

Lesson # 6

Egg Laying Hens

Core Area: Animal Science

Unit: Poultry Industry

Lesson # 6: Egg Laying Hens

California CTE Standards (Agriculture):

D1.1 Understand appropriate space and location requirements for habitat, housing, feed, and water.

D3.1 Understand the major systems and the function of the organs within each system.

D4.2 Understand the gestation process and basic fetal development.

D12.2 Understand the relative importance of the major meat classifications, including the per capita consumption and nutritive value of those classifications.

D12.4 Understand how non-meat products (such as eggs, wool, pelts, hides, and by-products) are harvested and processed.

FS 4.6 Differentiate among, select, and apply appropriate tools and technology.

FS 8.1 Know major local, district, state, and federal regulatory agencies and entities that affect industry and how they enforce laws and regulations.

FS 11.0 Demonstration and Application.

California Academic Standards

Investigation and Experimentation

1a Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.

Student Learning Objectives.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. The following resource should be selected to accompany this lesson:

1. The United Egg Producers —<http://www.unitedegg.org>
2. Poultry Science Manual for National FFA Career Development Events — 5th Edition (IMS); available at <http://www-ims.tamu.edu>

Other Resources: The following resources will be useful to students and teachers:

1. Eggcyclopedia —<http://www.incredibleegg.org/egg-facts/eggcyclopedia>

List of Equipment, Tools, Supplies, and Facilities.

- ✓ Video Projector (overhead projector may be substituted if necessary)
- ✓ Projection screen
- ✓ Computer loaded with supplementary images and videos (or still images may be printed on an overhead)
- ✓ Three (minimum) items that contain eggs (see Interest Approach)
- ✓ Class sets of attached labs, worksheets, and tests
- ✓ Enough raw eggs for each student to have one (may do one egg per two students if necessary)
- ✓ Dark colored paper plates (one per egg)
- ✓ A sampling of the packaging materials and types of eggs available at a local grocery store

Terms. The following terms are presented in this lesson (shown in bold italics):

- Laying Hen
- Molt
- Egg
- Push-Out (mature or spent hen)
- Yolk
- Follicle
- Ovulation
- Infundibulum (funnel)
- Magnum
- Isthmus
- Cuticle
- Uterus
- Vent
- Shell
- Calcium
- Cage House
- Cage Free or Floor House
- Aviary
- Embryo
- Free Range
- Fertile
- Cage Free
- Organic

Interest Approach.

Before class, obtain a root beer, a jar of mayonnaise, a muffin, marshmallows, crackers, a pudding cup, some egg beaters, a shell egg, or any other egg containing products. ANY product that contains in its ingredient list globulin, albumin, apovitellenin, livetin, ovalbumin, ovomucin, ovomuciod, ovovitellin, phosvitin, lysozyme, silica albuminate, vitellan, ovotranferrin, ovovitella, ovoglobulin, or surimi has some form of egg product in it. Try to obtain at least three egg containing items including a shell egg. Before the class enters the room, place these items (except the whole egg) in view on a table, desk, shelf, etc. Before beginning the lecture, ask the students if they know what all of the items you have brought have in common. After some guesses, bring out the shell egg and explain that all of the products have eggs in them. Use this as a basis to introduce the importance of eggs as a food staple for human consumption.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Understand the purpose of egg laying hens.

Anticipated Problem: Why does the commercial poultry industry exist?

1. **Laying Hens** produce eggs for human consumption.
 - A. In 2009, per capita egg consumption in the U.S was 248.0.
 - B. Fast food breakfast and changes in health perceptions about eggs have led to an overall increase in egg consumption in recent years.
 - C. **Eggs** are found in a wide variety of products and forms.
 1. Shell **eggs** —come in a shell in a carton of some kind.
 2. Liquid **egg** products —“Egg beaters.” Eggs removed from shell at a breaking plant. Usually just egg whites with added coloring.
 3. Dried **eggs** or egg powder.
 4. **Eggs** in one of their many forms can commonly be found in the following foods: doughnuts, pudding, pretzels, mayonnaise, marshmallows, waffles, crackers, cookies, cake, pie crust, jell beans, root beer, sherbet, muffins, tar tar sauce, frosting, ice cream, cream puffs, some candies, and in virtually anything that is battered and then fried just to name a few.

