Kansas 4-H Poultry Leader Notebook

Level III

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Advancing in the Poultry Project by Reaching Goals

Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
• To set goals for their poultry project
• To explore various areas for poultry projects

ABOUT THEMSELVES:
• Understanding the importance of overcoming barriers

Materials Needed:
• Flip chart and markers or chalkboard and chalk
• Poultry Member Guide and Annual Report (MG-26)
• Activity Sheet 1, Barriers to Reaching My Goals (two copies)

ACTIVITY TIME NEEDED: 40 MINUTES

ACTIVITY:
As you become older, you can branch out into a variety of areas related to the poultry project. This lesson is prepared to guide members into different areas of interest through a goal-setting process.

Some lesson suggestions might be:
• Proper handling of hatching eggs
• Learning basic nutritional needs of poultry
• Effect of light on chickens
• Flight adaptations
• Egg grading
• Processing poultry meat

Goal setting
After having had time to see all the topics that can be addressed when raising poultry, it is time to make some goals for the year.

Let’s think about possible barriers that might prevent us from reaching our goals.

Barriers
It is important to know how to cope with and eliminate barriers that might stop you from reaching your goals. Some major barriers to reaching goals can include time, money, resources, knowledge or ability.

When you have completed question 1, fill out your Poultry Member Guide and Annual Report, for MAP STEPS 1 through 3.

Leader Notes
Ask the members what different things they would like to learn about poultry. List these on the board.


In groups of two or three members, fill out question 1 on Activity Sheet 1.
The best way to deal with barriers is to design strategies of how you will overcome the barrier.

For each step you’ve listed on your Poultry Member Guide and Annual Report, identify a barrier you think could possibly prevent you from reaching your goal.

Now, identify with two or three group members some ways of overcoming those barriers in question 3.

For question 4 identify what you think will be the biggest personal barrier you will encounter this year and how you plan to overcome it.

Now using your Poultry Member Guide and Annual Report, complete MAP STEPS 4 through 7. Use a second copy of Activity Sheet 1, Barriers to Reaching Goals, to analyze your second major goal.

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. What is a barrier to reaching goals that has to do with time?
2. What is a barrier to reaching goals that has to do with money?

**Process:**
3. Why is it important to know possible barriers that might prevent you from reaching your goals?
4. How will you overcome barriers that prevent you from reaching your goals?

**Generalize:**
5. What frustrations occurred when you discussed barriers? Why?
6. How do you deal with the frustrations that result from working with barriers?

**Apply:**
7. What are some barriers you may face in the future?
GOING FURTHER:
- Teach this goal-setting process to other 4-H members or groups.

REFERENCES:

Author:
James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
Poultry Design Team
ADVANCING IN THE POULTRY PROJECT BY REACHING GOALS
POULTRY, LEVEL III
Activity Sheet 1, Barriers to Reaching My Goals

1. **BARRIER:** What might be a barrier to reaching a goal that could include?
   - time: ___________________________
   - money: __________________________
   - resources: ________________________
   - knowledge: _______________________
   - ability: __________________________
   - other barriers: ____________________

2. **OVERCOMING BARRIERS:** What are some barriers you might encounter when reaching your goals?
   For MAP STEP 2
   - Barrier 1: _________________________
   - Barrier 2: _________________________
   - Barrier 3: _________________________
   - Barrier 4: _________________________
   - Barrier 5: _________________________

3. **STRATEGIES FOR OVERCOMING BARRIERS:** How will you overcome the barriers that might prevent you from reaching your goal?
   For MAP STEP 2
   - Strategy 1: _________________________
   - Strategy 2: _________________________
   - Strategy 3: _________________________
   - Strategy 4: _________________________
   - Strategy 5: _________________________

4. **YOUR PERSONAL BARRIER:** What do you think will be your biggest barrier to overcome during the next year for your poultry project and how do you plan to overcome it?

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What Members Will Learn . . .

ABOUT THE PROJECT:
• The physical behavior and secondary sex characteristics of poultry during courtship

ABOUT THEMSELVES:
• Importance of planning and preparation

Materials Needed:
• Member Handout 1, Mating Behavior Diagrams: Chickens, Ducks

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY:

It is important for you to know the sexual behavior of the animals with which you are working. Sexual behavior involves courtship and mating rituals and is usually controlled by hormones.

