



Plymouth County Extension 4-H Youth Development Program



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Dear Educator,

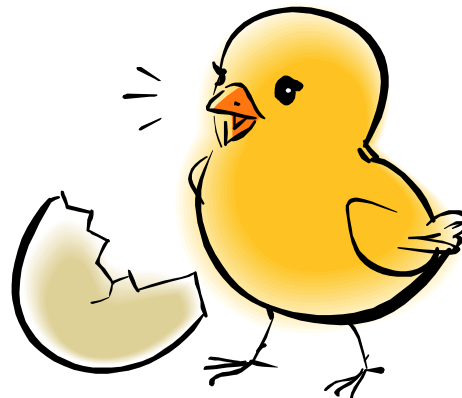
Welcome to the 4-H Embryology Program!

This resource packet has been assembled for your use during the 4-H Embryology Project. Please use the enclosed sheets to make copies, as worksheets for class members of as a reference for yourself. If you have any questions during the project, please contact me.



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Good Luck and Happy Hatching!



4-H Embryology Definitions:

ALBUMEN- the white of the egg

BLASTODISC- a spot on the yolk containing an unfertilized ovum (egg). Present on all eggs. When fertile, this develops into the embryo and eventually a chick.

BROODING- keeping baby chicks warm, dry, fed and watered while they grow.

CANDLING- holding an incubated egg up to a strong light to observe the embryo inside.

CHALAZAE- thread-like portion in the albumen that anchors the yolk.

CHICK- a newly hatched baby chicken.

CHICK STARTER- a chicken mash especially made for baby chicks.

COMB- the fleshy protruding part on top of the head of a chicken or other fowl.

DOWN- the soft, fine, fluffy covering of a young bird.

EGG- a special reproductive cell from a female.

EGG TOOTH- the temporary hard projection (“tooth”) on the end of the chick’s beak, used to break out of the shell while hatching.

EMBRYO- a developing chick inside of the eggshell.

EMBRYOLOGY- the study of the growth and development of unborn animals.

FOWL- a collective term applying to ducks, chickens, geese, turkeys and other avian species.

HEN- an adult female chicken.

INCUBATE- to apply heat to create an environment where fertile eggs can develop and hatch.

MASH- a finely chopped chicken feed.

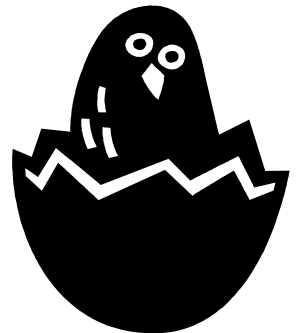
MOLT- the process of shedding old feathers and re-growing new feathers.

PIPPING- a baby chick breaking from the egg.

PULLET- a young female chicken.

ROOSTER- an adult male chicken.

YOLK- the nourishment for a growing chicken embryo.



Background information for Teachers:

Embryo development begins when the egg is fertilized. The single female cell on the surface on the yolk divides into two cells. The embryo usually consists of two or more layers of cells by the time the egg is laid.

Shortly after incubation begins, three distinct layers of cells are formed. The layers: the ectoderm, mesoderm and endoderm, are the material from which the various organs and systems of the body develop. The skin, feathers, beak, claws, nervous system, parts of the eye, and linings of the mouth and vent develop from the ectoderm. The bones, muscles, blood, reproductive organs, and the excretory organs develop from the mesoderm. The endoderm produces the linings of the digestive tract.

During the first 24 hours of incubation, the head of the embryo becomes observable. By the second day, the heart is formed and beating.

There are three extra-embryonic membranes which are essential to the growth of the embryo. They are the amnion, yolk sac, and allantoids. The amnion is a transparent sac filled with a colorless fluid that surrounds the embryo. This liquid filled sac protects the embryo from the mechanical shock and allows the embryo to move about somewhat freely.

