements incorporates this disciplinary core idea

**Crosscutting Concepts**

**Cause and Effect**

- Evidence is used to support claims about cause and effect relationships and their mechanisms. (b)

**Systems and System Models**

- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (a),(c)
- Models can be used to represent systems and their interactions—such as inputs, outputs, and feedback loops—and to test their predictions. (a),(b),(c)

Lowercase letters designate which of the standard statements incorporate this crosscutting concept

Connection Boxes

*Connections to other topics in this grade level: MS.PS-CR*

*Articulation across grade-levels: 3.SFS, HS.LS-SFIP*

*Common Core State Standards Connections:*

**ELA –**

**RST.6.3** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks

**RI.6.8** Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not.

**RI.8.8** Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.

**Mathematics –**

**MP.2** Reason abstractly and quantitatively.

**MP.6** Attend to precision.

**7.SP.1.2** Use random sampling to draw inferences about a population.





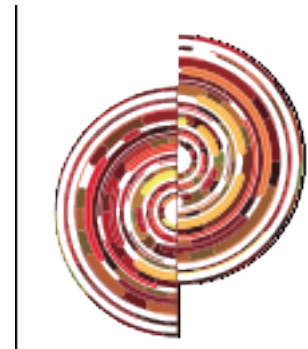
# NHPS Science Plan



- **Science: CT State Standards to Next Gen Science Standards:**
- **8 Practices, Cross Cutting Concepts, Content Strands (Increase in content in physics, astronomy, earth science (some levels))**
- **Science:**
- 12-13
- No change in science content. (ADD Career Awareness Components!)
- Use informational text readings in current elementary science kits (complex text). K-5
- Use reading passages (critical text) in district science assessments 7-12.
- Revise unit significant tasks (projects) 7-12 to incorporate research/writing/presentation standards. (21st century skills)
- Add engineering/design tasks.
- Align measurement tasks K-6 with Math measurement/data (K-5)
- Align middle school labs with Math statistics/probability (6-8)
- Align common use of data/regression with Math Modeling
  
- 13-14 Begin NGSS content shift (grades K,3,6,9)
- Align NGSS Practices with core significant tasks (commonalities with CCSS practices include: argumentation, discourse, use of evidence, modeling)
- Revise units to include engineering/design principles.
- 
- 14-15 NGSS content shift (grades (1,4,7,10)
- 15-16 NGSS content shift (grades 2,5,8, 11,12)
- <http://www.newhavenscience.org/ScienceCommonCore.htm>
- <http://www.newhavenscience.org/ScienceCommonCoreNHPS.htm>