CHICKENS
Mating in chickens is preceded by various behavior patterns known as displays or courting, which accompany sexual activities of males and females.

Courting by the cock may be exhibited in three ways:
1. by waltzing, fluttering his wings or dancing,
2. by extending his head and grasping the hen’s comb or neck feathers, or
3. by chasing the hen, grasping her comb or neck feathers; mounting, grasping the comb or neck feathers and treading.

The hen may respond to courting in any of three ways:
1. acting indifferently
2. acting negatively
   • by stepping aside
   • by walking or running away
   • by struggling
3. acting positively
   • by crouching, often with her head low and wings spread, moving tail to one side
   • by everting cloaca

NOTE: Any of the above may be accompanied by vocalization, ranging from faint screams to loud squawks.
TURKEYS
In contrast to chickens, a receptive turkey hen invites copulation by assuming a marked sexual crouch in front of a tom in full display. The tom’s display includes gobbling, elaborate movements and fanning of tail feathers, strutting and puffing air in the air sacs. The turkey hen is not receptive to the tom for periods of several days after either successful or unsuccessful mating, both of which involve eversion of the vagina.

DUCKS
Ducks usually bond into pairs. Social courtship displays and displays associated with pair formation occur only during the autumn, winter and early spring months.

The female courtship displays may include the following:
1. **Inciting**—a display associated with the pairing and maintenance of the pair-bond. It indicates the female’s choice of one male and rejection of another. The female usually moves beside or behind a chosen male, makes threatening movements over one shoulder, and utters loud calls.

2. **Nod-swimming**—the female holds her head high but moves it forward and backward.

3. **Repulsion**—this behavior usually occurs when females are incubating or brooding, and are harassed by the drake. The female tucks her head back, opens her bill, ruffles the plumage on her back and flanks, fans her tail and emits loud, harsh calls.

4. **Distraction Displays**—in this setting, the female thrashes both wings, flaps across the ground or water and squawks loudly.

The male may exhibit:
1. **Preliminary Displays**—the male takes on a pose with his head sunk in the shoulders, ruffles his head feathers, shakes his head and wags his tail.

2. **Major Courtship Displays**—usually occur suddenly in the drake. Some examples are:
   - **Grunt-whistle**—The drake lowers his bill into the water surface, arches his body, flicks his bill to one side, sending a fine spray of water toward the female, and utters a loud whistle followed by a grunt.
   - **Head-up, tail-up**—The drake makes complex movements by the sudden raising of his head, cocking of the tail and raising the closed wings, and makes a loud whistle.
   - **Down-up**—The drake dips his breast deeply into the water, jerks his bill upward and flips water as he goes, raises his tail high out of the water and whistles when his head is at the highest level.
DIALOGUE FOR CRITICAL THINKING:
Share:
1. What are some courting behaviors of chickens?
2. What are some courting behaviors of ducks?

Process:
4. What behavior is significant in ducks as compared to chickens and turkeys? (Pairing)
5. Which courtship behaviors were most easily identified in chickens? Turkeys? Ducks?

Generalize:
6. Why is it important to be able to identify courting and mating behaviors in other farm animals?

Apply:
7. How can the observation of mating behavior help you plan and prepare for future production?

GOING FURTHER:
- Visit a small poultry flock and observe the behaviors of the birds.
- Prepare and present a talk about the mating behaviors at your next 4-H meeting or school class.
- Discuss the practice of artificial insemination and its practicality in birds.

REFERENCES:
* Poultry Science, Ensminger
* Domestic Animal Behavior, Craig
Leader Notes

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10-Poultry, Level III
POULTRY DATING GAME
POULTRY, LEVEL III
Member Handout 1, Mating Behavior Diagrams: Chickens, Ducks

CHICKENS

Sexual approaches
waltz or wingflutter
from the rear;
other approaches

Escapes by running
Avoids by stepping aside
Sexual crouch — avoids

Mounting & treading
Moves tail to one side
& everts cloaca

Spreads tail &
everts cloaca

Vents meet

Ejaculation

Steps off
Stands, shakes

may circle or waltz
may run

DUCKS

The “rab rab” chatter
of a Mallard pair
(hen left; drake right)
calms both members.

A female (in foreground) nods-
swimming among drakes.