Teachers: It may be helpful to show the attached visual of what 248 eggs looks like to give the students better perspective on the average per capita consumption per year in the U.S.

Objective 2: Discuss where in the world our eggs come from and the size of the egg industry in the United States.

Anticipated Problem: Where do most of the eggs for the U.S. come from?

1. Egg production in the U.S. occurs in almost every state; however, the top five producing states are Iowa, Ohio, Indiana, Pennsylvania, and California.
 - A. These are the largest egg producing states and they house approximately 50% of the **laying hens** in the U.S.
 - B. In the U.S., approximately 3,136,500,000 dozen eggs were produced during 2008.
 - C. In addition to producing eggs for the U.S., 21 million dozen eggs were exported, mainly to Asian countries but also to Europe, Canada, and Mexico.

Teachers: When discussing this section, it may be helpful to display the attached US map on an overhead or video projector. This will help students gain better perspective on where many of the eggs in the U.S. come from.

Objective 3: Obtain basic knowledge about reproductive physiology and how eggs form.

Anticipated Problem: How does a chicken egg form?

1. Anatomy and function of reproductive tract.
 - A. An egg takes approximately 24-25 hours to completely form from the point of ovulation to the time the egg is laid.
 - B. **Ovary**
 1. Hens only have one functioning ovary (usually the left one).
 - a) This is different from many other species like human beings who have two.
 2. The place from which the true egg originates.
 3. The ovary contains a series of follicles that mature as **yolk** material is added to them.
 - a) **Yolk** material is manufactured in the liver.
 4. When one ruptures, ovulation occurs.

5. The ovulated follicle then leaves the ovary and makes its way down the reproductive tract.
 - a) If two follicles rupture at the same time, double **yolked** eggs can form.

C. Infundibulum (funnel)

1. After leaving the ovary, the follicle enters the infundibulum.
2. The infundibulum is controlled by tactile (touch) stimulation, so anytime something touches the inside of the funnel, an egg forms.
 - a) This can lead to no **yolk** eggs or eggs formed around a piece of the oviduct that has broken off in some cases.
3. If hens were allowed to breed, this is also where conception would take place.

D. Magnum

1. This is where the thick and thin egg white forms.

E. Isthmus

1. The shell membranes form here.

F. Uterus (Shell Gland)

1. The egg spends the most time in the uterus (approximately 20 of the 24 hours).
2. The shell forms
 - a) Most of the shell formation takes place at night.
 - b) Even though an egg shell may look solid, there are actually thousands of tiny pores on each shell.
 - (1) These pores allow the developing embryo to breath.
3. The shell color is added (if not white).
4. A protective cuticle is added to the outside of the shell.
 - a) This is like a natural sealant for the egg.
 - b) Keeps the egg from losing water too quickly.

G. Vagina

1. Basically acts as a transport passage from the uterus to the vent.

H. Vent (Cloaca)

1. Outer opening of the hens reproductive and digestive systems.
2. Eggs and the feces/urinary mixture eventually pass through this opening.

Teachers: *The students may benefit from following along and filling in the attached reproductive tract worksheet as you explain the different parts and functions.*

Objective 4: Learn how to tell what color egg a chicken will lay.

Anticipated Problem: How can you tell what color eggs a chicken will lay?

- I. Chickens have ear lobes
 - A. The color of the ear lobe determines what color egg the hen will lay.
 - 1. White ear lobe —white egg
 - 2. Red ear lobe —brown egg
 - 3. Yellow/brownish color ear lobe —blue/green egg

Teachers: Showing the attached pictures of a hens ear lobes may help the students to better understand what you are talking about.

