

Chick Embryology

Adapted by Duc Tran, Environmental Science Institute, February 2011

Source: “Exercise 6: Reproduction and Development” from “Laboratory Experiments in Biology: Structure and Function of Organisms” lab manual written by the University of Texas at Austin Biology Department

Grade Level: High school

Time: 1 - 2 class periods

TEKS:

§112.34. Biology: 1A, 1B, 2E, 2F, 2G, 2H, 3A, 7A, 7B

Overview: In this activity students will be able to observe a live chick embryo. Students are required to record both qualitative and quantitative data. Also, they will turn in a lab report along with their data.

Qualitative Data	Quantitative Data
<ul style="list-style-type: none">Deals with descriptionsCan be observed but not measured (i.e. colors, textures, smells, tastes, appearance, beauty, etc.)	<ul style="list-style-type: none">Deals with numbersCan be measured (i.e. length, height, area, volume, weight, speed, time, temperature, humidity, sound levels, cost, members, ages, etc.)

(Source: <http://www.regentsprep.org/Regents/math/ALGEBRA/AD1/qualquant.htm>)

Objectives

Students will be able to:

- Compare and contrast the embryos at different time periods (33 hours, 72 hours, and 96 hours).
- Construct a bar graph.
- Describe the structure of an embryo.
- Explain the difference between qualitative and quantitative data.

Background:

Embryology is the study of the formation of life. Embryologists examine fertilization and track the development of the embryo (an organism in the early stages of development which cannot survive on its own) until it bears a resemblance to its progenitors. Embryology has been a valuable tool in the study of evolution. The evidences acquired through studying embryos among different species can be use to support the theory of evolution.

Note to teachers: Depending on the budget, this lab can be modified. Instead of allowing each group of students to have their own chick embryo, teachers can just use one embryo per class. This exercise can be a station of a larger lab activity or it can serve as an engagement to the study of embryology.

Materials (per group)

- Chick Ringer's solution
- Chick embryo (72 hrs)
- 1 Petri dish
- Forceps
- Scissors for dissection
- Methylene Blue
- Permanent mounted embryo tissue (33hours, 72 hours and/or 96 hours)

Procedure

Before starting the lab activity, a worksheet should be provided for students to record observations and data. Divide the class into groups of 4. Provide students with a list of terminologies they might need to know. A sample list is provided in the section below, titled "**Terminology.**"

1. Crack the egg into a Petri dish filled with Ringer's solution.
2. The egg will turn so that the embryo is on top; if not, twist the chalazae (the thick, twisted strands of the albumen) until the embryo is on top.
3. Make a cut in the yolk outside at the lower side of the blastoderm.
4. Grasp the opaque peripheral area of the blastoderm (which is continuous with the yolk) with your forceps.
5. Completely cut around the blastoderm while holding it with your forceps and gently pull the blastoderm loose, moving it to a part of the dish with no yolk or albumen.
6. Add 2-3 drops of methylene blue and allow it to sit for 5 minutes. This is done to enhance contrast.
7. Rinse the embryo with warm Ringer's solution.
8. Time the heart beat of the embryo: how many beats per minute do you observe? Do this 5 times for every 5 minutes interval.
9. Make a rough sketch of the isolated chick embryo and take observations.
10. Measure and record the size of the embryo.
11. Compare and contrast permanent mounted embryo tissue with the live embryo.

Terminology:

1. **Chalaza (pl. chalazae):** structure inside an egg which helps to keep the yolk in place. The chalazae attach to either end of the yolk and anchor to the inside of the eggshell, essentially suspending the yolk. Chalazae prevent the yolk from being damaged, promoting the healthy development of the embryonic bird. (Source: <http://www.wisegeek.com/what-is-chalaza.htm>)

2. **Albumen:** the clear substance that surrounds the yolk of an egg. Commonly known as the egg white. Albumen is composed of proteins that dissolved in water. The typical egg white contains about 15% protein and about 85% water.
(Source: <http://www.wisegeek.com/what-is-albumen.htm>)

3. **Blastoderm:** a layer of cells surrounding the central cavity (blastocoels) that is form when a morula transitions to a blastula
 - A blastula is an early phase of embryonic development that occurs when the fertilized egg has divided multiple times, but before its cells have become differentiated.
(Source: <http://www.wisegeek.com/what-is-the-blastula.htm>)

4. **Yolk:** the yellow part of the egg that is surrounded by white or clear material. When an egg is fertilized, the developing chick uses the egg yolk as a food source, and it's an excellent one because of its nutritional content. This superior nutrition has long been recognized by humans as a primary reason to eat eggs. (Source : <http://www.wisegeek.com/what-is-an-egg-yolk.htm>)

5. **Chick Ringer's solution:** a solution of several salts dissolved in water for the purpose of creating an isotonic solution relative to the bodily fluids of an animal.
(Source: http://en.wikipedia.org/wiki/Ringer%27s_solution)

Lab Report

The report is to be done outside of class. Below are some sample questions and answers that can be asked concerning the lab. Students are able to use in class or other resources to answer these questions.

