## COMPETENCY GOAL 2: The learner will develop an understanding of the continuity of life and the changes of organisms over time.

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| 4%     | **2.01** Analyze the molecular basis of heredity/DNA including: | Instruction should include:  
1) The structure of DNA, base pairing, and the formation of hydrogen bonds.  
2) Mutation as a change in DNA code.  
3) The contributions of James Watson & Francis Crick. | 1) Creation of models. |  
http://vector.cshl.org/dnaftb/DNA from the Beginning – Useful for many goal 2 objectives. Cold Spring Harbor Laboratory  
http://biocsrs.biomed.brown.edu/Books/Chapters/Ch%208/DH-Paper.html This is a web reprint of Watson and Crick’s original paper. (Link must be pasted into browser)  
Video – The Race for the Double Helix |
|        | 2.01a Replication. | Replication allows daughter cells to have an exact copy of parental DNA, is semi-conservative and takes place before cells can divide. | 1) Use of models to demonstrate replication. | http://www.pbs.org/wgbh/aso/tryit/dna/index.html# PBS has an interactive tutorial for replication and protein synthesis. |
|        | 2.01b Protein Synthesis. | 1) Recognition of protein synthesis as a process:  
• Transcription produces mRNA copy  
• mRNA travels to ribosome  
• Translation - tRNA supplies appropriate amino acids  
• Amino acids link to form protein  
2) Mutation as a change in DNA code that can lead to a change in protein. | 1) Inquiry Support Lab – What are the effects of Various Mutations on Protein Synthesis?  
2) Use of models that enable students to work through the processes of transcription and translation to determine the resulting amino acid chain. | |
| 4%     | **2.02** Compare and contrast the characteristics of asexual and sexual reproduction. | 1) Function of Mitosis & Meiosis including:  
• Attention to similarities and differences between mitosis and meiosis  
• Changes in chromosome number  
• Ability to put diagrams in order and describe what is occurring throughout the process  
*Students are not expected to memorize the names of the steps or the order of the step names.*  
2) Sources and amount of variation including:  
• Crossing over  
• Random assortment of chromosomes | 1) Observation of slides such as a plant root tip.  
2) Use or creation of models that allow students to manipulate structures with in a cell to demonstrate Mitosis and Meiosis. |  
http://blog-101-104.bio.cornell.edu/bioG101_104/tutorials/cell_division.html interactive tutorial with pictures of phases  
http://www.biology.arizona.edu/cell_bio/cell_bio.html cell cycle tutorials and a web version of an onion root tip lab – many of these tutorials are also available in Spanish |
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| 6%     | 2.03      | **Interpret and use the laws of probability to predict patterns of inheritance.** | 1) Students should be able to solve and interpret problems featuring:  
   - One and two traits  
   - Monohybrid and dihybrid crosses  
   - Test crosses  
   - Punnett squares  
   - Dominant, recessive and codominant alleles  
   - Multiple alleles as in A,B,O blood types  
   - Sex linked (X and Y) traits  
   - Pedigrees-(with and without identification of the heterozygous condition)  
   - Polygenic traits  
2) Discussion of Mendel’s experiments and laws.  
3) Discussion of Charles Drew and his impact on blood donation and blood banks. | 1) Inquiry Support Lab – *The Genetics of Parenthood*  
2) Solve genetic problems and analyze pedigrees.  
3) Participation in probability activities.  
4) Test crosses with plants or fruit flies. |  

