Note to teachers:

This log book is designed to provide a variety of options for teachers to utilize this investigation. It can be modified in whatever way best suits your students and your application.

Embryology

What do you think that you will be studying based on the title of this log book?

Common Name	Genus	Species
Japanese Medaka		

During this investigation, you will be utilizing a specific fish, the Japanese Medaka. Before you begin your investigation, you should gather background information on your test subject.

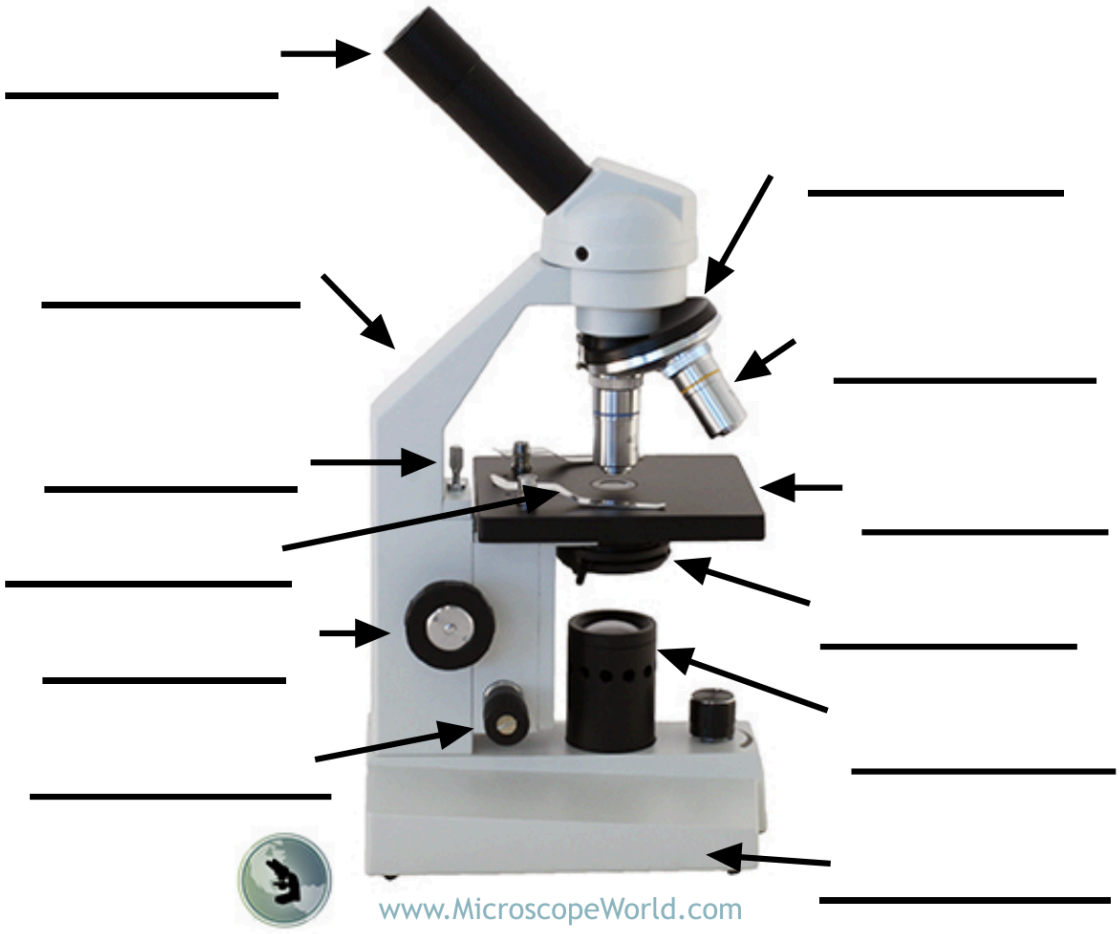
As a scientist, it is important to gather background research before you begin your investigation. Therefore, research the Japanese Medaka. Some suggested topics that you should look into could be:
Natural Habitat
Food
Mating behaviors
Husbandry

Record you notes below:

Notes	**Source (URL is acceptable at this time)**

It is important to be familiar with the equipment that you will need to carry out your investigation. Identify the parts of the microscope. In the next page, describe the function of each.