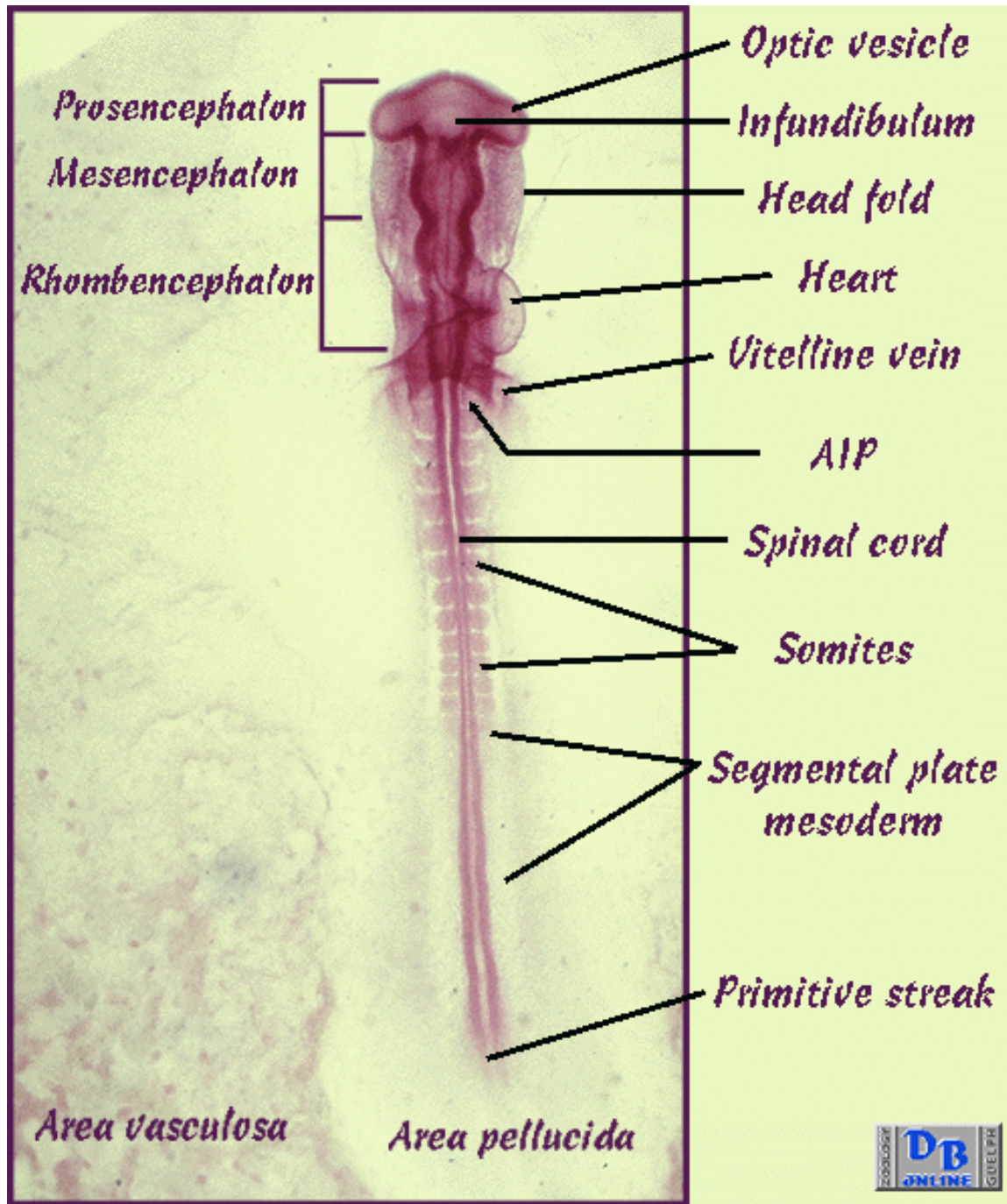
1. What is the importance of Chick Ringer's solution? [Chick Ringer's solution provides nutrients for the animal tissue, allowing it to live longer outside its natural environment.]
2. Why should warm Ringer's solution be used? [Ringer's solution should be warm because you want to retain the embryo's normal temperature condition (inside the egg).]
3. What differences in detail do you notice in freshly prepared versus permanently mounted tissue? [In the freshly prepared tissue, one can observe the heart beating and the natural color of the specimen while the permanently mounted tissues reveal more details through contrast by utilizing stain but it was unable to show the beating of the chick's heart.]
4. Did heart beat increase or decrease over time? Explain your answer.
5. Where does the embryo acquire the necessary nutrients for development? [The embryo acquires nutrients from the yolk.]
6. Explain the difference between quantitative and qualitative data.
7. What is embryology? How is it relevant to the theory of evolution?