Rejection-gesture used
by the female when
harassed by drakes
intent on forced mating.

In this posture,
the drake utters
the attraction and
warning call, “rab.”

Headshake of the drake

Grunt-whistle of
Grunt-whistle of the drake

Head-up, tail-up of
the drake
Reproduction and Fertilization of Poultry

What Members Will Learn . . .

ABOUT THE PROJECT:
• The parts of a female bird’s reproductive tract
• The parts of a male bird’s reproductive system
• To trace paths of egg (ovum) and sperm to complete fertilization

ABOUT THEMSELVES:
• The contribution of each part to the success of a whole system

Materials Needed:
• Activity Sheet 1, Hen’s Reproductive Tract
• Leader’s Key, Activity Sheet 1, Hen’s Reproductive Tract
• Pencils for each member
• Tape
• Small pieces of paper with the names of the parts of the hen’s reproductive tract
• Member Handout 2, Time Frame for Egg Formation
• Member Handout 3, Genital Organs: Cock and Hen

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY:

What is a hen’s purpose? Basically, it is to lay eggs to be used as food or for hatching. A hen’s body is specially designed to form eggs. The reproductive system of a bird is different from that of mammals. The most obvious difference is the egg is fertilized, supplied with nutrients, surrounded by a shell and expelled from the body in birds. In contrast, the fertilized egg of mammals remains in the reproductive tract until birth.

Female Reproductive System
These are the different parts of the hen’s reproductive tract. It is the same as on your paper. The egg-making machinery of the hen consists of two main parts: the ovary and the oviduct.

This is the ovary. The ovum or yolk develops here. The hen has two ovaries, but only the left one is functional. It is located in the body cavity near the backbone. An ovary contains several thousand egg yolks (ova) which are present at the time the female chick is hatched.

This is the follicle. The follicle is a thin-walled sac containing blood vessels which supply the yolk materials and contain the yolk until its release.

Leader Notes
Give each member Activity Sheet 1, Hen’s Reproductive Tract. List the names of the various parts of the ovary and oviduct on a flip chart or chalkboard. See how many parts members can identify on their handout before discussing parts and egg formation pathway. Ask members to discuss each part and its function before giving the correct answer. Ask: what? how? why? and other follow-ups to their comments. Another approach would be to make a large poster of Activity Sheet 1, Hen’s Reproductive Tract. Write the names of the parts on slips of paper and let each member place the name to a part on the poster. Give the group time to reach a consensus on correct labeling before asking the group to explain and discuss their decisions.
This is the stigma. This is a line devoid of blood vessels on the follicle wall where it ruptures to release the yolk. This process is called ovulation.

This is the oviduct. Egg formation is completed as the yolk travels down the oviduct. The oviduct is divided into five sections:

1. The infundibulum. This is the section that picks up the released yolk from the ruptured follicle. Fertilization occurs here if live sperm are present.
2. The magnum. Thick white (albumen) is deposited around the yolk and the shape of the egg is formed in this section.
3. The isthmus. Inner and outer shell membranes are added here.
4. The uterus. It is also known as the shell gland. First, thin albumen consisting mainly of water and salts is added. Then, calcium is added to the shell membranes, forming the hard shell. If the shell is going to be colored, pigment is added in this section.
5. The vagina. This section connects the oviduct with the cloaca. The egg is held here until laid.
6. The cloaca. This is the external opening to the reproductive and digestive tracts.

A normal hen requires 22 to 26 hours to complete an egg. Within 30 minutes after the egg is laid another yolk is released from the ovary if the hen is going to lay the following day.

Male Reproductive System

The male bird’s reproductive system is simple. Let’s look at the diagram and identify the parts.

The male bird has two testes. This is where the sperm are made. They also contain endocrine cells which secrete the male sex hormone, androgen, which is responsible for development of secondary sex characteristics, such as development of the comb, spurs, crowing and feather shape. The testes are located in the body cavity rather than in a scrotum like mammals.

The ductus deferens store sperm and transport it from the testes to the copulatory organ.

The copulatory apparatus consists of two papillae, which are located in the vent. It is more developed in ducks and geese than in chickens and turkeys.

