

## Life Science Standard LS1H

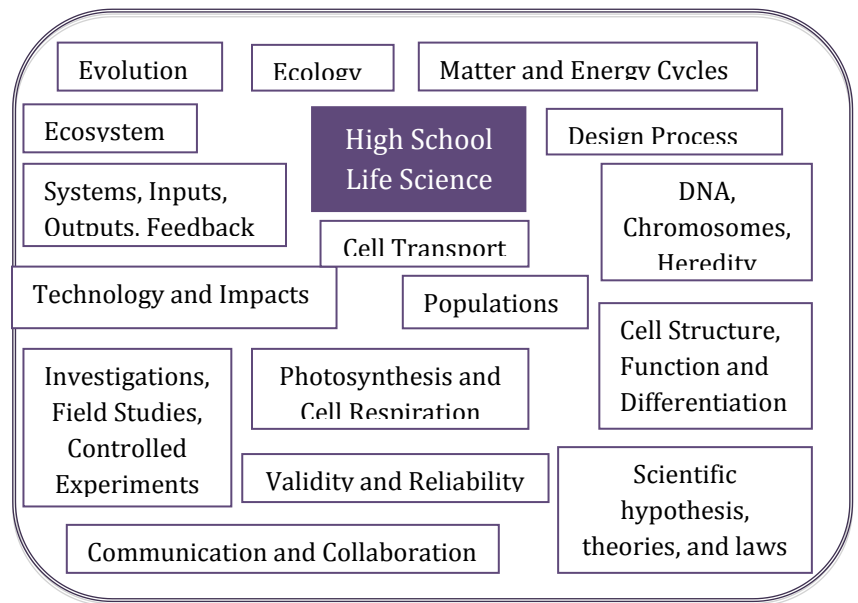
**Content Standard:**

Genes are carried on chromosomes. Animal cells contain two copies of each chromosome with genetic information that regulate body structure and functions. Most cells divide by a process called mitosis, in which the genetic information is copied so that each new cell contains exact copies of the original chromosomes.

**Performance Indicators:** Describe and model the process of mitosis, in which one cell divides, producing two cells, each with copies of both chromosomes from each pair in the original cell.

**Item Specifications:**

- Describe that genes are carried on chromosomes.
- Describe that typical animal cells contain two copies of each chromosome, one from each biological parent, with genetic information that regulates body structure and function.
- Describe the process of mitosis (e.g., the genetic information is copied and each of two new cells receives exact copies of the original chromosomes) and/or the product of mitosis (e.g., two cells each with the same number of chromosomes as the original cell).

**Reflective Questions for Students:**

- How does your body grow?
  - Do all organisms, both plants and animals, grow the same way?
- 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:**

The following links will help you visualize the process of mitosis. Animal

- Mitosis <http://cellsalive.com/mitosis.htm>
- Mitosis: The Dance of the Chromosomes [http://www.contexo.info/DNA\\_Basics/Mitosis.htm](http://www.contexo.info/DNA_Basics/Mitosis.htm)
- Mitosis: What is Mitosis? <http://www.microscope-microscope.org/activities/school/mitosis.htm>
- This site contains an activity that allows you to identify the steps of mitosis. <http://learn genetics.utah.edu/>

*Using these websites, can you now describe how your body grows?*

# Teacher Center

## Elements of Effective Science Instruction

### **Disciplinary Core Ideas**

In order to understand the concept of mitosis, students need background knowledge in the parts of the cell as well as understanding of the role of DNA in genetics and regulating cell function. See standards LS1E, LS1F and LS1G. LIMIT: Students do not need to **memorize** the every detailed step. Such memorization is likely to cause students to miss the big picture about the purpose and end results of this mitosis. The same goes for meiosis. Students should also be familiar with the idea of using models to represent or show a biological process.

### **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.

- Chromosomes are made of DNA which code for genes carried on chromosomes.
- Genes contain the genetic information passed from parents to offspring.
- Every animal cell contains 2 copies of each chromosome inside the nucleus.
- Every cell in the body of an organism contains DNA with all the genetic information of that living organism.
- All the animals of the same species have the same number of chromosomes in the nucleus of their cells. Examples: all humans have 46 chromosomes arranged in 23 pairs. Fruit flies have 8 chromosomes arranged in 4 pairs.

