

University of California
Agriculture and Natural Resources

Making a Difference for California

PLACER:
11477 E Avenue
Auburn, CA 95603
530.889.7385 office
530.889.7397 fax
ceplacer@ucdavis.edu



NEVADA:
255 So. Auburn Street
Grass Valley, CA 95945
530.273.4563 office
530.273.4769 fax
cenevada@ucdavis.edu

Website: <http://ceplacernevada.ucdavis.edu>

EMBRYOLOGY..AN EGG-CITING ADVENTURE

January
2020

Development of Life in the Classroom

RESERVE INCUBATORS AND EGGS ON-LINE

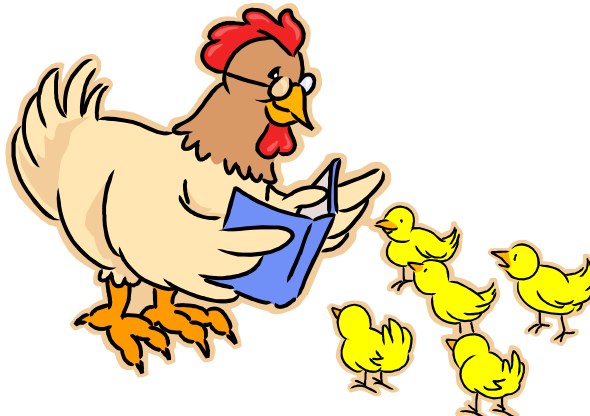
Incubators are available for short term loan through the Placer County Extension Office.

To reserve equipment and/or order fertile Chicken or Duck eggs in go to: <http://ucanr.org/educatorresources>

Equipment and eggs must be reserved a minimum of **TWO WEEKS** prior to date needed. Keep in mind the equipment is in heavy demand so **RESERVE EARLY!!**

Please note: Equipment rental is **ONLY** available to Placer and Nevada County schools/residents, and we do not take phone or e-mail reservations. If you do not have web access, contact the 4-H office at 530-889-7385 and reservation forms will be mailed to you.

Refer to the Embryology website for video clips explaining various aspects of hatching eggs: <http://ucanr.edu/embryology>. Access the video clips at the bottom of the webpage.



Incubation Procedures

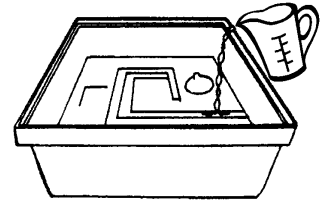
Use of Incubator – Prior to starting this project, review the instructions for using the incubator. Incubators are either still-air or forced-air (fan ventilated). Operating instructions and optimum temperatures will differ with the two.

Location of Incubator – Locate your incubator in a draft-free room with the room temperature constant between 70° to 75° F. Avoid drafts and excessive variations in temperature. Be certain that the machine sits level. Do NOT place the incubator near windows where it will be exposed to the direct rays of the sun, since this can cause a rise in the temperature that can kill the embryos.

Incubator Factors:

Temperature – In forced-air machines, air temperature will be the same throughout the chamber and should be kept at 99.5° F. Plug in incubator, add water and run for several hours to be certain it maintains temperature before adding the eggs. After adding the eggs, wait two or three hours to adjust temperature as it will take time for the eggs to warm through and maintain temperature. Overheating is more damaging than under-heating. Short cooling periods do not usually harm embryos, for eggs will still hatch after several hours exposure to temperatures as low as 50° F during the second week of incubation. Periods of low temperature will slow embryonic development and require a longer period of incubation.

Humidity – Each incubator has instructions as to how to maintain the correct moisture level. The ideal moisture level is about 50 to 55 percent relative humidity for the first 18 days and about 65 percent for the last three days. Some variation above or below the ideal level usually will not affect hatchability drastically. When refilling the water pan, use warm water (99° F). Hot or cold water will affect the temperature of the incubator too much. It isn't the volume of water, but the total surface area.