During the act of copulation (mating) between the male and female, the papillae of the male become erected and deposit semen on the everted vagina of the female. The sperm travels up the female’s reproductive tract. Fertilization (joining of the sperm and ovum) takes place in the infundibulum soon after ovulation and before the egg reaches the magnum. Avian sperm will survive in the body of the female for several days or weeks, depending on the species, compared to a few hours in mammals.
DIALOGUE FOR CRITICAL THINKING:

Share:
1. How many parts of the hen’s reproductive tract could you identify?

2. What parts of the cock’s reproductive tract could you identify?

Process:
3. How many ova or yolks does a newborn female chick have?

4. What is the path taken by the ova from the ovary until it is laid as an egg? List the time spent in each part of the reproductive tract and what part of the egg is formed at each location.

Generalize:
5. How does a hen’s ova/egg differ from a cow’s ova?

6. How is a bird’s reproductive system different from that of mammals? (Consider both sexes.)

Apply:
7. How is the understanding of the hen’s reproductive system useful to the poultry industry?

8. How important do you think artificial insemination is in the poultry industry? Why?

GOING FURTHER:
• Give a talk on the development of an egg to your class at school.
• Visit a farm flock and take pictures or observe chickens mating.

REFERENCES:
Poultry Science, M.E. Ensminger
Leader Notes

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Label the parts of the ovary and oviduct.

**A. Ovary**
1. _____________
2. _____________
3. _____________
4. _____________

**B. Oviduct**
1. _____________
2. _____________
3. _____________
4. _____________
5. _____________
6. _____________
7. _____________
REPRODUCTION AND FERTILIZATION OF POULTRY
POULTRY, LEVEL III
Leader’s Key, Activity Sheet 1, Hen’s Reproductive Tract

Label the parts of the ovary and oviduct.

A. Ovary
1. Mature yolk within yolk sac or follicle
2. Immature yolk
3. Empty follicle
4. Stigma or suture line

B. Oviduct
1. Infundibulum
2. Magnum
3. Isthmus
4. Uterus
5. Vagina
6. Cloaca
7. Vent
REPRODUCTION AND FERTILIZATION OF POULTRY
POULTRY, LEVEL III
Member Handout 2, Time Frame for Egg Formation

<table>
<thead>
<tr>
<th>Section</th>
<th>Time Egg Spends in Section</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infundibulum</td>
<td>15 minutes</td>
<td>Engulfing of yolk, site of fertilization</td>
</tr>
<tr>
<td>Magnum</td>
<td>3 hours</td>
<td>Secretion of thick white (high in protein)</td>
</tr>
<tr>
<td>Isthmus</td>
<td>15 minutes</td>
<td>Formation of two shell membranes</td>
</tr>
<tr>
<td>Uterus</td>
<td>20-21 hours</td>
<td>Addition of thin albumen consists mainly of water and salts; hard white shell, and shell pigment are added</td>
</tr>
<tr>
<td>Vagina</td>
<td></td>
<td>Passage of egg</td>
</tr>
</tbody>
</table>

Think Back:
What do you think is the most significant aspect of poultry reproduction? Why?
REPRODUCTION AND FERTILIZATION OF POULTRY
POULTRY, LEVEL III
Member Handout 3, Genital Organs: Cock and Hen

Genital Organs of the Hen

1. Kidney  
2. Ureter  
3. Rudimentary right oviduct  
4. Left ovary  
5. Infundibulum of oviduct  
6. Magnum of oviduct  
7. Isthmus of oviduct  
8. Uterus of oviduct  
9. Cloaca

Genital Organs of the Cock

1. Kidneys  
2. Ureter  
3. Cloaca  
4. Testes  
5. Ductus deferens  
6. Seminal vesicle  
7. Papillae
Proper Handling of Hatching Eggs

Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
- The proper practices for handling eggs to be incubated
- Three reasons for poor hatchability in eggs

ABOUT THEMSELVES:
- The values of experimentation

Materials Needed:
- Two and one-half dozen eggs for hatching
- Activity Sheet 2, Egg Handling Activities and Problems

ACTIVITY TIME NEEDED: 30 MINUTES

ACTIVITY:

Not all fertile eggs will hatch. The embryo may die any time between fertilization and hatching. Many embryos die during incubation because of the condition of the breeding flock, storage conditions prior to incubation and the incubator environment.