The yolk sac surrounds the yolk and facilitates the uptake of the nutrition in the yolk material. The allantoid carries capillaries which come in contact with the shell membrane. The association serves as an embryonic respiratory organ, receives excretion from the kidneys, absorbs egg white nutrients, and absorbs calcium from the shell.

On the fourth day of incubation, limb buds appear. These eventually develop into legs and wings. Legs and wings begin to move on the eleventh day. During the eight day formation feathers start to form. By the ninth day the embryo appears bird like. Down covers the body by day thirteen and scales and nails appear on the legs and feet. The beak is well formed by the sixteenth day. On day nineteen, the yolk begins to enter the body and the beak may pierce the air cell and the lungs begin to function.

A horny cap on the end of the upper part of the beak is used to chip the eggshell. This usually occurs on the twentieth day. As the chick slowly rotates in the shell, a circular path is chipped around the larger end of the egg. A final push finished the break and the chick can emerge.

Important Events in Chicken Embryonic Development

<u>Day</u>	<u>Development</u>
Before egg laying	Fertilization Division and growth of living cells Segregation of cells into groups of special function
Between laying and incubation	No growth; stage of inactive embryonic life
During Incubation:	
Day 1	
16 hours	First signs of resemblance to a chick embryo
18 hours	Appearance of alimentary canal (digestive system)
20 hours	Appearance of vertebral column
21 hours	Beginning of formation of nervous system
22 hours	Beginning formation of the head
23 hours	Appearance of blood island- vitelline circulation
24 hours	Beginning of eye formation
Day 2	
25 hours	Beginning formation of the heart
35 hours	Beginning formation of the ears
42 hours	Heart will begin to beat
Day 3	
50 hours	Beginning formation of the amnion
60 hours	Formation of the nose
62 hours	Formation of the legs
64 hours	Beginning formation of the wings
70 hours	Beginning formation of the allantois
Day 4	Formation of the tongue
Day 5	Formation of the reproductive organs and differentiation of sex
Day 6	Beginning formation of the beak and egg-tooth
Day 8	Beginning of the formation of feathers
Day 10	Beginning of hardening of the beak
Day 13	Appearance of scales and claws
Day 14	Embryo turns it's head towards blunt end of egg
Day 16	Scales, beak and claws becoming firm
Day 17	Beak turn toward air cell
Day 19	Yolk sac begins to enter the body cavity
Day 20	Yolk sac is completely drawn into body cavity Embryo occupies practically all the space in the egg except the air cell
Day 21	Hatching of the chick

4-H Embryology Word Search

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ALBUMEN
ALLANTOIS
AMNION
BLASTODERM
BLASTODISC
CANDELING
CELL
CHALAZAE
CHICK
CHICKEN
EGG
EMBRYO
EMBRYOLOGY
FERTILIZED
HANDS
HATCHED