Label parts of the Microscope:



Microscope structure and function

Name of the part	Function

Research question: Will the temperature that an embryo develops affect the gestation period?

What do you think? Support your hypothesis

Research Protocol

1) You will be given an embryo in a petri dish that was collected from the parents in the class fish tank.
2) Record the approximate time of fertilization. (This will be provided by your teacher)

Date of fertilization	Approximate time of fertilization

3) Each day you will observe your embryo under the microscope recording your observations.

   You will be required to:

   Draw a diagram of your embryo.
   Adding color can improve quality of your diagrams
   Make Qualitative observations
   Describing changes to your embryo
   Make at least 1 Quantitative observation
   Count something. Measure something.
   As soon as your embryo has a heartbeat, the **heart rate** is a required quantitative data point

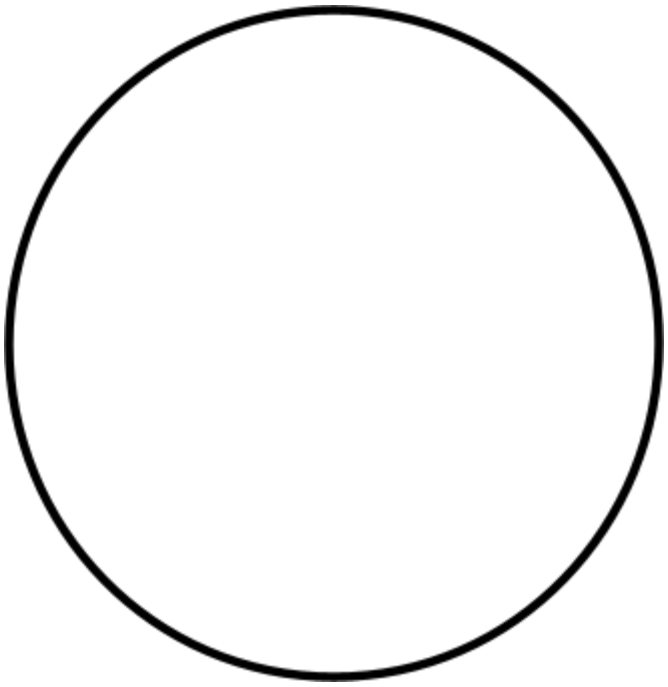
4) You will be paired with another research scientist in your classroom. One of you will keep your petri dish in a room temperature environment and the other will put your petri dish in an environment that is colder. **Be sure to record the temperatures and heart rates for each temperature below in your log book.**

My embryo temperature	**My partner_____ Temperature**

Observation # 1

Date_____

_____hours gestation



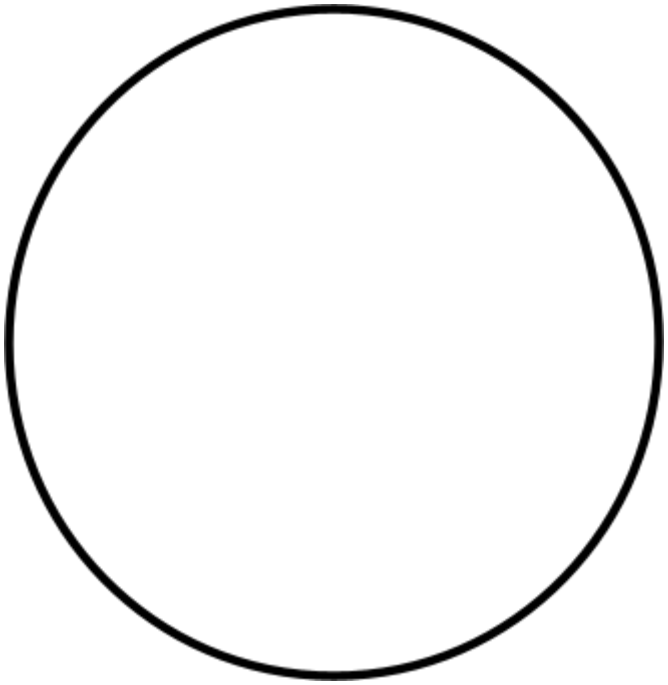
Qualitative Observations	Quantitative Observations