The structural development of the chick embryo starts soon after fertilization, which occurs approximately 24 to 26 hours before the egg is laid. Cell division continues as the egg travels down the oviduct of the hen. Proper handling of the egg after being laid is critical for a successful hatch. Improper handling of eggs during storage can weaken the germ or damage the egg, resulting in reduced hatchability.

The following practices for handling eggs are recommended:

1. **Gather eggs** frequently when temperatures are extremely cold or hot, to prevent chilling or overheating. If you gather eggs frequently, you will also prevent contamination from feces and nesting materials.

2. **Cleanliness.** Dry-clean slightly soiled eggs by rubbing them with fine sandpaper or steel wool. You can wash slightly soiled eggs in 105°F water containing a suitable detergent-sanitizer, but never wash eggs in water that is cooler than the eggs. If eggs are extremely soiled, they should not be used. Any sanitizer should be applied as soon as possible after the eggs are laid to prevent the growth of bacteria and penetration of the shell.
3. **Storage of Eggs.** Store your hatching eggs in a clean area at 55° to 65°F and 70 to 80 percent relative humidity, such as in a cool basement or cellar. After the egg is laid and the temperature drops, embryonic development stops. High humidity will help to prevent evaporation and an enlargement of the egg’s air cell and improve hatchability. You should turn the eggs slightly once per day if they are to be held longer than seven days. This prevents the yolk from sticking to the shell.

4. **Hold eggs for minimum time.** Eggs should be set seven to 10 days after they are laid because hatchability decreases as holding time increases. Eggs should not be held longer than 10 days.

5. **Egg quality.** Eggs that are misshapen and either extremely large or small hatch poorly. Cracked eggs rarely hatch. Beeswax or a similar material can be used to seal cracks in very valuable eggs. The larger the egg the less the effect of a crack on hatchability.

If you follow these simple procedures, you should have successful hatchability.

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. What changes in egg weight did you observe while doing the first activity?
2. What major embryo changes did you observe at each weight date?

**Process:**
3. What are the main causes of poor egg hatchability?
4. Why is the relative humidity important when storing eggs?

**Generalize:**
5. What happened to egg hatchability under the three treatments in the third activity? Why?

**Apply:**
6. What could you do differently to obtain different results, if you did the third activity again?

**GOING FURTHER:**
- Visit a hatchery and observe their egg-handling procedures.
- Obtain a small, still air incubator and incubate some eggs.
REFERENCES:

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Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

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PROPER HANDLING OF HATCHING EGGS
POULTRY, LEVEL III
Activity Sheet 2, Egg Handling

Do the following activities and problems.

1. Selection and Traying of Hatching Eggs—Select a dozen hatching eggs. Mark each egg with your initials and number them in consecutive order. Weigh each egg and record that weight at setting, 7 days, 14 days, and 20 days.

2. Detection of Fertility in Incubated Eggs—Candle each egg after it is weighed to determine fertility. Record observations.

3. Effects of Various Conditions of Hatchability—Make observations on hatchability on six eggs treated in each of the following ways:
   a. No turning during incubation.
   b. Trayed with large end down.
   c. Eggs dipped in mineral oil.

4. Problems—Answer the following and discuss in your group.
   a. How many eggs would have to be set to obtain 1,000 pullet chicks. Assume 90 percent hatchability of all eggs set. Show calculations.
   b. What effect could low humidity during the hatching process have on chicks?
   c. What should you do if the electrical power to an incubator was off for 2 to 3 hours?
   d. Why does it take longer for the first set of eggs placed in an incubator to hatch than subsequent sets?
Embryonic Mortality
Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
• Three critical periods of embryonic development
• Causes of embryonic mortality

ABOUT THEMSELVES:
• The value of planning and preparation

Materials Needed:
• Cards with incubator climate conditions for skillathon
• Incubators and eggs for each member (if possible)

ACTIVITY TIME NEEDED: 20 MINUTES–4 WEEKS

ACTIVITY:
Incubation of eggs is a fascinating experience if all goes well. On the other hand, poor results or total failure can be very frustrating. As with most biological processes, many abnormalities may occur during development of the bird embryo.

The term embryonic mortality is used to describe the death of an embryo during the incubation period. Mortality rates vary with each group of eggs incubated. Mortality can be caused by a variety of conditions. There are three critical periods during embryonic development of chicken eggs: (1) 0 to 4 days, (2) 5 to 17 days, and (3) 18 to 21 days.