HEAD
HEALTH
HEART
HEN
HUMIDITY
INCUBATOR
MEMBRANES
NEST
ONE
PIPPING
ROOSTER
ROTATE
SHELL
TOOTH
TWENTY

Incubator Cheat Sheet

1. To store eggs before setting, keep them in a cool, dry place between 50-60 degrees F. (A refrigerator is too cold and most homes are too warm) A garage, or basement is usually an ideal place.
2. Bring the eggs up to room temperature before placing in the incubator. Eggs should not be cool to the touch before going into the incubator.
3. You should plug in the incubator a few hours before you put in the eggs. This is to regulate the thermostat and to be sure the temperature registers 100-101 degrees F steadily for two hours. Fluctuating temperatures can kill the eggs.
4. Make sure water channel in the bottom of the incubator has water in it at all times. There is no way to measure humidity in the incubator, by making sure water is in the channel will ensure proper humidity for the eggs.
5. Make sure the eggs are not sitting in the water. Eggs should be placed directly on the mesh liner in the incubator.
6. Mark each egg with a pencil on one side. This makes it easier to record turning the eggs. If eggs can not be turned during the weekend don't worry. The eggs should still hatch if they are turned properly during the week. It is recommended to turn the eggs over the weekend if possible, the more they are turned, the better your hatch rate. Eggs should be turned an odd number of times each day, 3 times is recommended.
7. Eggs should not be turned in the last 3 days of incubation. This is also a critical point to monitor the amount of water in the tray. High humidity is needed for chicks to fully hatch.
8. Chicken Eggs hatch in 21 days. They will remain in the incubator for up to 24 hours after hatching. Before hatching, the chick draws the yolk of the egg through the navel into its body cavity. This will provide enough food for the chick for 24-48 hours. The chick should be fluffy and dry before being removed from the incubator.
9. Chicks must have a warm environment after they are removed from the incubator. Chicks should have one section of the brooder box with a heat source so they can exercise and sleep. The other side of the box can be cooler, food and water can be kept on the cool side.
10. You should arrange for a home for your chicks before they hatch. In the event that you can not find a home for the chicks please call Molly Vollmer at the Plymouth County Extension Office, 781-293-3541 to make other arrangements.

After the Chicks Hatch

Chicks may be kept in the classroom for 1-2 weeks if proper care and facilities are provided. It is important to protect, feed and water them to ensure their comfort. Remember to find a permanent home for the chicks after the period of classroom observation is over. If no appropriate home can be found, call the Plymouth County Extension Office to make an arrangement.

Equipment and Supplies for Brooding Chicks:

- Large Cardboard Box or Large (20 gal) Aquarium can be used.
- A wire or mesh cover for the top of the brooder box
- A heat source (Gooseneck or shop light with 60-75 watt bulb should be sufficient)
- Wood shavings or other appropriate litter material
- Feed dish
- Chick Waterer or very shallow water dish
- Chick Starter Feed

Procedure:

The principles of brooding are the same regardless of the number of chicks in the flock. Whether there are two chicks in the brooding unit or one hundred, they have to be kept warm, well fed and watered, protected from predators and dampness; and provided with plenty of fresh air. A simple cardboard box can easily meet the needs of a small group of chicks. The illustration to the right shows a simple brooder. A gooseneck lamp can be used to supply heat. Generally a brooder temperature should be about 85-90 degrees. The lamp can be adjusted so the temperature remains correct. Chicks need to be able to move away from the heat source, the lamp should be positioned at one end of the brooder to allow for this natural movement of the chicks. Comfortable chicks will be evenly distributed throughout the brooder. If your brooder is too hot, the chicks will be gathered away from the light. If the brooder is too cool, they will be clustered below the lamp.

The litter in the brooder serves as insulation and as an absorptive material. Wood shavings, peat moss, chopped straw or shredded paper can be used. Don't place chicks on a smooth surface, they will not be able to stand or get proper exercise. The litter in your brooder will need to be changed when it becomes dirty from chick droppings or spilled water.

Chicks will need to be checked first thing in the morning, through out the day and at the end of the day or before going to bed. Water should be replenished several times as the chicks may spill the water dish. Chicks will need a foster home over weekends; they can be easily transported right in their brooder box. Chicks should not be left over a weekend in a classroom.

Incubator Trouble Shooting

<u>Symptom</u>	<u>Probable Cause</u>
Chicks hatching too early with bloody navels.	Incubator Temperature is too high
Long hatch: some chicks early but slow in finishing	Temperature too high
Delayed hatch: eggs not pipping until 21 st day or later.	Temperature in incubator is too low
Short down on chicks	High temperature or low humidity
Mushy chicks, Bad Odor	Navel infection caused by bacteria in incubator
Chicks very small	Low humidity or high temperature
Shell Sticking to Chicks	Low humidity at hatching time
Chicks smeared with egg contents	Low average temperature, Humidity may be too high
Rough Navels	High temperature or low humidity
Crooked or curled toes	Incubator temperature too high
Crippled chicks, missing eye, cross beak, etc.	Mostly chance. Heredity.