Ventilation – Proper room and incubator ventilation is very important during the incubation process. While the embryo is developing, oxygen enters the egg through the shell and carbon dioxide escapes in the same manner. As the chicks begin to hatch, it is essential that they receive an increasing supply of oxygen. This means that the air openings on the top of the incubator need to be opened to increase the flow of air.

Length of Incubation – Chicken eggs require 21 days to hatch. The incubation period of other species of poultry varies. For example: duck eggs require 28 to 35 days depending on the species. To help insure your chicks hatch while students are in the classroom, stagger the start of incubation over two days, by adding a few eggs to the incubator in the morning and evening of Tuesday and Wednesday or Wednesday and Thursday. This increases the hatching period, and if the eggs are a little fast or slow they are less likely to hatch during a weekend.

4-H Embryology...An EGGciting Adventure Teacher's Manual provides complete step-by-step instructions on how to set up and monitor the incubation process.

Available at the UCCE Offices.

Length of Incubation



<u>Species</u>	<u># of Days</u>	<u>Species</u>	<u># of Days</u>
Chicken	21	Ringneck Pheasant	23 to 25
Turkey	28	Mongolian Pheasant	24 to 25
Duck	28	Bobwhite Quail	23
Muscovy Duck	35	Japanese Quail	16 to 18
Goose	29 to 31	Chukar Partridge	22 to 23
Canada/Egyptian Goose	35	Peafowl	28
Guinea Fowl	24 to 25	Ostrich	42
Pigeon	16 to 18		

Note: Not all species of poultry are suitable or are available for incubation in the classroom.

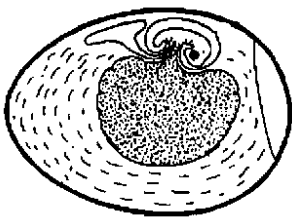
OBSERVING THE DEVELOPMENT OF THE EMBRYO

Determining whether the egg is fertile or not can be done by means of a candling light. A candling light, such as a bright flashlight, is merely a device whereby light is beamed through the shell to give a picture of what is inside the egg. It is an interesting phase of the project, as it is possible to see the developing embryo.

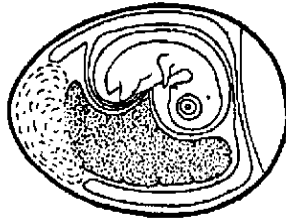
Darken the room and hold the large end of the egg to the light of the candler. What you will see depends mostly on the age of the embryo. On the 6th day, a blood spot will appear with several blood vessels. On the 18th day, the egg will look entirely opaque with the exception of the air cell in the broad end of the egg. By candling the egg, one can determine if the embryo is making normal growth. Do NOT remove or discard questionable eggs. Give them an opportunity to develop.

SUCCESSIVE CHANGES IN THE DEVELOPMENT OF THE CHICK EMBRYO

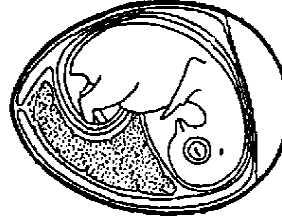
5 days



10 days



15 days



21 days



By the sixth day the main division of the wings and legs are visible. The feather tracts appear on the eighth day and by the ninth day the embryo has a birdlike appearance. On the thirteenth day, the color of the chick down may be observed. By the sixteenth day the beak, nails, and scales are well formed. The supply of albumen is now exhausted; therefore, the yolk must serve as the sole source of nutrients.

HOW THE CHICK EMERGES FROM THE SHELL

The time of hatching is an important event in the life of the chick. The head of the chick develops at the large end of the egg.

Between the 15th and 16th days, the chick orients itself so that its head is near the air cell at the large end of the egg. Several changes, preparatory to hatching, take place between the 17th and 19th days. Fluid decreases in the amnion. The neck acquires a double bend so that the beak is under the right wing and toward the air chamber. The remaining yolk sac is retracted into the body cavity for use as a food after hatching.

