

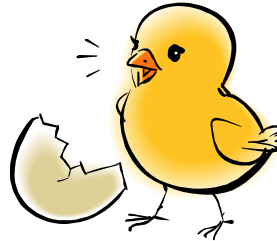


## Everything you always wanted to know about embryology, but were afraid to ask

After many years of managing the Montgomery County 4-H School Enrichment program, we have found that teachers often have similar questions about the embryology project. To improve your experience with the project, we have compiled these frequently asked questions with answers for you.

The questions are divided into sections:

- Setting up the Incubator,
- Maintaining the Incubator
- Hatching
- The Brooder Box
- Finishing the Project



If you have any other question about the embryology project, please feel free to call us at 610-489-4315. If we're not in the office, leave a message that you are hatching eggs and a time when we can call you back. Good luck!

Nancy Kadwill. Extension Educator  
In cooperation with Sheila Sykora, 4-H Program Assistant

### **I. *Setting up the incubator*** **Q. *Where should I put the incubator in my classroom?***

The incubator should be in an area that is free from drafts and away from direct sunlight. Place the incubator on a sturdy table or desk near an electrical outlet. If possible, the incubator should be plugged directly into the outlet. Without the use of an extension cord. Make sure the outlet is not one that is operated by a wall switch. Be sure to alert the custodian not to turn the electricity off at night or over the weekend!

### **Q. *How do I put the incubator together?***

Place the bottom of the incubator on the table. Put the wire screen on the bottom of the incubator. Fill the middle reservoir (marked with a "W" or "Water") in the bottom with ½ cup of water. Put the incubator and plug it in. Do this a day before you add the eggs, because it gives the incubator time to regulate. It also gives your students time to become familiar with the incubator. Place the stem of the thermometer through the groove between the lid and base of the incubator and push it in as far as it will go. The thermometer dial should be resting up against the incubator.

### **Q. *What should the temperature be?***

The ideal temperature for hatching chick eggs is 99° - 100.8° F. Your incubator should stay as close to this as possible. Your thermometer should read between 98° - 100° F. If the temperature goes above 103°, even for short period of time, you will ruin the embryos.

**Q. How do I adjust the temperature in the incubator?**

The electronic thermostat incubators are self regulating. You need do nothing. If you do not have an electronic thermostat incubator then the temperature is adjusted by loosening the wing nut and turning the L shaped metal dial on the top of the incubator. Be careful, as adjustments should be made with  $\frac{1}{4}$  or  $\frac{1}{2}$  turns. The red light on the top of the incubator will come on when the heating elements is on. Once you have the temperature set, tighten wing nut on the dial. You may wish to put tape across the top of the dial, since it is tempting to turn it. If the red plugs are missing, cover the two large air holes with tape. Then on Friday remove the tape and/or plugs to allow for more air ventilation during hatching.

**Q. How often do I need to adjust the temperature?**

Once the temperature is set, you should not have to make adjustments. Every time the eggs are turned, you can check the temperature, but avoid the habit of fiddling with the dial. About halfway through the hatching process, you may note an increase in temperature. This is normal, and is caused by the embryo forming and generating heat. Adjust the incubator temperature down if necessary.

**Q. How do I adjust the humidity?**

Ideally, the humidity inside the incubator should be about 50%. As a rule of thumb, keep  $\frac{1}{2}$  cup of water in the middle reservoir in the bottom of the incubator. Add water as needed to keep level  $\frac{1}{2}$  full. Add warm tap water. You can check the water level when turning the eggs each morning. If you notice drops of water forming on top of the incubator, the humidity is too high; remove the lid and wipe off the excess moisture; add less water than you have been doing. During the hatching time, the embryos need extra humidity so the shells will not stick to the chicks. On Monday, fill the middle reservoir to the top.

**Q. How should I mark the eggs?**

Use a pencil (not a pen or marker) to mark the eggs, dividing them into three sections, marking them 1,2,3, or A,B,C. That will help you remember to turn the eggs three times a day. Please do not mark the eggs with the students' initials, because if a student's egg doesn't hatch (and many times not all the eggs will hatch), he/she will be heartbroken.

**Q. What about adding the eggs?**

When the incubator has been plugged in for several hours or overnight, and the temperature and humidity are set, you are ready to add the eggs. Place the marked eggs on the wire screen. Do not adjust the temperature for 24 hours. It takes time for the incubator temperature to stabilize after adding the eggs.

