Life Science Standard **LS3E**

Content Standard:

Biological classifications are based on how *organisms* are related, reflecting their evolutionary history. Scientists *infer relationships* from physiological traits, *genetic information*, and the ability of two *organisms* to produce fertile offspring.

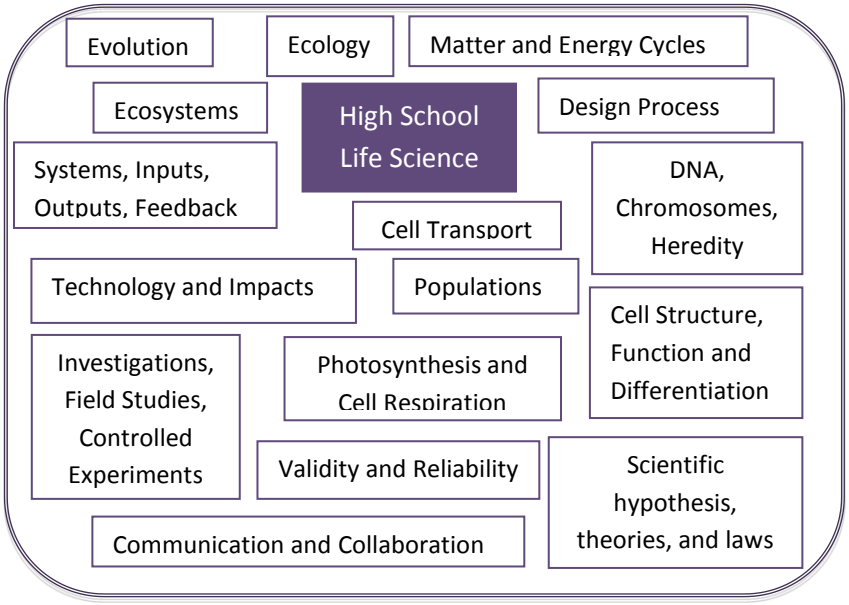
Performance Indicators:

Classify *organisms*, using similarities and differences in physical and functional *characteristics*.
Explain similarities and differences among closely related *organisms* in terms of biological *evolution* (e.g., "Darwin's finches" had different beaks due to food sources on the islands where they evolved).

Item Specifications:

Describe that scientists infer the degree of evolutionary relationship among organisms using physiological traits, genetic information, and/or the ability of two organisms to produce fertile offspring.
Describe relationship(s) among organisms based on similarities and/or differences in physical and/or functional characteristics.
Describe the similarities and/or differences (i.e., embryology, homology, analogous structures, genetic sequences) of given organisms in terms of biological evolution (e.g., Darwin's finches had different beaks due to food sources on the islands where they evolved).
Describe the evolutionary relationship between two organisms and/ or identify the organisms that are most closely related given a diagram representing an evolutionary tree.

Classroom only: Design a classification scheme based on relationships among organisms, determined by/given similarities and/or differences in physical and/or functional characteristics.



Reflective Questions for Students:

How are living things classified?

Why are scientists interested in understanding the relationships between different organisms?

How do scientists know if organisms are related?

Assessment Information

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

Quick Links for Students:

A few quick links include:

eonsepochsetc.com and

http://anthro.palomar.edu/animal/default.htm

http://animaldiversity.ummz.umich.edu/site/animal_names/phylogeny_ranks.html

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 the teacher's instructional decision making.

Big Ideas of Random Change from A Framework for K – 12 Science Education (2011)

- The time needed for biological evolution is geological time.
- Classify organisms, using similarities and differences in physical and functional characteristics.
- Explain similarities and differences among closely related organisms in terms of biological evolution (e.g., "Darwin's finches" had different beaks due to food sources on the islands where they evolved).
- Biological evolution explains the unity and diversity of species.
- Organisms cannot "adapt" to habitat or environmental changes within one generation. Change happens very slowly, or not at all.
- Organisms can become extinct if habitat changes quickly

Supporting Websites:

- Ahttp://www.bio200.buffalo.edu/labs/nomenclature.html This is basic information
- http://www.bioedonline.org/slides/slide01.cfm?tk=1&dpg=4 This site provides a power point presentation for teachers with speaker notes which could be used in a classroom, along with other teacher resources.
- http://www.visionlearning.com/library/module_viewer.php?mid=89&mcid=&l=. This site is a lesson for students, but provides background information for a teacher with a reading on topic of taxonomy.
- http://scidiiv.bellevuecollege.edu/rkr/biology160lectures/ Background information on how species form.