Objective 5: Learn to identify basic parts of the egg.

Anticipated Problem: What are the different structures present in an egg?

- I. Eggs have a variety of different structures.
 - A. **Yolk**
 - 1. This is the yellow part in the center of the egg.
 - a) The actual color of the egg yolk varies based on what the hen who laid the egg is fed.
 - (1) Hens fed a diet high in corn or alfalfa tend to have a more dark yellow to orange colored yolk because those feeds are high in a fat soluble pigment called xanthophyll.
 - (2) Hens who are fed a diet of mostly wheat, which is low in xanthophyll, would have a very light yellow or even slightly grayish yolk.
 - 2. Separated from the white by the vitelline membrane.
 - 3. The yolk provides “food” that is essential for the developing chick embryo.
 - B. **Germ**
 - 1. The small white circle found on the yolk.
 - 2. In a fertile egg, this is where the embryo starts to develop.
 - 3. In non-fertile eggs, this spot stays small and white.
 - C. **Albumen**
 - 1. Also known as the “**egg white.**”

2. There are two types of albumen:
 - a) **Thick white**
 - (1) Located closest to the yolk.
 - (2) The less liquid, more dense portion of the white.
 - (3) In fresher eggs, the thick albumen is denser than in older eggs.
 - b) **Thin white**
 - (1) The more liquid “runny” portion of the egg white.

D. Shell

1. The hard, normally white (may also be brown or greenish blue) coating that provides the eggs solid structure and shape and protects the developing embryo.
2. As mentioned before, the shell of an egg contains thousands of tiny pores.

E. Shell Membranes

1. Membranes that are located just inside the shell.
2. Act as a barrier between the shell and the albumen.

F. Air Cell

1. The small open space at the large end of an egg.
2. Formed by the separation of the two shell membranes.
3. Provides the chick with an air supply during the final stage of development just before hatching.
4. Older non-fertile eggs will have a larger air cell due to moisture loss.

G. Chalaza

1. The small, white, rope-like structures at both ends of the yolk.
 - a) These structures help keep the yolk centered within the egg.
 - (1) If the yolk were to come into contact with the shell during embryo development, the process would be aborted and the embryo would cease development.

Teachers: *Students may benefit from doing the attached egg dissection lab and completing the attached worksheet at this time*

Objective 6: Understand different systems for raising laying hens.

Anticipated Problem: Why do some people choose to raise laying hens in cages and others on the floor?.

- I. There are two major methods of raising laying hens:
 - A. **Cage Free or Floor House**
 1. Hens are raised in a building without cages, with light and temperature controlled.
 2. Usually equipped with an automated feeding and watering system, as well as a mechanical nest for egg gathering.
 3. Hens are free to roam and congregate where they please.
 - B. **Cage House**
 1. Hens are raised in cages.
 - a) Sometimes there will be a single layer of cages per house.
 - b) Normally several rows of cages stacked on top of one another (stacked deck house).
 2. Cages have roll outs and normally an automated egg gathering system.
 3. Normally have an automated feeding and watering system.
 4. Automated ventilation and artificial lighting.

Teachers: Showing the attached images of both cage and floor houses or tracking down your own images to show may greatly increase student understanding of the concepts you are presenting

Objective 7: Gain a basic understanding of the life cycle of a laying hen.

Anticipated Problem: How long do chickens live in a typical production agriculture setting?

- I. Laying hens typically have a two year life-cycle
 1. Hens arrive at a brood/grow out facility at one day of age.
 2. They usually stay in the grow facility for approximately 17 weeks.
 - a) It is critical that during this time, hens are not exposed to increasing day length.