**Q. How many eggs will hatch?**

This is difficult to answer. Some embryos fail to develop for various reasons. Some chicks do not survive the hatching process. But remember the adage: Don't count your chickens before they hatch. You will notice different hatch rates between classrooms, or between years in the same classroom.

**II. Maintaining the incubator**

**Q. Who should maintain the incubator?**

This depends on your class. Students in grades 5 and up should be able to handle the routine maintenance of the incubator. You might assign this job to a different

student each day, or put one student leader in charge for a week. The student should be responsible for turning the eggs, checking the temperature and humidity, and noting anything unusual about the incubator and eggs. In grades 4 and lower, the teacher may want to take responsibility for this with the help of the students. A daily chart noting times eggs are turned and temperature and humidity works well. (See sample chart enclosed.) Remember, this is a “hands on” project and students should be involved throughout the entire incubation and hatching process. Be sure students don’t touch the heating element in the lid.

**Q. *What is involved in the daily operation of the incubator?***

Check the temperature. Add water if needed. Turning the eggs three times a day (morning, lunchtime, and before dismissal) works best in a school classroom.

**Q. *What if the power goes out and the eggs cool off?***

If the eggs cool off because of a power failure, or the incubator was unplugged, reheat the incubator and continue as before. Even if the eggs are without heat for several hours, they will probably still hatch, although hatching may be delayed for a day. Cooling off for a half-hour or so is nothing to be concerned about. Remember that the mother chicken has to leave the nest to eat.

**Q. *What if the temperature goes up?***

If the temperature goes over 130° even for a short time, it will kill the developing embryos, and there is nothing to do but start over with new eggs.

**Q. *Why do we turn the eggs?***

Turning the eggs serves two purposes. It forces the embryo to exercise inside the eggs and develop the strength needed to push out of the shell. It prevents the embryo from migrating through the albumen and sticking to the shell membrane. ***The last day that you will turn your eggs is Friday afternoon, because your eggs will be hatching by Monday night/Tuesday morning. Each time the eggs are turned, do a complete revolution before advancing to the next number.***

**Q. *Since there’s no one at the school on weekends, should I take the incubator home?***

Transporting the incubator probably decreases the hatch as much as not turning the eggs. ***Do not take the incubator home!*** What you may want to do, however, is attached a note near the incubator to remind the janitors not to turn off the power supply. It may also be a good idea to show the janitors or maintenance personnel the incubator before the weekend. ***Also before you leave for the weekend, remember to do the following: turn the eggs one last time and open the two top holes.***

**Q. *Can oil from our hands clog the pores of the eggs?***

While perspiration and grease from your hands can collect on the eggshell, it would be difficult to clog all of the thousands of pores in the shell. Take the simple precaution of washing your hands before and after handling the eggs. Please post the enclosed sign near the incubator.

**Q. How do I candle the eggs? And why?**

Candling the eggs is fun and educational, something we recommend as part of the project. To do it, you need a bright light source; a film strip or slide projector is ideal. You can use the projector as is, or intensify the light by covering it with a piece of cardboard with a small hole. Darken the room lights. Take a few eggs out of the incubator and place them in an egg carton. Carry the egg carton to the projector, and you are ready to begin candling. Hold the egg directly up to the light. You should be able to see the air sac, which will change as the embryo develops. You should also be able to see the developing embryo itself, and you should see movement of live embryos. If you look in the teacher's manual, you will see drawings of the daily development on the embryo. It is easier to candle eggs with white shells, but you should be able to see something developing in eggs with brown shells also.

Another easy way to candle the eggs is to place an egg over the end of a flashlight in a darkened room. You can then observe the air cell and shadows of the chick. You may also use the candler we provide.

You can candle a table egg from the refrigerator to compare the fertile eggs with an infertile egg. Infertile eggs are clear, except for the yolk shadow. Dead embryos will not move or kick when candled. You may see a blood ring or bloody area separate from the embryo. Dead embryos will not grow, so they are apparent if you candle at regular intervals.

Candling eggs can be one of the most exciting parts of the project for your students. Even fifth and sixth grade students can do candling with supervision. Younger students can observe the teacher as you candle the eggs. Please try this activity to pique your students' interest in the incubating eggs.