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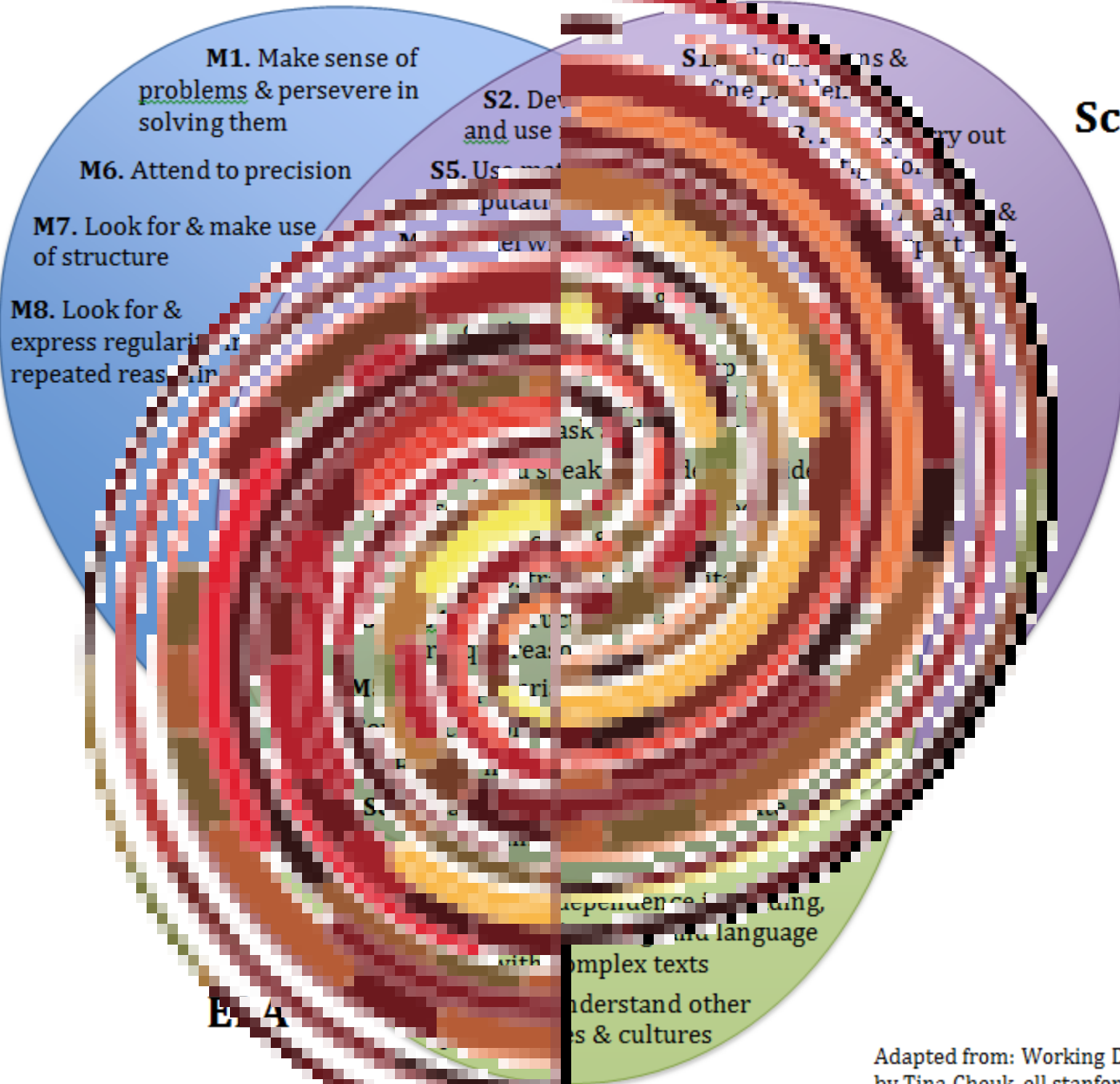


# COMMON CORE

- Is HERE now!
- Math Common Core shifts SOME content, but mostly shifts practices: Focus, Coherence, Rigor
- ELA Common Core shifts practices: see: student portraits
- Details (Standards and appendices:
  - <http://www.corestandards.org/the-standards>)
- All 3 subjects are similar to our 21<sup>st</sup> Cent Skills!

# Math

# Science





21 <sup>st</sup> Century Competency		As demonstrated by a student's ability to...
1	<b>Problem Solving and Critical Thinking</b>	<ul style="list-style-type: none"> <li>• Reason effectively</li> <li>• Make insightful judgments and decisions</li> <li>• Solve problems</li> </ul>
2	<b>Accessing and Analyzing Information*</b>	<ul style="list-style-type: none"> <li>• Use research tools to access and evaluate information from multiple sources</li> <li>• Organize and synthesize information using multiple methods</li> </ul>
3	<b>Communication and Collaboration* (digital)</b>	<ul style="list-style-type: none"> <li>• Articulate ideas clearly and effectively to a variety of audiences using multiple modes</li> <li>• Communicate effectively and work productively with others</li> </ul>
4	<b>Creativity and Innovation</b>	<ul style="list-style-type: none"> <li>• Demonstrate originality and inventiveness in work</li> </ul>
5	<b>Initiative, Self-Direction and Accountability</b>	<ul style="list-style-type: none"> <li>• Set and meet high standards and goals for one's self and others</li> <li>• Manage time and resources to produce high quality results in a timely manner</li> <li>• Take responsibility for one's own learning</li> </ul>
6	<b>Citizenship and Responsibility</b>	<ul style="list-style-type: none"> <li>• Exercise empathy and respect for diverse cultures and perspectives</li> <li>• Contribute to and take responsibility for the larger community</li> </ul>