Extension(s):

http://www.visionlearning.com/library/module_viewer.php?mid=68&l= Reading and questions on adaptation of penguins to their special habitat.

Cross Cutting Ideas:
Designing for Learning

Strategies to reveal student understanding:

- http://undsci.berkeley.edu/teaching/misconceptions.php This site has lots of resources for teachers, especially student misconceptions in general.
- http://www.rpdp.net/sciencetips_v2/downloads/07_HSPE_Review_Life_D_with_Key.pdf State of Nevada Standards. This is a multiple choice activity to assess student understanding of diversity and classification.
- http://www.doe.mass.edu/omste/ste/LifeScience.doc Scroll to page 38 to see the scientific ideas, skills and misconceptions associated with biodiversity.
  Paige Keeley's Formative Assessments available through NSTA.

Prerequisite knowledge required:

- Students should understand that sexual reproduction results in variability of offspring.
- Students should understand the role of finite resources, disease and predation on a population.
- The fossil record and DNA analysis provide evidence of evolution.

Student learning progressions can include:

- Classify organisms, using similarities and differences in physical and functional characteristics.
- Explain similarities and differences among closely related organisms in terms of biological evolution (e.g., "Darwin's finches" had different beaks due to food sources on the islands where they evolved).

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

- How do scientists classify living things?
- What does the classification system tell us about living things?
- What characteristics reveal how living things are related?
- How do species develop?
- What can fossils tell us about organisms in the past?
- How do fossils form?
- How can the Theory of Evolution predict the types of fossil forms that may have existed in the past?

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

- **SYSTEMS (EALR 1):**
  - http://www.pbs.org/wgbh/evolution/darwin/origin/index.html This activity allows students to follow a species as it responds to changes in habitat over time.

- **APPLICATION (EALR 2):**
  - http://www.teachersdomain.org/resource/evol07.sci.life.evo.lptiktaalik/ this series of lessons with video and individual activities, focuses on change over time from fish to amphibean. It shows how scientists use a prediction to seek a transitional fossil.
  - http://www.pbs.org/teachers/connect/resources/7793/preview/ Bones of Contention is an interactive website that allows students to classify mystery fossils of hominids by comparing them to an actual data base of fossils.

- **INQUIRY (EALR 3):**
  - http://www.nhptv.org/natureworks/nwep1.htm, this site has information and a lab on adaptation of a species, specifically how birds' beaks are adapted to their food.

- **LIFE SCIENCE (EALR 4):**
  - http://sciencecases.lib.buffalo.edu/cs/collection/results.asp?search=&subject_headings=Evolutionary+Biology&educational_level=High+school&type_methods=&topical_areas=&x=36&y=10
  - Case studies of various cases involving evolutionary biology.

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: • At the following site, there are 3 articles from NSTA archives that focus on students processing their own learning. You must be a member to access these articles. • http://www.nsta.org/publications/search_journals.aspx?keyword=student%20processing&journal=TST	**Activities that show how this content standard relates to students' everyday lives include:** • http://sciencecases.lib.buffalo.edu/cs/collection/results.asp?search=&subject_headings=Evolutionary+Biology&educational_level=High+school&type_methods=&topical_areas=&x=36&y=1 Several case studies of evolutionary biology.

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:**
• The following website contains strategies that will work for all students. http://dww.ed.gov/Encouraging-Girls/Sparking-Curiosity/see/index.cfm?T_ID=18&P_ID=37&c1=440&c2=401#cluster-1	http://www.pbs.org/teachers/connect/resources/7793/preview