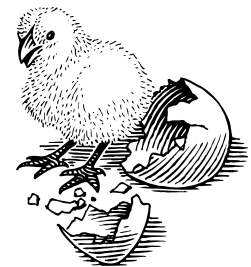
**III. Hatching**

**Q. When will the chicks hatch?**

Chicken eggs should hatch 21 days after they first start in an incubator. (Remember that your eggs have already been incubated for 14 days before you receive them!) Other bird species have different incubation times. For instance, duck eggs take 28 days to hatch; goose eggs take 30 days. The hatching process actually starts about day 18, when the chicks start to prepare to break out of the egg. That is why you stop turning the eggs on day 18, and try not to disturb them.

**Q. What happens during hatching?**

On the 18th and 19th day, the chick positions itself with its head back and its beak toward the air sac. It absorbs the rest of the yolk into its body for use as food after hatching. On day 20, the chick pierces the membrane into the air chamber. The chick breathes air for the first time, and you may hear the chick peeping inside the egg. This is called pipping. On the 21st day, the chick begins to break out of the shell. Using its egg tooth, it first pecks a hole through the shell. Then it pecks a circle around the end of the egg. The chick twists its neck and pushes with its feet and breaks the shell open. Healthy chicks accomplish this in a few hours.



**Q. *Our chicks looked dead when they hatched. Was that normal?***

Hatching out of the egg is hard work. The newly hatched chicks will be wet and tired and will look weak and exhausted. They should dry out and begin to move around within a few hours.

**Q. *When should I take the chicks out of the incubator?***

When the chicks are dry and fluffy and able to walk around, you can gently remove them to the brooder box. Move them in pairs because they like company. They can stay in the incubator for a day, so don't be concerned if the chicks hatch overnight when you are not at the school.

**Q. *Should I help the chicks out of the shell?***

Healthy chicks are able to hatch out all by themselves. Weak or sick chicks may not survive the hatching process. ***However, it is best to just let nature take its course.***

**Q. *Most of the chicks hatched yesterday. Will more chicks hatch?***

The chicks that are going to hatch should all hatch within a 24-hour period. Even though you saw many live embryos when you last candled the eggs, that does not mean that all those chicks will hatch. There are a lot of changes that happen in the last three days before hatching, so many embryos do not make it through this process. You can leave the unhatched eggs in the incubator for another day, but if there are no signs of hatching, those eggs will not hatch. If you are sure they will not be hatching, you may wish to open the egg as a learning experience to see where development stopped.

**Q. *When do the chicks start to eat and drink?***

Newly hatched chicks may not need to eat or drink for at least 24 hours. One of the last things the chick does inside the egg is absorb the remaining yolk sac, which provides nourishment the first few days after hatching. Baby chicks can remain in the incubator for up to 24 hours without food because of this. Do remember, however, to provide both food and water for the chicks in the brooder box.

**Q. *What can I do with a chick that is crippled or unhealthy?***

You may have some chicks that have bad legs or otherwise are unhealthy. In nature, these weaker chicks would not survive. When placed with healthy chicks, the strong chicks will pick on the sick chick. You may want to put the unhealthy chick in its own "hospital" box with its own food, water, and heat source. Some chicks rally and survive with a few days of special treatment. This situation can send mixed signals to your students. Some teachers use the example that children sometimes pick on others who are weaker or different. If you give the chick special treatment, this could be compared to a child born with a birth defect who gets special medical treatment. How you handle this in your classroom will depend on the age of your students. Some teachers find it best if the dying chick "disappears" overnight and is disposed of humanely.

#### **IV. The brooder box**

**Q. *What is a brooder box?***

After the chicks hatch they need a warm environment similar to nestling under the mother hen. To do this, you need a cardboard box or aquarium. A cardboard box has the advantage of easy disposal and no cleaning. An aquarium allows you to look in and watch the chicks. You need a heat source to keep the chicks warm. The easiest way to provide heat is with a clip on light or gooseneck lamp with a 60-watt bulb. Keep the light on all the time. It's a good idea to prepare your brooder box before the chicks hatch.

**Q. *How will I know if the chicks are warm enough?***

The chicks should be walking around the brooder box, leaving the light area to eat and drink. Chicks normally sleep in a pile, but if you see the chicks are always huddling together, they probably aren't warm enough. Move the light closer to the chicks or increase the wattage of the lamp. For very young chicks, you may want to cover the top of the brooder box with a towel. Be careful not to cover the lamp with the towel.

**Q. *What kind of bedding should we use in the brooder box?***

Put a layer of PLAIN paper towels in the bottom. Change it twice daily or as often as necessary for odor control. Do not use cedar shavings, as it will sometimes give the chicks diarrhea.

