Life Science Standard **LS1G**

Content Standard:

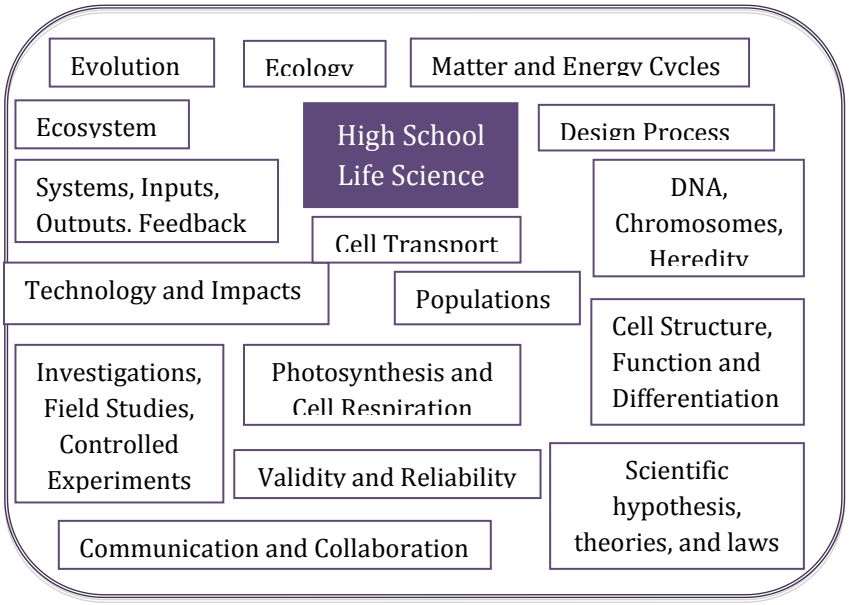
Cells use the DNA that forms their *genes* to encode *enzymes* and other proteins that allow a cell to grow and divide to produce more cells, and to respond to the *environment*.

Performance Indicators:

Explain *that* regulation of cell *functions* can occur by changing the activity of proteins within cells and/or by changing whether and how often particular *genes* are expressed.

Item Specifications:

- Describe that cells use DNA that forms their genes to encode enzymes and other proteins.
- Describe that cell functions (e.g., cell growth and division, response to the environment) can be regulated by changing the activity of proteins and/or by changing whether and how often particular genes are expressed.
- Describe that changes in the environment can cause changes in the amount and/or activity of proteins (e.g., enzymes) produced by a gene.



Reflective Questions for Students:

- Explain the difference between chromosomes, DNA, and genes.
- How can a signal from the outside world change a genes expression?

When you think about the answers to these questions, think about models that you could develop, diagrams that would demonstrate processes and functions of parts in relationship to their structure.

Assessment Information

http://www.k12.wa.us/Science/Assessments.aspx

Quick Links for Students:

Use the following links to explore your understanding of DNA, proteins, and their functioning.

- An interactive link regarding cellular transport: http://www.teachersdomain.org/resource/tdc02.sci.life.cell.membraneweb/
- What is a Gene? http://learn.genetics.utah.edu/content/begin/dna/tour_gene.html
- Gene Control simulation and explanation http://learn.genetics.utah.edu/content/epigenetics/control/
- Lick Your Rat an Inquiry http://learn.genetics.utah.edu/content/epigenetics/rats/

Teacher Center
Elements of Effective Science Instruction

Disciplinary Core Ideas

Essential teaching components leading to the big ideas:

Student acquisition of the content of science involves opportunities to meet state crosscutting and domain standards and recognize how the big ideas fit within a large conceptual framework. Learning is best achieved through sequencing learning targets into learning progressions that inform teacher's instructional decision making.

- Genes encode for enzymes and other proteins.
- Cell functions are regulated by changing the production of proteins.
- Changes in environment can cause changes in the production of enzymes.

Additional supports and extensions for understanding how students grasp the concept:

- Paige Keeley's Formative assessment probes available through nsta.org
- Go to the life science file on this next page for extensive descriptions of common student misconceptions about concepts in biology.
  http://www.doe.mass.edu/omste/ste/default.html
- This website gives common misconceptions for many concepts in genetics.

http://www.rpdp.net/sciencetips_v3/L8A1.htm#misconcept

Cross Cutting Ideas:
Designing for Learning

Strategies to reveal student understanding include:

- Paige Keeley's Formative assessment probes available through nsta.org
- Teacher's Toolkit: Misconceptions in the science classroom, Science Scope at www.nsta.org
  This article in Science Scope offers suggestions for identifying science misconceptions in general.
- Student responds to a writing prompt comparing contrasting the terms DNA, chromosome, and gene
- Students give examples of a change in an organism or cell that changes with response to the environment
- Students analyze how diet of mother affects the development of fetus. (or other relationship between environment and gene expression)
- Sites for misconceptions with DNA, Genetics, and Protein synthesis
  http://rpdp.net/sciencetips_v2/L12A1.htm#misconcept
  http://www.doe.mass.edu/omste/ste/default.html go to the life document at the bottom of the page and search the document for genetics starting on page 25.

Prerequisite knowledge required:

- See LS1E and LSE1F

Student learning progressions

- Cells use DNA that forms their genes to encode enzymes and other proteins
- Cell functions are carried out by many different types of molecules, mostly proteins. Productions of these proteins are directed by genes.
- Changes in the environment can cause changes in the activity of these genes.

Scientifically oriented questions focused on clarifying and extending student understanding include:

- Explain how hormones or other chemicals are produced by cells in your body?
- Describe how a person's cells respond to food intake.

Activities supporting opportunities for students to make claims, use evidence and communicate reasonings include:

- **SYSTEMS (EALR 1):**
  - A
- **INQUIRY (EALR 2):**

  Lick Your Rat an Inquiry http://learn.genetics.utah.edu/content/epigenetics/rats/
- **APPLICATION (EALR 3):**
  http://learn.genetics.utah.edu/content/epigenetics/nutrition/
- **LIFE SCIENCE (EALR 4):**
  Cells Alive http://www.cellsalive.com/index.htm

Cross Cutting Ideas: *Sense Making*	**Cross Cutting Ideas:** *Classroom Culture and Environment*
Planning time in the lessons to support time for students to make sense of what they are learning include: • Students reflect on ways that environmental factors effect gene expression.	**Activities that show how this content standard relates to students' everyday lives include:** • Have a discussion about how our environment can affect our minds and bodies based on information at the following site: http://learn.genetics.utah.edu/content/epigenetics/
Strategies to focus on student conversations, interactive notebook prompts, model-building include:	**Activities that show how scientists think and do science in relationship to this content standards include:**