Daily thought question: What would be the function of the structures on the outer surface of the cell?

Observation # 2

Date_____

_____hours gestation



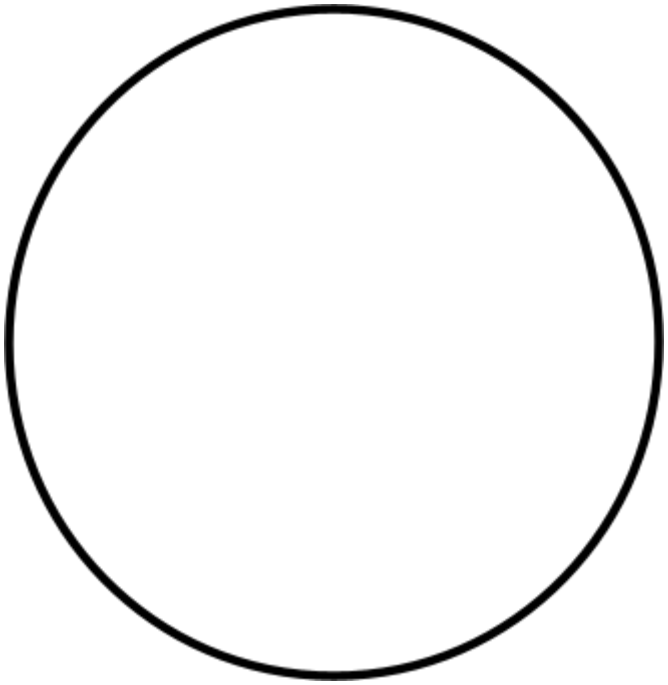
Qualitative Observations	Quantitative Observations

Daily thought question: One of the most notable structures within the cell on day one was a large “bubble” near the center of the egg. Have you noticed any changes to that structure?

Observation # 3

Date_____

_____hours gestation



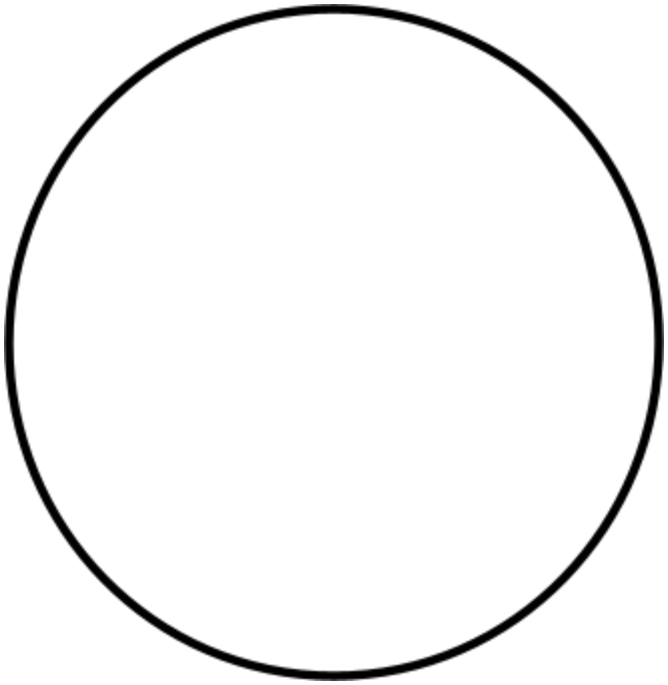
Qualitative Observations	Quantitative Observations

Daily thought question: What have you seen in your egg that you wonder about? List and explain at least 2 things you have observed that you may not understand.

