**Basics of Embryology**

**Background**

Embryology is the branch of biology that deals with embryos and their development. An embryo is the very beginning stage of life. Vertebrates and seed plants start out as an embryo (examples include cats, dogs, frogs, humans, beans). This program specifically focuses on the chicken embryo. Fertile eggs are required to produce a chick. In order for an egg to be fertile, both a hen and rooster must be present in the flock of chickens. Every egg has a germ spot on the surface of the yolk. The germ spot is the place where embryo development begins if the egg is fertile. You cannot tell if an egg is fertile until after two days of incubation. A hen can produce an egg once every 24 to 26 hours although it may not produce 365 days a year. Eggs will hatch about 21 days from the date that they are placed in the incubator.

**Embryo Development**

The embryo will need food, water, and air to develop inside the egg. On the second day, the embryo will begin to develop blood vessels to carry everything the embryo needs to develop throughout the egg. It will obtain the food from the yolk (yellow). Water comes from the albumen (white), which also contains protein. The air will come from the pores in the eggshell. Both moisture and air can travel through the pores and the membrane. The air cell on the large end of the egg is utilized during the last three days that the chick is inside the egg.

**Eggs**

* Eggs can be obtained from:
  + A local resident or farmer with a flock of chickens and at least one rooster for every 7 to 10 hens
  + A hatchery
* Eggs should be fresh (not more than 10 to 12 days old) to achieve the best results.
* If you don’t need large quantities, it’s frequently more convenient and supportive of your community to find a local source.
* If the temperature of the eggs drops below 40°F, it will cause them to be infertile.
* The number of eggs that can be placed in each incubator varies, but 1 to 2 dozen is a good amount. Check the incubator or turner directions to see if there is a limit they can hold.
* Do not store eggs in a refrigerator, and do not wash the eggs. Do store the eggs in a shaded, cool place (such as a basement) until they are ready to place in the incubator.

**The Incubator**

* The incubator temperature will need to be set and maintained at 100°F (99ºF to 102ºF is acceptable, but the temperature must remain steady). The embryo will begin to form once the internal temperature of the egg has reached 80°F.
  + A hen sets on eggs to keep them warm. This maintains a steady and consistent temperature.
  + A circulated air incubator is recommended for use in this program.
  + If possible, run the incubator for 24 hours before the eggs are put in to ensure it keeps a steady temperature.
  + It is best if the incubator is kept away from drafts and direct sunlight.
  + Place the incubator on a level surface.
* Humidity (moisture in the air) is needed for a successful hatch.
  + The hen brings moisture to her eggs to prevent the shell membrane from becoming tough. Once the hen sits on the nest and heats up the eggs, humidity is created. Pores on the surface of the shell allow moisture to enter the egg. This allows the membrane to remain soft. If the membrane becomes dry and tough, the chick will have a difficult time hatching or may not be able to hatch.
  + Place warm tap water in the bottom of your incubator in the tray. Replace the water as it evaporates. The type of incubator you use will affect how often you will need to add water and how much water you will need to add.
  + The humidity will need to stay around 55 percent, and on day 18, the humidity is increased to 65 percent.
* The eggs will need turned three times a day or at least an odd number of times per day until the eighteenth day.
  + This simulates the hen turning the eggs continually with its beak or feet.
  + To help ensure all eggs are turned, place an X on one side of the egg and an O on the other side. When the eggs are turned, either all the Xs or all the Os will be up.
    - If you are using an egg turner, be sure the large end of the egg is up. The air cell is found on the large end of the egg.
  + The eggs need to be turned to provide adequate egg heating and to prevent the embryo from sticking to one side of the shell. The chalazae are the white string-appearing parts on either end of the yolk. They work to keep the yolk in the center of the egg. If the embryo gets stuck to the side of the shell, it may become deformed or die.
* Encourage everyone who handles the eggs to wash their hands before and after handling them. It should be noted that no health problems have ever resulted from handling the eggs. Hand washing is merely a safety precaution. Since the eggs will come directly from a farm or hatchery, they should not have been cleaned with soap or chemicals. A coating made of protein covers the eggs and protects them from germs. Washing the eggs can wash off the protein layer and make the embryos vulnerable to germs.

**Candling Eggs**

It is important to candle the eggs to see how the embryos are growing. Dark-shelled eggs are harder to see inside. If you leave eggs in your incubator that are not fertilized or have embryos in them that have died, those eggs could turn into rotten eggs.