During the early embryonic stage (0 to 4 days), causes of mortality may be:
• Eggs held too long—eggs should be set by seven to 10 days after laid for maximum hatchability.
• Eggs stored improperly—eggs should be stored in a clean area at 55° to 65°F and 70 to 80 percent relative humidity.
• Improper sanitizing of eggs.
• Exposure to toxic substances during cooling and storage.
• Rough handling—handle eggs gently to prevent shell breakage and ruptured air cells.
• Egg-borne diseases in breeding flock—certain diseases can pass from the infected hen to the egg during egg formation. Example: Salmonella pullorum-typhoid.
• Severe nutritional deficiencies (particularly vitamins)—The embryo’s only food supply during incubation comes from the nutrients in the egg. If the hen’s ration is inadequate, there will not be enough nutrients in the egg for proper nourishment of the embryo.
• Improper temperature, humidity, ventilation and turning.

Leader Notes
Have each member incubate a certain number of eggs. Have each member document the environmental conditions and figure embryonic mortality and the suspected reasons.

If incubation is not possible, set up a skillathon by listing certain conditions to see if members could detect causes of embryonic mortality.

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**Middle mortality** (5 to 17 days) causes may be:
- Nutritional deficiencies
- Bacterial contamination
- Improper temperature, humidity, ventilation and turning.

**Late mortality** (18 to 21 days) causes may be:
- Marginal nutrition
- Contamination
- Improper turning
- Improper temperature, humidity and ventilation
- Old eggs

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. If you hatched some eggs, what were the major causes of embryonic mortality? In which period did the deaths occur? Why?

2. If you did a skillathon, what situation did you study? Why?

**Process:**
3. What are the three critical periods during chick embryo development?

4. What management practices prevent chick embryonic mortality?

**Generalize:**
5. What stages of embryonic development are most critical in other farm animals? Why?

**Apply:**
6. How can the study of embryonic development help you make appropriate decisions for healthy and efficient production?
REFERENCES:
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27-Poultry, Level III
What Members Will Learn . . .

ABOUT THE PROJECT:
- Pre- and post-hatch functions of an efficient hatchery
- Stages of embryonic development
- Important record keeping information for hatcheries

ABOUT THEMSELVES:
- Their interest in business management
- Their feelings about the value of business records

Materials Needed:
- Member Handout 4, Embryonic Mortality and Development Stages
- Member Activity Sheet 3, Hatchery Record Sheet

ACTIVITY TIME NEEDED: 30 MINUTES

ACTIVITY:

Today’s U.S. poultry industry consists of a number of highly specialized support industries. One such industry is the hatchery industry. This industry converts fertile hatching eggs into day-old poultry using artificial setting hens called incubators.

Because of its place in the production/marketing chain, the hatchery industry has contributed much to the rapid development of the poultry industry. In addition to using the hatchery as a source of improved breeding stock and the source of day-old birds, many poultry people look to the hatchery for information about disease control, nutrition and management, and as a supplier of medication and equipment.

A hatchery is a manufacturing unit. Its raw product is the hatching egg, its manufacturing process is the incubation of eggs, and its finished product is day-old poultry. Whether or not a hatchery is successful depends largely on the number of eggs that produce saleable birds. This is called hatchability. Factors that influence hatchability are fertility, health and nutritional level of the breeders, care and handling of the eggs, environmental conditions during incubation and sanitation in the hatchery.

Many processes are involved, from receiving the hatching eggs at the hatchery to delivery of the day-old birds to the grower.

CLEANING THE EGGS. Most hatcheries wash or dry clean, and in some cases fumigate, all hatching eggs upon arrival from the farm.
STORAGE OF EGGS. After cleaning, the eggs are held in egg coolers at a temperature of 60° to 65°F and a relative humidity of 70 to 80 percent. The eggs are moved into the incubator room several hours prior to setting to warm the eggs up to room temperature (70° to 75°F).

INCUBATION. Incubators are of two general types: (1) small, still-air type, in which ventilation is provided by natural air movement, and (2) forced-draft incubators, in which air movement is provided by electric fans. The latter type varies from cabinet incubators that hold several thousand eggs to room-size incubators that hold many thousands of eggs. In these machines, temperature, humidity, ventilation and turning are controlled by automatic controls. The following are general recommendations for chicken eggs incubated in a forced-draft incubator.