Students should use the heart beat data to construct a scatterplot. The x-axis is time with an interval of 5 minutes, starting at zero minute. The y-axis is the number of heart beats per minute.

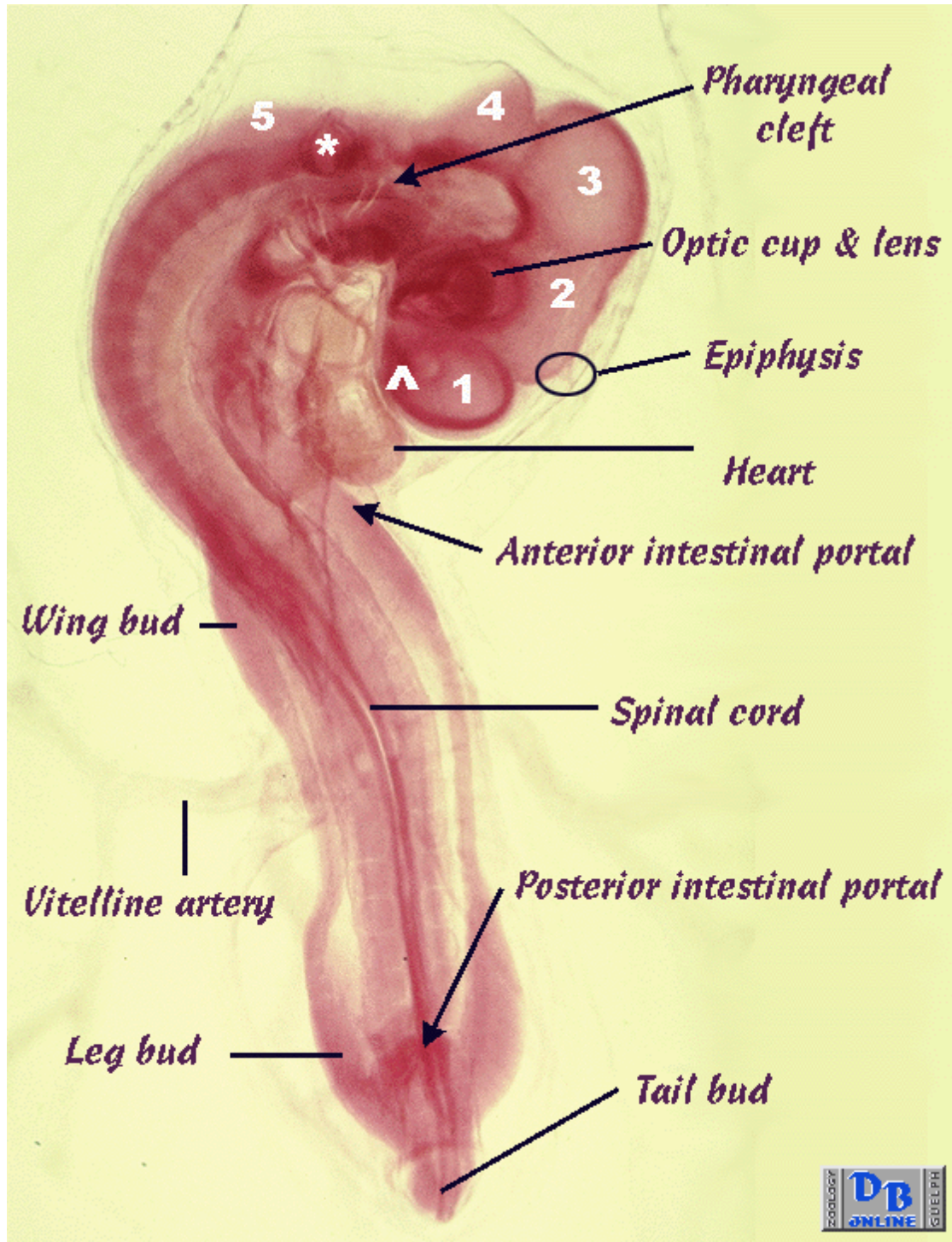
Chick Embryology - Additional Resources

Below are pictures of chick embryos at different stages.

- At 33 hours (<http://www.uoguelph.ca/zoology/devobio/210labs/33hrwm.htm>)



- At 72 hours (<http://www.uoguelph.ca/zoology/devobio/210labs/72hrwm.htm>)



Key: 1 = Telencephalon; 2 = Diencephalon; 3 = Mesencephalon; 4 = Metencephalon; 5 = Myelencephalon; * = Otic capsule; ^ = Olfactory pit

- At 96 hours (<http://www.devbio.net/images/96hrchick.gif>)

