

poultry

Incubators in the Classroom: A Guide for Teachers

By Dr. Mickey Latour & Ryan A. Meunier

Background on incubation: Egg incubation is not a new process. In fact, the Chinese incubated eggs as early as 246 B.C., and Aristotle told of Egyptians incubating eggs in 400 B.C. Humans have continued incubating eggs; and as time has progressed, they have become more and more successful at egg incubation. The success rate has continued to be improved over recent years.

Even though a steady improvement in hatchability has been achieved over recent years, the incubation process has remained similar. These improvements have come as a result of the better understanding of genetics, nutrition, hen management, and the health of the breeding flock. As shown in Table 1, considerable improvements have been made in hatching domestic chicken eggs; the knowledge gained from various studies has positively impacted a number of avian species. Several species of birds have been saved as a result of this increased knowledge. Around 1970, several landmark papers directed attention to yet another valuable and intriguing aspect of the eggs of domestic fowl: fowl eggs were used to describe the fundamental processes governing gaseous diffusion (2-5). The basic principles emerging from those studies were rapidly applied to wild birds (6), which had received little study other than their physical dimensions (7). The interest generated from these initial studies prompted scientists to investigate numerous aspects of wild birds (e.g., physiology and morphology) as they relate to evolution, ecology, and environmental adaptation of avian groups (9).

General information: Hatching eggs are very perishable, and their viability is greatly affected by storage conditions. Properly stored, the number of hatching failures can be kept to a minimum. It is recommended that most eggs be stored no longer than one week. The hatchability will decrease rapidly after 7-8 days of storage. The temperature and humidity during storage, as well as the hen age and species, all contribute to the overall hatchability of hatching eggs.

Egg collection and egg storage: When collecting eggs, don't select excessively dirty eggs for hatching. These eggs can contaminate other eggs or chicks. It is possible to clean slightly soiled eggs by wiping them off with a dry cloth, but you should avoid washing hatching eggs because this allows bacteria through the shell and into the eggs.

Eggs should be collected and stored soon after they are laid and maintained at 50-65°F. This temperature can be achieved by storing the eggs in the vegetable section of your refrigerator. An excellent storage container is a cardboard egg carton. When

storing the eggs, store at temperatures below 65°F unless they are being prepared for incubation. If they are kept at temperatures above 65°F, the embryo will start developing. If the eggs are cooled again after the embryo starts developing, a poor hatch will usually result. The relative humidity in the storage facility should be 70%, which is very close to the humidity in the vegetable section of a refrigerator. Daily egg turning or repositioning is recommended to prevent the yolk from sticking to the inside surface of the shell.

Setting the eggs: During a normal incubation process, chicken eggs hatch in 21 days. Chicken eggs removed from storage to start developing (50-65°F) should warm to room temperature before being placed in the incubator. The shock of warming the eggs too rapidly will cause moisture to condense on the shell, and like washing the eggs, this may lead to the bacterial contamination of the eggs.

While waiting for the eggs to reach room temperature, be sure the incubator is running at 99-100°F with a relative humidity of 60-70%. For the incubators supplied by Purdue University, evaluating the temperature and relative humidity is easy. Specifically, the incubators have standard thermometers, and to achieve a near perfect relative humidity, just fill-up the pie pan inside the incubator with hot water every day.

For incubators not supplied by Purdue, a device used to measure humidity inside an incubator is called the hygrometer. Readings from a hygrometer are measured in "degrees, wet bulb." The relative humidity in the incubator for the first 18 days should remain at 55-61%, or 85-87°F, wet bulb.

Increase the humidity during the last three days of incubation to at least 65% relative humidity or 90-94°F, wet bulb. The eggs need to be turned at least three or five times daily during the first 18 days of incubation. Turning keeps the embryo from sticking to the shell membranes. Turning should not be performed during the last three days before hatching.

An excellent method to tell if all eggs have been turned is to mark a "P" on one side of the shell and an "U" on the opposite side. You should use a pencil for this, because the lead will not penetrate the eggshell and affect the embryo.

When turning the eggs, be sure your hands are clean and free of greasy or dusty substances. During the first week of incubation, turn eggs carefully because the developing embryos have delicate

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blood vessels that may be ruptured if jarred or shaken.

An incubation sheet is included (Table 1) so that times and events can be recorded.

The developing chick embryo: Because this section is covered in great detail in our CD *The Developing Chick*, this will be brief. For further information on this topic, please consult "The Developing Chick CD-ROM."

The avian egg, in all its complexity, is still a mystery. The two constituents that are easily visualized when breaking open an egg are the albumen (the white portion) and the yolk. The albumen is composed primarily of protein, while the yolk is made almost entirely of fat. During the initial stages of chick development, the embryo has no access to oxygen, which is a necessity for metabolizing fats. Therefore, the embryo cannot break down the fats in the yolk and must utilize the proteins in the albumen until the blood vessels are formed along the interior of the shell. This vast network of vascular tissue allows the embryo to breath oxygen, a requirement for fat utilization (the yolk).

Hatched chick: It's recommended to not touch the eggs during the last three days of incubation. Therefore, place adequate water in the incubator and make necessary adjustments before closing the incubator on the 18th day. Do not open the incubator until all chicks have hatched. Opening the incubator allows moisture to escape and makes it more difficult for later chicks to hatch. All the chicks should be out of their shells by the end of the 21st day unless proper incubation conditions were not maintained. Chicks hatched after the 22nd day will not be healthy and vigorous. After the chicks have hatched and fluffed up, remove them from the incubator and place them under a brooder with feed and water. For

brooding information, see Mississippi Cooperative Extension Service Publication 268, *The Home Flock*.

When the hatch is completed, disconnect the incubator and remove all chicks, shells, and unhatched eggs. Wash the interior of the incubator with a warm detergent solution. If the incubator is to be used again immediately, rinse it with a disinfectant solution. After the incubator has dried thoroughly, store it for later use.

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Table 1. An Incubator Check Sheet.

Day of Incubation	Turn (Time)	Temperature	Water Pan (Time)
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