On the twentieth day, the chick moves his head and the beak pierces the membranes and enters the air cell. The chick slowly begins to breathe the contained air and it may be heard to peep within the shell. Using its egg tooth (*a tiny, sharp horny projection on the end of its beak*), the chick pecks at the shell thousands of times. After the chick has made a hole in the shell, it stops pipping for three to eight hours and rests. During this time, it is acclimating its lungs to the outside atmosphere.

During the process of hatching, the shell will be chipped while the chick turns in a circular path. In two to five hours, the chick has made about three quarters of a turn inside the egg. As the chick progresses in its movement around the shell, it begins pushing on the egg cap (*large end*).

Squirming and struggling, the chick works feverishly for about 40 minutes pushing at the cap. Finally, with a vigorous twist of the neck, the chick breaks free from the shell, still wet and panting.

At first, the chick is wet and seems exhausted. However, in a few hours the chick is dry and fluffy and wanders about the new and mysterious world. The yolk inside the chick will help supply its food and water it needs for the first 24 hours while it remains in the incubator, before moving to the brooder.



This "Early Bird" decided to arrive prior to the turner being removed on the 19th day. Removing the turner is very important for the chick's safety.

PREVENTING SPRADDLE



The best “bedding” for the first few days is an old bath towel or piece of cloth such as an old T-shirt. Good footing when the babies are small helps their legs to develop properly. Don’t use hay or straw, as it just sticks to them and is harder to clean. Don’t use newspaper for the first week or two as they tend to be unable to get their footing and sometimes this causes “spraddle” or “splayed legs”. This condition is caused by poor traction with the feet and legs sliding to the side permanently stretching the tendons. This condition makes it impossible for the baby to stand up correctly and can be permanently crippled.

HATCHING DUCKLINGS

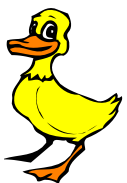
Hatching ducklings has become a popular variation to hatching baby chicks each year.

What are some of the pros and cons?

- Baby ducklings are very personable and bond well with people. They love to be read to.
- They can be very messy as they love water and are constantly playing with their food in it.
- The length of incubation time varies according to the breed of duck, about 28 days is average while chick eggs take 21 days.
- Use a taller incubator to allow room for the larger duck eggs and make sure it has a circulating fan to keep the air temperature even throughout the incubator.
- Waterfowl eggs have a greater tendency to rot and cause problems in the incubator for two reasons. The first is that ducks are not as clean in their nests and the eggs are often soiled. Waterfowl also take longer to develop allowing another week for bacteria to grow. Inspect eggs carefully during later stages of incubation and remove any that develop cracks and are seeping or smell bad.
- Brooder container needs to be a large plastic storage bin to contain the moisture as they play in the water and for easy cleaning. Clear sides make for easy observation of the ducklings from a distance.
- Use “non-medicated mash” as ducklings eat a lot more than chicks and can poison themselves on the medicated brands.
- Baby ducklings hatched away from their mother have no water resistant oil on their down. They should not be placed in water deeper than they can stand in and with constant supervision. In nature baby ducklings get their water resistant oils from their mom’s under feathers until they are five or six weeks old and their own oil glands begin to function. Baby ducklings love to swim but without their mom are vulnerable to drowning and chills.



Baby ducklings are very personable and bond well with people.



If you would like to try your hand at hatching ducklings, we have additional information to share with you when picking up your equipment and eggs.

Duck eggs will be available beginning approximately mid-March 2019.

CURRICULUM: FUN NEW OPTIONS FOR ENGAGING YOUR STUDENTS

The Curriculum offered by the 4-H office in Placer County is designed to provide you with background information and exciting experiential activities dealing with life science for use in your classroom. Each activity is designed to be grade-level appropriate and has been correlated to U.S. National Science Education Standards. Within this curriculum your students will have the opportunity to develop life skills related to science processes, teamwork, keeping records, planning and organizing.