* Equipment
  + You need a bright light to see inside the eggs. You can purchase a candler, use a bright flashlight, or use an old overhead projector.
* Candling the eggs
  + Shut off the lights in the room as much as possible and turn on the candler or light source. Hold the larger end of the egg up to the light and slowly turn it until you can see inside the egg. The light won't hurt the embryo; however, it is not recommended to hold the egg up to the light for an extended period of time.
  + Conduct candling between day 7 and day 14. Do not candle on or after day 18.
* Inside the egg
  + The air cell is found on the larger end of the egg.
  + You will see blood vessels if the embryo is alive, or a blood ring around the yolk if it has died.
  + The small, darkest mass is the embryo.
  + The yolk is the darker shape, typically in the lower back portion of the egg.
  + If the embryo moves and a dark spot presses against the shell, that is the eye.
* Candling photos and descriptions
  + Description of Fertile Eggs
    - In fertile eggs, embryos have developed. Blood vessels are visible. After day 7, the embryo's eye and the shadow of its body are visible.
    - The embryo may move.
  + Description of Early Dead Eggs
    - These are embryos that started to develop but died for some reason.
    - There will be a thin blood ring around the yolk, or a dark spot inside the egg that is the deceased embryo.
    - Remove them from the incubator and discard them at an appropriate time and place. It is recommended to enclose the egg in a bag and place it in an outside dumpster.
  + Description of Infertile Eggs
    - An infertile egg looks bright, similar to the sun. No blood vessels or blood rings are visible.
    - The eggs are not safe to eat after being in the incubator.

**Last Three Days of Incubation**

During the **last three days** of incubation, a number of changes will take place. On the nineteenth day, the chick will poke its beak through the shell membrane into the air cell and start to breathe. The chick will start to absorb the remaining contents inside the egg. This allows the chick to survive for two to three days without food or water after it hatches.

At the end of the eighteenth day you will need to do the following:

* Stop turning the eggs.
* Fill the tray in the incubator to increase the humidity to 65 percent. Refer to the incubator’s instructions for how to properly increase the humidity.
* Remove the egg turner if you are using one.
* Remove the plug out of the top of the incubator if your incubator has one. This provides air flow as the chicks produce more heat of their own.
* Close the lid and do not open it again until the chicks are hatched.

**Hatching**

* The chicks could begin to hatch on day 20. They may begin to chirp before they break through the shell.
* Using the egg tooth on the tip of the beak, the chick will pip a hole in the shell. It can take up to 24 hours for the chick to completely break out of the shell. It could be slow progress for the chick, as they rest as they are pipping.
* Do not help the chick out of the shell. Chicks gain strength from getting themselves out of the shell and assisting them greatly lowers their chances of survival.
* It is important not to touch or mess with the chicks as they are hatching because they may not survive if they can’t get out of the shell by themselves.
* During this process, the chick is still absorbing the yolk.
* The chicks will be wet and will lie down for a while once they hatch.
* The chicks can be removed from the incubator once they are dried off and moving around. Keep the incubator closed as much as possible so to maintain the humidity in the incubator.
  + The newly hatched chicks are fine to stay inside the incubator until they are dried off and moving around because they absorb the yolk shortly before they hatch. This is similar to being born with a built-in food supply!

**A New Home**

When the chicks come out of the incubator they will need:

* a box for their home
* newspaper or shavings for bedding
* light bulb or lamp
  + The first week after hatching the chicks need to remain in a space where the temperature is maintained at 95 degrees. The chicks will move toward and away from the light to adjust their temperature. If they start to pile directly under the light, they are cold and need more heat. To increase the temperature, lower the heat lamp.
* feed dish and feed
  + A lid from a food storage container such as a sour cream container works (for a smaller number of chicks). If you have a larger number of chicks, a poultry feeder should be purchased. Chick starter pellets and a poultry feeder can be purchased at a farm supply store. It is recommended that Extension staff provide the school with a small amount of feed.
* Water dish and water
  + An empty tuna can works for a water dish, or a chicken watering dish can be purchased at your local farm supply store. Tip: Place a rock in the bottom of the water dish to prevent the chicks from spilling the water.

**Cleaning the Incubator**

After the hatch is complete, clean the incubator with soap and water. Also consult the incubator’s owner manual to perform other recommended cleaning procedures.