<table>
<thead>
<tr>
<th>Stage of Development</th>
<th>1 to 18 days</th>
<th>18 to 21 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>99°–100°F</td>
<td>97°–98°F</td>
</tr>
<tr>
<td>Humidity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative humidity</td>
<td>60%</td>
<td>75%</td>
</tr>
<tr>
<td>Wet bulb temperature</td>
<td>84°–86°F</td>
<td>88°–90°F</td>
</tr>
<tr>
<td>Oxygen level</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>Carbon dioxide level</td>
<td>.5%</td>
<td>.5%</td>
</tr>
<tr>
<td>Turning</td>
<td>3–8 times</td>
<td>Not necessary</td>
</tr>
</tbody>
</table>

TROUBLE SHOOTING. Incubation is a very critical biological process. If the eggs are of poor quality or haven’t been handled properly, or if the incubators are not functioning properly, excess embryonic mortality, deformed chicks, etc., can occur. To prevent these conditions or to determine their probable cause, hatchery managers keep accurate records of incubator temperature and humidity, fertility and hatchability. A useful tool in determining what caused excess embryonic mortality is to break out the unhatched eggs and determine the approximate age at which the embryos died and the presence of abnormal embryos.

GRADING. This involves removing those birds that are weak, deformed or have unhealed navels. Concurrent with grading, the birds are counted and placed in boxes for delivery to the producer.

MISCELLANEOUS PRACTICES. In addition to incubating hatching eggs, hatcheries perform other services related to preparing the birds for delivery to the producer. Many of these services are done at the hatchery because of the ease of handling small birds. Hatcheries usually charge a small fee for each of these services. Examples of these services are:

Beak trimming. This procedure is done to prevent cannibalism. Because of their short life cycles and ease of handling, broiler chicks and turkey pouls are usually beak-trimmed prior to leaving the hatchery.

Declawing. This procedure involves the surgical removal of the tips of the two to three toes to prevent scratching of penmates; particularly among cage layers and breeding males.
Desnooding. This procedure involves the removal of the snoods on day-old male turkeys using nail clippers or small scissors. It is done to reduce injury from fighting.

Dewinging. This procedure is done to permanently prevent flight. It is done by either severing the outer tendon on one wing or by removal of the wing tip on one wing with a hot wire or blade.

Dubbing. This is the surgical removal of the combs of chicks. Dubbing reduces injury from fighting. It is primarily done on potential breeding cockerels and game fowl.

Injections. It is a common practice to inject poults with an antibiotic and electrolyte solution before they leave the hatchery to reduce the effects of stress.

Sexing. If the customer wants the sexes separated, the chicks or poults are sexed soon after hatching by either the autosexing or vent sexing methods. This is a common practice in egg-type chickens, because the cockerels have little value, and in turkeys because males and females have different nutritional requirements as they grow.

Vaccination. In some cases, birds are vaccinated for specific diseases before they leave the hatchery.

Wingbanding. Chicks and poults are sometimes wingbanded before they leave the hatchery when individual bird identity is needed, e.g., breeding stocks.

**DIALOGUE FOR CRITICAL THINKING**

**Share:**
1. What was your first impression of hatchery management?

2. How successful were you in hatching your eggs? Why? Why not?

**Process:**
3. What are the factors affecting hatchability?

4. What is the biggest problem when operating a hatchery? Why?

**Generalize:**
5. What business concepts did you observe that would be similar to other business?

6. What is the significance of record keeping in a business?

**Apply:**
7. What principles did you learn that will help you in the future?

8. What is the potential for hatchery management as a career? Why?

Visit a hatchery to see how many of the additional services are provided. Discuss the need and economics of each service.
GOING FURTHER:
- Study the potential for future broiler production in your area.
- Give a presentation about the services provided by a hatchery.
- Discuss consumer demand for poultry meat past, present and future.