Observation # 4

Date_____

_____hours gestation



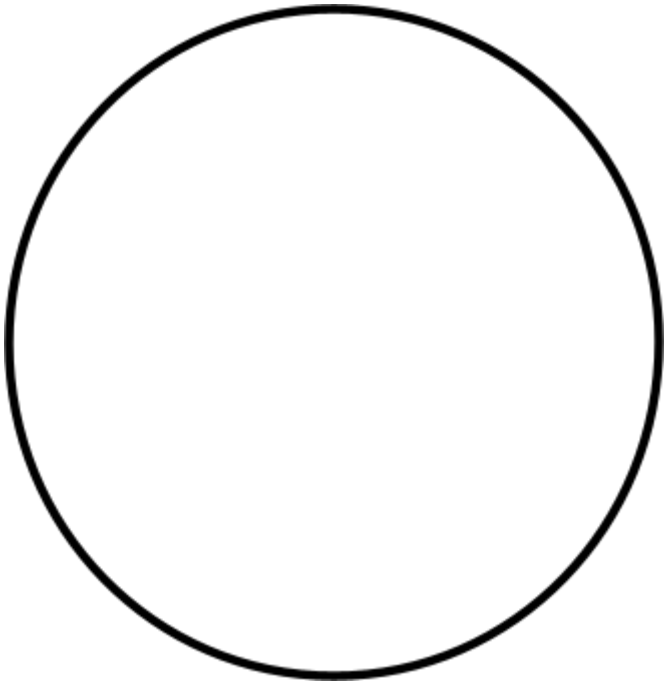
Qualitative Observations	Quantitative Observations

Daily thought question: Has the Japanese Medaka ever traveled in space? If so, when? On what shuttle(s)? What were the results of their travel?

Observation # 5

Date_____

_____hours gestation



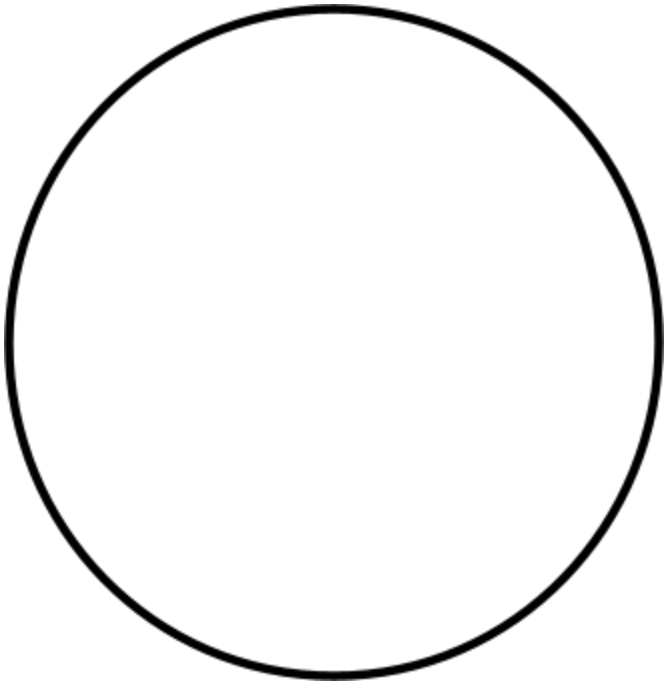
Qualitative Observations	Quantitative Observations

Daily thought question: Would you expect the behavior of your specimen to change if you altered the amount of light that is hitting the petri dish.? Why?/Why not? Test this. What did you observe?