3. Once hens have reached proper body weight, they can be light stimulated to encourage egg production
 - a) During this period, hens should be exposed to an increasing day length (typically 16 hours).
4. Typically, hens will lay until 70-75 weeks of age and then be **molted**.
 - a) **Molting** is the process of causing hens to stop laying for a short period to rebuild bones and give their reproductive tracts a rest.
5. After the molt, hens are usually productive until 110-115 weeks of age.
6. After their productive life has ended, hens are called “**push-outs**” or “**mature spent hens**” and are sold or euthanized on the farm.

Teachers: Handle the issue of what is done with the hens carefully if students are curious. Many hens are sold for pet food or are simply rendered.

Objective 8: Discuss types of eggs that can be purchased at the grocery store.

Anticipated Problem: What kinds of eggs can commonly be found at a grocery store?

I. Regular white egg

A. Most commonly found and generally cheapest eggs on market.

II. Specialty Eggs

A. Brown Eggs

1. Can sometimes be slightly more expensive.
2. No difference between white and brown eggs other than shell color.

B. Omega-3 eggs

1. Eggs contain additional Omega-3 fatty acids.
2. Gives eggs a better health perception.

C. Reduced cholesterol eggs

1. Viewed as a heart healthier alternative to regular eggs.

D. Free-range eggs

1. Hens are required to be given some access to the outdoors.

E. Cage-free eggs

1. Hens are not allowed to be housed in wire cages.
2. Typically hens are housed in a large floor house with nest boxes.

F. Organic Eggs

1. Hens must be fed a completely organic diet from hatching.

2. Other restrictions on use of pesticides, antibiotics, etc. may also exist.

G. Fertile eggs

1. A specialty type of egg that was laid by a hen who was given the opportunity to mate.
2. Supermarkets and consumers must be extremely carefully to properly handle and store these eggs or the embryo may begin to develop, resulting in what looks like a black comma on the yolk surface.
3. Nutritionally enhanced such as Eggland's Best.

Teachers: Students may benefit from seeing samples of the different types of eggs and the packaging that they typically come in from a local grocery store.

Review/Summary. Focus the review of the lesson around the student learning objectives. Ask students to explain the content associated with each objective. Use their responses as the basis for determining any areas that need to be covered again.

Application. Application can involve student activity with the provided labs.

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as a written test. A sample test is attached.

Answers to Sample Test:

Part One: Matching

C	1. Pullet
G	2. Laying hen
H	3. Replacement pullet
I	4. Push-out
D	5. Molt
J	6. Cage house
A	7. Cage free or floor house
F	8. Aviary
B	9. Free range
E	10. Organic

Part Two: Matching

F	1. Fertile
I	2. Embryo
H	3. Follicle
K	4. Ovulation
N	5. infundibulum (funnel)
A	6. Magnum
J	7. Isthmus
B	8. Cuticle
D	9. Uterus
L	10. Vent
P	11. Egg
C	12. Thick white
M	13. Thin white
E	14. Yolk
G	15. Shell
O	16. Calcium

Part Three: T / F

1. T
2. T
3. T
4. F
5. F
6. T
7. T
8. T
9. T
10. T
11. T

Parts of the Egg Worksheet / Lab

In this lab, you will learn about the parts of an egg through visual examination. Locate each listed part and record it on the diagram below.

1. Carefully crack your egg onto the provided plate. Be careful not to break the yoke.
2. Before discarding the shell, find the shell membranes. If possible, see if you can pull a little piece of the membrane away from the shell and examine it. Also, note the location of the air cell.
3. Locate the:
 - 3.1. Yolk
 - 3.2. Thick albumen
 - 3.3. Thin albumen
 - 3.4. Air cell
 - 3.5. Vitelline membrane
 - 3.6. Germinal disk
 - 3.7. Chalazae
 - 3.8. Shell
 - 3.9. Shell membranes

Record locations on the diagram to the right.

4. Answer the questions below.

1. What does the egg white do for the chick?
2. What do the chalazae do?
3. What is the function of the shell membrane?
4. What does the air cell do?
5. What does the shell do?