# Overall Shifts for Instruction

## ELA/Literacy Common Core

- <http://www.corestandards.org/the-standards>

**1. Building knowledge through content-rich nonfiction and informational texts**

**2. Reading and writing grounded in evidence from text**

**3. Regular practice with complex text and its academic vocabulary**





# Building knowledge through content-rich nonfiction and informational text

- Need to read more informational text -  
Move to **50/50 at the Elementary Level**  
**and 75/25 at the Secondary Level**
- Grades 6 – 12 – Three Contents must own  
this: English, Science and Social Studies
- All contents need to recognize the  
importance of their own connection to  
literacy



# Reading and writing grounded in **evidence from text**

- Read closely
- Ask text-dependent questions
- Answers are always be based on evidence from the text
- Writing assessments must move to text-evidence based writing prompts



# **WHY is this shift important?**

- **Most college and workplace writing is evidence-based and expository in nature (not narrative)**
- **Ability to cite evidence differentiates student performance on the National Assessment**
- **Writing Standards ask students to respond to evidence-based writing prompts (inform/argue)**
- **S&L standards require students to prepare for and refer to evidence on ideas under discussion**
- **Reading standards require students to respond to text-dependent questions with evidence-based claims**



# Regular practice with **complex text** and its **academic vocabulary**

- Focus on the complexity of what students need to read
- All grade levels need to have exposure to complex text
- Those with limited vocabulary need **scaffolding** – students will become more proficient with complex text with more exposure with complex text
- Provide experience reading shorter pieces and excerpts from longer selections
- Very little front loading of the text



# Overview of Text Complexity

- ◆ Reading Standards include exemplar texts (stories and literature, poetry, and informational texts) that illustrate appropriate level of complexity by grade (see Appendix B)  
<http://www.corestandards.org/the-standards>
  
- ◆ Text complexity is defined by:
  - **Qualitative measures** – levels of meaning, structure, language conventionality and clarity, and knowledge demands
  - **Quantitative measures** – readability and other scores of text complexity
  - **Reader and Task** – background knowledge of reader, motivation, interests, and complexity generated by tasks assigned





## Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects

- **College and Career Readiness (CCR) Standards (Portraits)**
  - Overarching standards further defined by grade-specific standards
- **Grade-Level Standards in English Language Arts**
- **<http://www.newhavenscience.org/CCSSNewHavenK-5.doc>**
- **<http://www.newhavenscience.org/CCSSGrades6-12.doc>**
  - K-8, grade-by-grade
  - 9-10 and 11-12 grade bands for high school
  - Four strands: *Reading, Writing, Speaking and Listening*, and *Language*
- **Standards for Literacy in History/Social Studies, Science, and Technical Subjects**
- **<http://www.newhavenscience.org/CCSSHistoryScienceTechnology6-12.doc>**
  - Embedded at grades K-5
  - Content-specific literacy standards are provided for grades 6-8, 9-10, and 11-12



# Overview of Literacy Standards

- ◆ Progressive development of reading comprehension; students gain more from what they read
- ◆ Emphasize the importance of grade-level texts that are of appropriate difficulty and are increasingly sophisticated
  - Reading Standards for Literature (K-12)
  - Reading Standards for Informational Text (K-12)
  - Standards for Reading Foundational Skills (K-5)
  - Reading Standards for Literacy in History/Social Studies (6-12)
  - Reading Standards for Literacy in Science and Technical Subjects (6-12)
  - Writing (K-12)
  - Speaking and Listening (K-12)
  - Language (K-12)



# Standards for Literacy in History, Science and Technical Subjects Standards (H-S-T)

<http://www.corestandards.org/the-standards/english-language-arts-standards/science-technical/>

- 10 reading standards expressly for Gr. 6-12 **science** teachers (p. 62) (same as ELA)
- 10 writing standards (p. 64-66)
- To be associated with **science content** and practices in state [and Next Generation] **science standards**
- <http://www.newhavenscience.org/CCSSHistoryScienceTechnology6-12.doc>