**Q. *How should we feed and water the chicks and how often?***

Keep food and water in front of the chicks all the time. Chicks should not get wet or they can get pneumonia. To avoid soaking in the water dish, put marbles or gravel in the bottom of the water dish or use the special waterer provided. The chicks can still drink, but can not get all the way into the dish. Food should be kept in a low dish or chick feeder we provide.

**Q. *Can the students handle the chicks?***

Yes, your students may handle the chicks, and they will want to pick up the chicks. To do this, put one hand under the chick's feet, and lightly put two fingers of the other hand around the chick's neck. That way you can hold the chick and it's not going to jump or fall. Remember that chicks are fragile and need to be handled very gently. Remind your students that the chicks might peck them, but it will not hurt. Children often ask if the chick will bite them. Since chicks don't have teeth, they cannot bite. Handling the chicks is an option, and not mandatory. Some children and adults are afraid of the chicks. They should be encouraged to observe the chicks without touching them.

***Always wash your hands both before and after handling the chicks. Please post the enclosed signs near the brooder box. On the first day of the hatch, handle the chicks as little as possible since they are so young.***

When you have the chicks out of the brooder box, ***do not leave them on a smooth surface like a desktop.*** They can slip on the smooth surface and displace a hip. Always keep the chicks on a layer of paper towels. Remember the chicks are not "potty trained."

**Q. *Can the students get salmonella from the chicks?***

Technically, it is possible to get salmonella from contact with the droppings of the chicks. This has never happened to students in the PA 4-H program, which involves over 50,000 students each year. ***Washing your hands with soap and warm water any time you handle the chicks or their bedding can eliminate the danger of salmonella. Remind your students of this.*** Young children who might put their hands in their

mouths after touching the chicks should be discouraged from handling the chicks. This is one of the reasons we do not offer the embryology project to kindergarten and preschool classes.

## **V. *Finishing the project***

### **Q. *How do I clean the incubator?***

Remove all the egg shells as the chicks are hatching: remove any unhatched eggs and dispose of them as soon as you move the chicks to the brooding box. The incubator can be cleaned with a solution of 1 teaspoon of chlorine bleach in one quart of water, and allow to air dry. This sterilizes the incubator before another hatch. You can gently scrub any hard-to-remove stains with an old toothbrush. Do not clean the incubator with petroleum based cleaners. This leaves a residue that will kill another hatch. If the incubator is hard to clean, try soaking the bottom and wire screen overnight in hot water. Most egg bits can then be wiped off with a cloth. Carefully wipe off the inside of the lid; do not soak the electrical element. Leave the lid off until the incubator is totally dried. You can help us keep track of the performance of the incubators by completing the teacher evaluation. Please return the incubator promptly so another class can use it. Replace the two red plugs in the lid or tape the holes closed if your incubator did not come with plugs.

### **Q. *What do we do with the chicks after they hatch?***

After the chicks hatch you will want to keep them in the classroom for a few days. All the chicks that are returned to us are taken to area farms. We do not destroy the chicks. Transport the chicks without food or water. The water will spill, wetting the chicks and causing them to get sick.

If you know a farmer who will keep the chicks, please let us know in writing before giving him the chicks. Sending a chick home with your students is not allowed because the chicks do not thrive alone. Keep in mind, cute little chicks quickly grow into loud smelly chickens. You may want to check the zoning regulations in your municipality on keeping poultry. If a family wants to take the whole hatch and can house them legally, we must have a letter in writing to that effect, prior to the day that all equipment and chicks are returned to us.

Note: Dr. Philip Clauer, the new Penn State Poultry specialist, has developed a website with lots of additional information and resources. Check it out, but beware! Items that relate to incubator temperature and humidity will not always agree with the information that we have given you, because his information is more general. We've spent considerable time experimenting with what works best for our classrooms and what will give you the best hatch. Please be sure to follow OUR guidelines, for best results.

The website is: <http://ulisse.cas.psu.edu/4hembryo/index.html>

**We hope you and your students enjoy the 4-H Embryology project. Montgomery County 4-H offers school enrichment projects in plant science, wildlife, space exploration, and many other life skills, such as career education and learning how to take care of yourself while alone at home. Please call us at 610-489-4315 for more information about other projects. Check the Pennsylvania 4-H website at <http://pa4h.cas.psu.edu> for more information about 4-H programs in Pennsylvania.**

Portions adapted from the Allegheny County 4-H Program with permission from Susan Taylor, Extension 4-H agent.