http://www.horton.ednet.ns.ca/staff/serig/AP/labs/Blood_activity.htm  This page has a virtual blood typing activity.  
http://www.stg.brown.edu/webs/MendelWeb/ links to Mendel’s original paper with annotated English translation and other information about Mendel’s work.  
http://www.carolina.com/achievements/janapr/drew.htm information about Charles Drew  
http://www.cdrewu.edu/about/drew.htm more information about Charles Drew  
NOVA episode – *Garden of Inheritance*
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| 4%     | **2.04** Assess the application of DNA technology to forensics, medicine, and agriculture. | 1) To include:  
• Identification of individuals  
• Identification of parentage  
• Crime scene applications  
• Screening for genetic disorders including use of amniocentesis  
• Gene therapy  
• Pharmaceutical applications such as the production of insulin  
• Transgenic organisms (plants, animals, & bacteria)  
• Cloning  
2) Gel electrophoresis as a technique.  
3) The ethical implications and possible dangers of biotechnology. | 1)Class discussion or debate of the ethical issues raised by the application of DNA technology.  
2)Observation of karyotype examples.  
[http://powayusd.sdcoe.k12.ca.us/dolly/toolbox.htm](http://powayusd.sdcoe.k12.ca.us/dolly/toolbox.htm)  
A web quest on cloning with links to some good resources.  
[http://www.gis.net/~peacewp/webquest.htm](http://www.gis.net/~peacewp/webquest.htm)  
A web quest on genetic engineering of food crops.  
The Human Genome Project: Exploring the Scientific and Humanistic Dimensions  
The book *Your Genes, Your Choices* raises many of the human issues related to biotechnology |

| 3%     | **2.05** Analyze and explain the role of genetics and environment in health and disease. | 1) Explain the interacting role of genetics and environment on human health.  
2) Describe genetic conditions such as sickle cell, colorblindness, cystic fibrosis, hemophilia, Down syndrome (trisomy 21), and Huntington’s disease.  
3) Describe conditions with genetic and environmental components such as; cardiovascular disease, diabetes, cancer, and asthma.  
4) Describe conditions with primarily environmental causes such as malnutrition and lead poisoning.  
5) Identification of environmental risk factors such as radiation and tobacco smoke.  
*Students are not expected to memorize detailed causes of particular diseases and conditions but are expected to recognize and analyze these genetic conditions in the context of genetic problems.* | Study of epidemiological research as tool for understanding causes of diseases and disorders. | [http://www.cdc.gov/genetics/](http://www.cdc.gov/genetics/)  
with links to information on all sorts of diseases  
Online Mendelian Inheritance in Man – this site is too technical for most students but may be useful to advanced students and teachers.  
sickle cell information  
see also sites recommended for 3.05 |

<p>| 7%     | <strong>2.06</strong> Examine the development of the Theory of Biological Evolution including: | | | |</p>
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<td>2.06a</td>
<td>The origins of life.</td>
<td>1) Biogenesis in contrast to abiogenesis. 2) The contributions of Pasteur. 3) Early atmosphere hypotheses and experiments.</td>
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| 2.06b  | Patterns. | Instruction should include:  
- Discussion of what can be inferred from patterns in the fossil record.  
- Adaptive radiation.  
- Vestigial structures.  
- Biochemical similarities. *Patterns in embryology and homologous and analogous vocabulary are intentionally excluded.* | | [http://www.mnh.si.edu/anthro/humanorigins/](http://www.mnh.si.edu/anthro/humanorigins/) The Smithsonian Institution’s Human Origins Program explores the fossil record left by early humans. |
| 2.06c  | Variation. | 1) Variation providing material for natural selection. 2) The roles of variation, reproductive and geographic isolation in speciation. | Measure and graph variation in populations of organisms. | |
| 2.06d  | Natural Selection. | 1) Charles Darwin’s development of the theory of evolution by natural selection. 2) Current applications of theory (pesticides and antibiotics) | Inquiry Support Lab – Fishy Frequencies  
Simulations of selection/reproduction over several generations. (Good computer simulations are available.) | [http://www.tulane.edu/~guill/demonstration_module.html](http://www.tulane.edu/~guill/demonstration_module.html) This is an up-to-date discussion of the peppered moth story and controversy.  
[http://www.indiana.edu/~ensiweb/lessons/ns.chips.html](http://www.indiana.edu/~ensiweb/lessons/ns.chips.html) one version of a selection activity  
[http://www.nap.edu/readingroom/books/evolution98/evol6-b.html](http://www.nap.edu/readingroom/books/evolution98/evol6-b.html) another lesson on evolution – written for middle school but also fits high school biology |

**Total Weight for Goal 2**  
28%