A resource for teaching about mitosis, with video clips, background information and lesson plans is at [http://www.teachersdomain.org/resource/tdc02/sci.life.repro.lp\\_cellreplc](http://www.teachersdomain.org/resource/tdc02/sci.life.repro.lp_cellreplc).

NSTA has several journal articles focused on teaching the concept of mitosis at [http://www.nsta.org/publications/serach\\_journals.spx?keyword=Mitosis&journal=TST](http://www.nsta.org/publications/serach_journals.spx?keyword=Mitosis&journal=TST)

The following site takes a teacher through the process of teaching mitosis, including tips on what to emphasize. <http://scidiv.bellevuecollege.edu/rkr/biology160/lectures/pdfs/Mitosis160.pdf>

### **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](http://www.nsta.org)  
This article in Science Scope offers suggestions for identifying science misconceptions in general.
- Private Universe Project in Science at <http://www.learner.org/resources/series29.html> is a collection of videos probing misconceptions of several important science concepts and offers insight into how these misconceptions interfere with learning.
- <http://www.doe.mass.edu/omste/st/default.html>: Go to the life science file on this page for extensive descriptions of common student misconceptions about concepts in biology.

**Prerequisite knowledge required:**

- Knowledge of cell structures
- Understanding of heredity

**Learning progressions for mitosis include:**

- Students need to know DNA is a macromolecule located in the nucleus of cells.
- Students need to know that DNA is the genetic molecule that transfers that information from parent to offspring.
- Students can describe that genes are carried on chromosomes
- Students can describe that most animal cells contain two copies of each chromosome, one from each parent, containing the genetic information for body structure and cell function.
- Students can model the process of mitosis (the chromosomes are copied and each new cell receives exact copies of the original chromosomes), and show the product of mitosis (two cells, each with the same number of chromosomes as the original cell).

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

- Why must each chromosome copy itself before the cell divides into two cells?
- How is the genetic blueprint that makes you who you are transferred faithfully from one cell to the next?
- Do all the cells of the body contain the same genetic information?
- What happens when something goes wrong during mitosis?
- Can mitosis happen outside of a living body? Could scientists cause cells to grow to make organs for transplanting in humans?

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

- Lesson 8: Mitosis: Chromosome Replication & Division  
[www.biologylessons.sdsu.edu/classes/lab8/lab8.html](http://www.biologylessons.sdsu.edu/classes/lab8/lab8.html)
- This is an on-line lab that students could do at home as well as on computers at school.  
[bio.rutgers.edu/~gb101/lab2\\_mitosis/index2.html](http://bio.rutgers.edu/~gb101/lab2_mitosis/index2.html)
- This site has activities on cancer growth and cloning, both support applications and systems.  
[http://www.teachersdomain.org/resource/tdc02.sci.life.cell.lp\\_divide/](http://www.teachersdomain.org/resource/tdc02.sci.life.cell.lp_divide/)

<p><b><u>Cross Cutting Ideas:</u></b> <i>Sense Making</i></p>	<p><b><u>Cross Cutting Ideas:</u></b> <i>Classroom Culture and Environment</i></p>
<p><b>Planning time in the lessons to support time for students to make sense of what they are learning include:</b></p> <ul style="list-style-type: none"><li>• This website offers a variety of professional development lessons and videos for strategies to teach specific concepts within science. <a href="http://www.teachersdomain.org/search/?q=strategies+for+effective+teaching&amp;fq_grade=PK&amp;fq_grade=PS">http://www.teachersdomain.org/search/?q=strategies+for+effective+teaching&amp;fq_grade=PK&amp;fq_grade=PS</a>.</li></ul>	<p><b>Activities that show how this content standard relates to students' everyday lives include:</b></p> <ul style="list-style-type: none"><li>• This site has several lessons on cloning. <a href="http://www.lessonplanet.com/lesson-plans/cloning">http://www.lessonplanet.com/lesson-plans/cloning</a>.</li><li>• This site has several lessons on cancer, including cancer and the cell cycle. <a href="http://science.education.nih.gov/supplement/nih1/cancer/guide/pdfs.htm">http://science.education.nih.gov/supplement/nih1/cancer/guide/pdfs.htm</a>.</li><li>• The site on cancer lessons also has examples and information on the questions scientist ask</li></ul>

	to guide their research.
<b>Strategies to focus on student conversations, interactive notebook prompts, model-building include:</b>	<b>Activities that show how scientists think and do science in relationship to this content standards include:</b>