4-H Youth Development Program Curriculum Embryology—An Eggciting Adventure

Curriculum Objectives

- Develop an appreciation for the basic principles of science and gain knowledge about animal reproduction.
- Develop the skills needed to care for the eggs and relate it to the processes of living things.
- Instill an appreciation and concern for life from the very beginning.

This project provides opportunities for K-8th grade to learn the value of life, in addition to information about chickens, eggs and embryology development. Students will read and write about what they observe and apply what they have learned through art and drama activities.

The curriculum includes age appropriate materials on:

- Detailed incubation procedures
- Parts of the egg and their function in the embryo development
- The reproductive system and fertilization
- Chick embryo development/fetus development

- Anatomy of the chicken
- Observing the development of the embryo
- Hatching of the egg
- Brooding and Chick Care
- Nutritional value of the egg
- Egg related math problems, word puzzles, games, and craft projects
- Certificate of merit

Subjects Included:

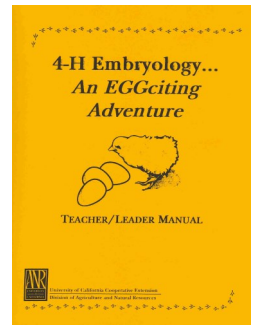
Science, Math, Language Arts and Nutrition

Skills Learned:

Listening, Thinking, Reading and Writing.

A Supplement is available with additional activities to use with **K-3rd grades & 4th - 8th grade students.**

To obtain a copy contact the 4-H Office. Limited quantities are available for loan. You can purchase a copy for \$9.00.



EGGsperiment

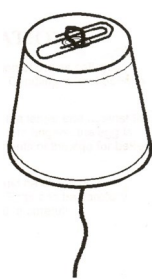
Activity from the 4-H Embryology...An EGGciting Adventure curriculum, available from the 4-H Office.

Chicken Cluckers

A fun way to imitate the sounds made by chickens

Supplies:

- Paper or Styrofoam cups—one per child
- 15 inches of string for each child
- Large paper clips—one per child
- Pencils
- Water
- Paper towels



Instructions

1. Provide each child with one cup, one large paper clip, and 15 inches of string.
2. Show the children how to turn the cup upside down and poke a small hole in the center of the cup's

bottom with a pencil.

3. Next, show the children how to tie the paper clip to one end of the string; pass the other end of the string through the hole in the bottom of the cup. Pull it all the way through the cup until the paper clip comes to rest on the bottom of the cup.
4. Now demonstrate how to wet the string with water.
5. Holding the cup in one hand, use the other hand to pull the string downward in short, quick tugs.
6. Allow the children time to experiment with the types of "chicken cluck sounds" made by the cups. If time permits, provide the children with different types and sizes of cups and ask them to see if they can make different sounds.

MOST FREQUENTLY ASKED QUESTIONS

What is the procedure for checking out equipment?

See page 1 of this newsletter for instructions. Reserve early, loan items are in heavy demand during the spring months. There is a non-refundable \$15 equipment use fee.

How are fertile eggs cared for prior to incubating?

Since most eggs sold at the grocery store are infertile, you will need to purchase eggs for this project from a breeding farm. Check with your local UC Cooperative Extension office or feed store for a list of suppliers. Eggs should be stored with the big end up or laid on their side. Eggs that are clean when they come from the nest are best for hatching. However, it is best NOT TO WASH eggs, since the bacteria on the shell and in the water may easily enter the eggs and cause them to rot. Keep the eggs at 50° to 60°F, do NOT refrigerate.



How long can I keep fertile eggs before incubating?

Ideally, eggs should not be more than seven days old when they are set (*placed in the incubator*). Hatchability will decline with older eggs.

Why do the eggs need turning?

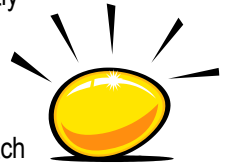
Turning assists proper development of the embryo and helps prevent the embryo from sticking to the shell membrane, which will occur if left in one position too long.

Can I encourage students to bond with certain eggs?

