

Science Education Collection

Basic Chick Care and Maintenance

URL: <http://www.jove.com/science-education/5154>

Abstract

Chicks (*Gallus gallus domesticus*) are a valuable research tool, not only for studying important concepts in vertebrate development, neuroscience, and tumor biology, but also as an efficient system in which to propagate viruses. Although eggs can be purchased from external suppliers and working with chicks requires very little specialized equipment, an understanding of proper handling procedures is required for normal embryo development.

This video will provide an overview of egg handling principles, including an explanation of the incubation parameters that can profoundly impact development: temperature, humidity, and egg rotation. Most experiments that use chicken eggs require access to the embryo within the shell, which is achieved by cutting a small, resealable hole, or "window." This process is described in step-by-step detail, along with several other techniques essential for working with chicks, such as candling and India ink injection. Finally, the video will review some practical applications of these basic techniques in advanced scientific research.

Transcript

Chicken embryos are a great model for studying early vertebrate development, in part because they are easy and inexpensive to maintain. Unlike most model organisms, which are bred in the lab, fertilized chicken eggs are purchased from an external supplier. Additionally, maintaining and working with the eggs requires very little specialized equipment. This video will provide general background on the acquisition and maintenance of chick eggs, techniques essential to working with developing embryos, and some practical applications of these methods.

Before we discuss working with chicks in the lab, let's review how hens care for their eggs at home. Although eggs are already fertilized when they are laid, chick development stops when the eggs are exposed to colder external temperatures. After laying about 12 eggs the hen sits on the nest to resume embryo development. During their incubation, the hen will rotate the eggs to warm them evenly and prevent the embryo from sticking to the shell. If all goes well, 21 days later, mom has herself a brood of chicks.

So how do scientists collect enough eggs for their experiments? Um... that could take a while. Because chickens are widely domesticated, fertilized eggs can be easily obtained from a hatchery or breeding farm. Eggs can even be ordered at specific developmental stages.

Once eggs have arrived in the lab, they can be stored at 13 - 16 °C for up to 5 days. When you're ready for them to develop, allow the eggs to warm to room temperature, then transfer them to a rocking incubator at 37 °C with 60% humidity until they've reached the desired stage.

Most experiments performed on chicks require a few preparatory steps, like checking if the eggs you received were fertilized in the first place. An easy approach is to use a bright light source or candler box to illuminate the egg. Using this technique, known as candling, internal structures such as blood vessels can be visualized to confirm that an embryo is present.

Leaving the egg intact improves chick survival, but the shell prevents access to the embryo. To crack this problem, researchers use a technique called windowing.

Begin by laying the eggs on their side and marking the top to identify the side to which the embryo will rise. To prevent damage to the yolk while cutting a window, a small amount of albumin, or egg white, is removed to lower the embryo away from the shell. To do this, first sterilize the shell by wiping it down with 70% ethanol. After the shell has dried, smooth a piece of tape over the blunt end of the egg. Then, use a sterile needle to pierce the tape and shell. Insert the needle downwards to avoid damaging the yolk and remove 5 ml of albumin. Lastly, to prevent leakage of albumin, seal the hole with another piece of tape.

To cut the shell, place a piece of tape over the area you plan to window. Using a pair of scissors, make a small hole in the shell and begin to cut a circular opening. During this process, the tape will prevent fragments of shell from falling onto the embryo.

Even after windowing, early stage embryos can be hard to visualize due to their small size and transparency. To improve contrast between the embryo and yolk, diluted, non-toxic India ink can be used. The ink is injected into the yolk under the embryo and allowed to diffuse. The embryo can now be seen in higher contrast against the dark background. Following experimental manipulations, the window should be resealed with tape and the egg placed back into the incubator.

Now that you're familiar with basic techniques for working with eggs, let's see how these methods are used to conduct experiments on chicken embryos.

To start, candling can be used to identify the location of embryonic structures in intact eggs. For example, the extraembryonic membranes of the chicken embryo are commonly used for the propagation of viruses. To infect the membrane, candling is performed to locate the interface between the allantoic cavity and the air sac, in order to inject virus directly into the allantoic cavity without damaging the embryo. After a few days of incubation, large numbers of viral particles can be harvested from the allantoic fluid.

Egg windowing is an extremely useful practice as it permits access to the embryo for experimentation. Many experiments begin with the delivery of DNA into specific tissues via microinjection. Electrodes are then placed around the tissue of interest and an electric field is applied to temporarily permeabilize the cell membrane and drive the nucleic acids into the cell.

When conducting experiments on early embryos, India ink injection is especially useful for visualizing transparent tissues. Here, the improved contrast allows researchers to microinject a DNA solution into refined tissue domains. Ultimately, this technique can produce individually labeled cells, which can be monitored over time to track cell divisions.

You've just watched JoVE's video on chick maintenance. This presentation has covered basic handling and maintenance of chicken eggs, common techniques for working with chicks and some examples of how these methods are applied in biological research. Thanks for watching!