# Close Reading of H-S-T Standards

<http://www.newhavenscience.org/CCSSHistoryScienceTechnology6-12.doc>

Focus Question: What reading skills will I be teaching through science readings? (10 min)

<http://www.corestandards.org/the-standards/english-language-arts-standards/science-technical/grades-9-10/>

Strategy: “Interact with the text”:

1. Choose a gradespan
2. Highlight the nouns and noun phrases
3. What do you NOTICE?
4. What do you THINK?



# Reading Skills in Science Gr. 6-12

1. Cite details as evidence
2. Determine central idea; summarize
3. Follow a complex multistep procedure
4. Determine meanings – symbols, terms, domain-specific
5. Analyze text structure (organization)
6. Author's purpose
7. Words to graphics; graphics to words
8. Evidence vs opinion
9. Compare claims in different texts
10. Level of text complexity





# Are Textbooks Sufficient?

## Complexity

Quantitative

Qualitative

Reader characteristics

## Quality

Recognized value

Classic or historically significant

Literary/Scientific merit

Cultural significance

Rich content

## Range

Authorship

Publication date

Subject matter



# Broad Definitions of “TEXT”

## WRITTEN

- Articles
- Field guides
- Manuals
- Biographies
- Schedules
- Wikipedia
- Blogs
- Web sites
- Apps

## GRAPHIC

- Photos
- Charts
- Tables
- Diagrams
- Maps
- Illustrations
- simulations

## MEDIA

- Video
- Podcasts
- NPR Science Friday
- Read alouds
- Books on tape
- Khan Academy
- Recorded lectures, courses, speeches



## Moving Toward Complex Text: QUALITIES TO LOOK FOR IN READING MATERIALS

- **PURPOSE:** Author's "message" is implied
- **STRUCTURE:**
  - Complex organization
  - Graphics essential to understanding text
- **LANGUAGE:**
  - Abstract or figurative language; irony
  - Complex sentences, unfamiliar, discipline-specific language
- **KNOWLEDGE DEMANDS**
  - Requires content knowledge
  - References/citations of other texts or theories



# Examples of Common Ground

## Common Core Literacy in Science

- Cite specific textual evidence to support analysis of science and technical texts... (RST.1)
- Determine the central ideas or conclusions of a text; provide an accurate summary distinct from prior knowledge or opinions (RST.2)
- Distinguish among facts, reasoned judgment based on research findings, and speculation in a text (RST.8)

## Next Gen Science Practices

- Construct an argument supported by evidence (Practice 7).
- Distinguish evidence from opinion (Practice 7).
- Read scientific and engineering text (Practice 8).
- Recognize major features of scientific and engineering writing and speaking (Practice 8)
- Engage in critical reading of primary scientific literature and media reports (Practice 8).



# Evaluating Reading Selections (5 min)

<http://www.newhavenscience.org/ScienceLiteracy.htm>

- What is the QUALITY?
- Which of the 10 Reading Standards does it provide opportunities to teach?
- Do you need a broader RANGE of readings?





# Guide to Text Dependent Questions for Close Analytic Reading

- Require familiarity with text! NOT opinion/feelings!
- Identify Core Understandings
- Start Small
- Target Vocabulary and Text Structure
- Tackle Tough Sections Head On
- Create Coherent Sequences of Text Dependent Questions
- Identify the Standards
- Create the Culminating Assignment



# Evaluating Reading Task (5 min)

<http://www.newhavenscience.org/ScienceLiteracy.htm>

- Judge the “cognitive demand” of what students are expected to do once they’ve read.
- Which of the 10 Reading Standards does it apply to?
- If none, can you change the assignment and keep the reading selection...or
- Do you need to change both the reading selection and the assignment?



# Text Dependent Questions

- Asks a question that can only be answered by referring explicitly back to the text being read.
- Does not rely on any particular background information or depend on students' prior experiences or knowledge;
- Students extract from the text only.
- PRACTICE!!! See Examples from Appendix B, C.
- [http://www.corestandards.org/assets/Appendix\\_B.pdf](http://www.corestandards.org/assets/Appendix_B.pdf)  
[http://www.corestandards.org/assets/Appendix\\_C.pdf](http://www.corestandards.org/assets/Appendix_C.pdf)