Observation # 6

Date_____

_____hours gestation



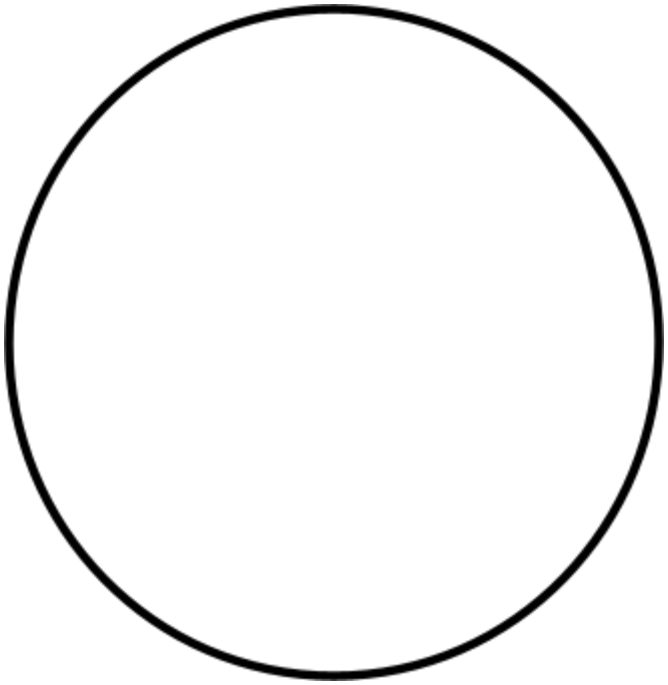
Qualitative Observations	Quantitative Observations

Daily thought question: What have you seen in your egg that you wonder about? List and explain at least 2 things you have observed that you may not understand.

Observation # 7

Date_____

_____hours gestation



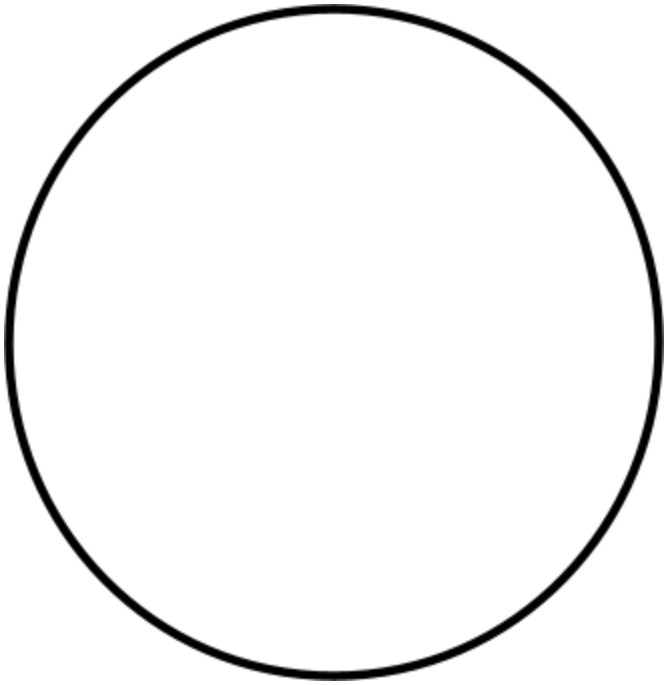
Qualitative Observations	Quantitative Observations

Daily thought question: As you continue to compare your results to your partner's results, begin to brainstorm reasons why your embryos may or may not be developing differently. After you discuss it, record 2 of your ideas with explanations.