To avoid disappointment, it is best to wait until the chicks have hatched before the bonding of students with chicks. A 60% hatch is a good hatch rate, thus some eggs do not hatch.

Can I help the chick crack out of the egg?

It is NOT recommended. To do so frequently kills the chick, as you will usually break open the Chorio-Allantoic Membrane (CAM) vessels which causes the chick to bleed to death. It is best to let the chick hatch on its own.



When do the chicks leave the incubator to go into the brooder box?

The baby chicks stay in the incubator for the first 24 hours. The yolk inside the chick will serve as its food and water. Be certain to dip the chick's bill in the water and then tip the head back as you place them in the brooder box to help them know the location of water and how to drink. The brooder should be warm and dry and have a heat source for the newly hatched chicks along with chick starter feed and water.

How long can the chicks remain in the classroom?

The brooder box will need a screen over it to keep the chicks in as they will have developed adequate wing feathers to fly up and perch on the edge of the brooder box when they are two weeks old. By this time they can cause dust and odor and it's best to relocate them to new homes.

How do children go about raising a baby chick?

A "Chick Care" leaflet is available to distribute to parents to inform them as to the needs of baby chicks. Chicks are social creatures, they appear to be more content when with another chick as a companion. It is often easier to raise at least two chicks together. Parents need to consent to this big undertaking.



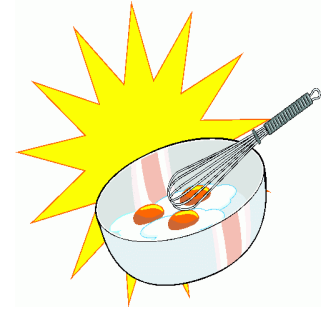
What do I do with the chicks at the end of the project if no one wants to take them, or down the road if it becomes necessary to relocate a grown chicken?

Contact June Stewart at (530) 885-3926
She will help find good homes for them.

COOKING EXPERIENCES



The embryology project provides numerous opportunities for classroom cooking. Following is a recipe that is fun and easy.



Eggs in a Nest

What You Need:

INGREDIENTS

1 egg
1 slice bread
1 tablespoon butter or margarine
Seasoning to taste

EQUIPMENT

Frying pan with cover
2-inch round cookie cutter
Spatula



How To Do It:

- Put bread on cutting board. Cut a circle in the center of each slice with a round cookie cutter.
- Heat the frying pan at medium heat with one tablespoon of butter or margarine in it until the fat melts and sizzles.
- Fry bread slice on one side. Turn bread over with spatula. (Circle may be fried, too.) Meanwhile, gently break egg into a saucer.
- Turn heat to low. Add a little more butter or margarine to pan if pan is very dry. Gently slip egg into the hole in the bread. Cover pan and cook egg for three to five minutes until it is cooked the way you like it.
- Serve on individual plate with slices of orange or other fruit. Add a glass of milk for a meal that contributes to a well-balanced diet!

EGG FACTS....All About the Egg

- ♦ The egg is one of the most nutritionally complete foods you can eat. It is a "complete source of protein" because it provides all essential amino acids your body needs for growth and repair.
- ♦ The protein found in eggs is second only to mother's milk, and is used by chemists to grade all other proteins.
- ♦ Eggs contain many of the essential vitamins and minerals needed for growth, such as Vitamin A and D. Another substance found in an egg is cholesterol. Our body needs

cholesterol to synthesize Vitamin D. Cholesterol intake should be moderate in your diet to protect you against heart disease.

- ♦ California is the second largest egg producing state, producing more eggs in one year than all of Canada.
- ♦ The only difference between white and brown eggs is the color - there is no nutritional difference.
- ♦ Annual per capita consumption of eggs is 240 eggs per person.

- ♦ Each laying hen produces approximately 240 eggs each year.

- ♦ Most of the eggs produced today will be in the supermarket within 72 hours.
- ♦ Annual egg production in California exceeds six and one-half billion eggs.



Cindy Fake
County Director

Dan Macon
Livestock and Natural Resources Advisor