**LESSON PLAN: EMBRYOLOGY, BIOGEOGRAPHY, AND LIZARD EVOLUTION LAB DAY 1**

**Date: Wednesday 4/13/16 Period(s): 1, 4, 5 Class: S138 – Honors Freshman Biology**

**Central Focus:**

- Evolution is supported by multiple lines of evidence that complement each other.
- Embryology demonstrates that related species develop in highly similar ways, suggesting common ancestry.
- Biogeography studies the distribution of species and supports evolution in a variety of ways.

**Standards:** *NGSS HS-LS4-1:* Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of evidence.
*District 211 Critical Learning Standard 6d:* Evolution of Populations
*District 211 Critical Learning Standard 6e:* Evidence for Evolution

**Learning Objectives:**

- Students can accurately match embryos at various stages of development and explain why embryology is evidence for evolution.
- Students can explain several ways that biogeography provides evidence for evolution.
- Students can create phylogenetic trees based on biogeography data.
- Students can use biogeographical and geological evidence to make an argument about the evolutionary history of the *Gallotia* lizards of the Canary Islands.

**Assessments:**
*Formative:* homologous/analogous/vestigial structures kahoot, embryology card sort, "Why don't polar bears eat penguins?" discussion, observation and discussion during lab time
*Summative:* Embryology card sort questions, lab packet collected and graded Friday after lab

**Instructional Resources and Materials:**
**For students:** Embryology card sort handouts (Document G, paper), "Evidence for Evolution – Embryology and Biogeography" Powerpoint student copy (Document H, Schoology), Canary Island Lizard Evolution Lab (Document I, Schoology)

**For teacher:** Homologous/analogous/vestigial structures kahoot (https://play.kahoot.it/#/k/8ccb39b5-2109-4092-b016-d6460771ca1c), "Evidence for Evolution – Embryology and Biogeography" Powerpoint teacher copy (Document J), scissors and tape for embryology card sort, large printouts of figure 3 maps and rulers for lab part 1

**Instructional Strategies and Learning Tasks**

- Homologous/analogous/vestigial structures kahoot
- Embryology card sort and discussion
- Notes: Biogeography
- Canary Island Lizard Evolution Lab: Parts 1 and 2

*Introduction:*

| Introduction Time Frame | Introduction Activity Description |
|---|---|
| 0:00-5:00 | Review of yesterday – anatomical evidence: Homologous/analogous/vestigial structures kahoot<br><br>*Comparative anatomy is a good lead-in to comparative embryology – anatomy of embryos* |

*Instruction:*

| Instruction Time Frame | Instruction Activity Description |
|---|---|
| 5:00-15:00 | Embryology card sort and discussion<br><br>Instructions to class – groups of 3-4, first 2 groups to finish get a prize!<br><br>Handouts, scissors, and tape at lab tables. Students may work individually or in groups, but each student must turn in their own work, including an embryology chart and answers to the questions.<br><br>I will circulate, ask probing questions about how things fit in and capitalize on comments like "these all look the same!"<br><br>After all groups have completed sorting, we will reconvene and discuss findings and how embryology is evidence for evolution. Answers due tomorrow for homework. |
| 15:00-30:00 | Notes: Biogeography<br><br>"Why don't polar bears eat penguins?" discussion<br><br>Biogeography and Phylogeny: walkthrough on drawing a phylogenetic tree from biogeography information |
| 30:00-48:00 | Canary Island Lizard Evolution Lab Day 1 – Parts 1 and 2<br><br>Review the lab: Yesterday's homework was to read the lab and answer pre-lab questions.<br><br>Students will work in lab groups of 4. Kids with privileges (good grade standing and comprehension, homework done all week, on task in class) can pick their groups, others will be assigned by me.<br><br>Part 1 involves measuring – large printouts of the relevant figure and rulers are available. All else can be done on Schoology.<br><br>This lab section is very short – 2 data tables, 3 questions. Kids should be able to complete it in class if they are on task.<br><br>If they finish early, they should finish the embryology card sort questions or start on Part 3. |

*Closure: I should have a good sense of where kids are based on the formatives and observations throughout class.*

| Closure Time Frame | Closure Activity Description |
|---|---|
| 48:00-50:00 | Clean up, sum up: quick review of embryology and biogeography, reminder to finish embryology questions, tell students to finish parts 1-2 of lab if they haven't. If they want to start on part 3 for homework they can. |