Observation # 8

Date_____

_____hours gestation



Qualitative Observations	Quantitative Observations

Daily thought question

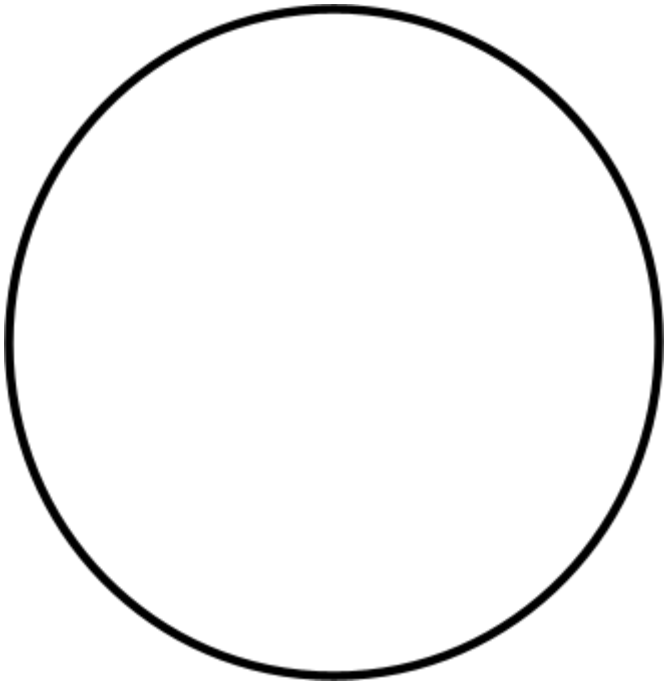
Teacher note: The actual number of observational days needed is dependent on your temperature choices. Gestation is 11-14 days typically. The temperature in the high range of normal would speed it up slightly and the low range will slow it down.

The ideal temperature range is documented to be: 64-75F (18-24C). The can survive outside of these ranges but it is not ideal. Noted survival range is 6.7-40C

Observation # 9

Date_____

_____hours gestation



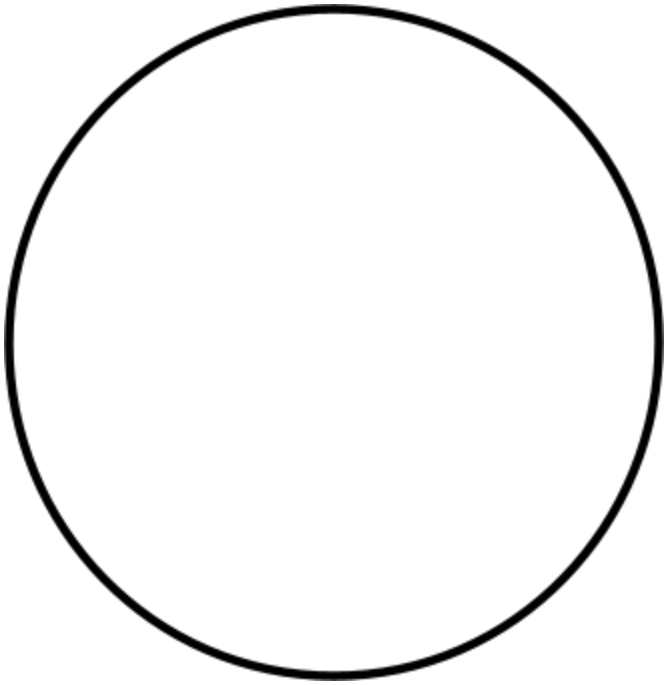
Qualitative Observations	Quantitative Observations

Daily thought question

Observation # 10

Date_____

_____hours gestation



Qualitative Observations	Quantitative Observations

Daily thought question

Compile the data that you have collected throughout this investigation for both you and your partner.

Your data	Temperature		**Partner's data**	Temperature
Gestational Age (Hours)	Heart Rate (Bpm)		Gestational Age (Hours)	Heart Rate (Bpm)

Graph the heart rate for both your embryo and your partner's.



Teacher note: This would be an opportunity to compile class data and make comparisons on a larger scale. A potential technology application would be to have the students create a shared spreadsheet inputting all of their data. Then they could graph using sheets.

Utilizing your background research and the data you collected, determine how the developing embryo was affected by the differing temperatures.