REFERENCES:
*Poultry Science Manual*, Department of Animal Sciences and Industry, Kansas State University

Author:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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32-Poultry, Level III
GENERAL HATCHERY MANAGEMENT PRACTICES
POULTRY, LEVEL III
Member Handout 4, Embryonic Mortality and Development Stages

Guidelines for Determining Age of Embryonic Mortality

I. Normal Distribution of Embryonic Mortality

<table>
<thead>
<tr>
<th>Age (days)</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early (0 to 4 days)</td>
<td>2 to 3%</td>
</tr>
<tr>
<td>Middle (5 to 17 days)</td>
<td>1%</td>
</tr>
<tr>
<td>Late (18 to 21 days)</td>
<td>3 to 4%</td>
</tr>
</tbody>
</table>

II. Breakout Guidelines—Use the stages in Development of the Chicken Embryo (below) to classify the approximate age at which each embryo died.

A. Early Mortality (0 to 4 days)—**No visible blood,** 0 to 36 hours, can be either embryos that died prior to placement in incubator or those that died prior to appearance of blood islands. Early dead germs are hard to distinguish from infertile eggs by candling. An infertile egg’s germ spot appears as an undefined area when broken out while that of a fertile egg appears as a donut-shaped ring. **Blood islands present,** 36 to 48 hours.

B. Middle Mortality (5 to 17 days). Feathers appear on the embryo’s body by the 11th day. By the 14th day, all parts are in place.

C. Late Mortality (18 to 21 days). During this period, the embryo gets into position for hatching and pips the air cell in the large end of the egg by the 20th day.

Stages in Development of the Chicken Embryo

Day 1  Blastoderm appears as a donut-shaped ring; infertile germinal disc appears as an undefined area.
2  Appearance of blood islets; formation of heart which starts to beat at about the 30th hour.
3  Vascular system well developed; leg and wing buds begin as swelling of approximately equal size.
5  Distinct eye development; demarcation of three distinct toes.
6  Beak being formed, no egg tooth on beak.
7  Egg tooth visible, distinct feather papilla on thigh.
8  Feet and wings well developed.
9  Feather follicles on all feather tracts; large egg tooth.
10 Wing finger and toes distinct; down feathers in tail; flight feathers conspicuous; comb appears as prominent ridge with slightly serrated edge.
11 Comb prominent and clearly serrated.
12 Down feathers on body and over eyes.
13 Appearance of wattles and prominent comb; beak hardened up to egg tooth.
12–16 Increase in size and feathering; claws and beak become firm.
17 Normal hatching position (head under right wing, pointed toward air cell).
18 Albumen gone; yolk absorption beginning.
19 Absorption of allantoic fluid completed; yolk sac about half enclosed in body cavity; beak pierces air sac.
20 Yolk sac completely absorbed; navel closing over; inner shell membrane pierced; pipping begins.
20–21 Hatching; usually takes 10 to 20 hours

*Adapted from Lillie’s Development of the Chick, revised by Howard L. Hamilton, 3rd edition, 1952. Published by Henry Hold and Co., New York and Adapted from J.M. Moulding, unpublished manuscript.*
GENERAL HATCHERY MANAGEMENT PRACTICES
POULTRY, LEVEL III
Activity Sheet 3, Hatchery Record Sheet

Source of Eggs___________ Date Eggs Set __________

<table>
<thead>
<tr>
<th>No. Eggs</th>
<th>Bulk Weight</th>
<th>No. Infertiles</th>
<th>No. Dead Germs</th>
<th>No. Chicks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set</td>
<td>Start</td>
<td>End</td>
<td>0-4d</td>
<td>5-17d</td>
</tr>
</tbody>
</table>

When a lot of eggs are set, indicate the number set, their bulk weight prior to placing in the incubator. Then bulk weight the eggs at 7 or 14 days of age and calculate the percent moisture loss using the formula below. Also, at this time record the number of infertile eggs. To further differentiate between apparent and true infertiles, break out the candled infertiles and record number of true infertiles and early dead germs using Member Handout, Guidelines for Determining Age of Embryonic Mortality. Also use this guideline to record the approximate age.

**Summary:**
Percent hatch of all eggs set __________________________

Percent hatch of fertile eggs __________________________

Percent dead germs _________________________________

**Percent weight loss:**
1. (day 0 bulk weight ______ minus day _____ bulk weight) × 100 = ________ percent weight loss

2. Average daily moisture loss: Percent weight loss from (1) ____ divided by days eggs were incubated = ______ percent moisture loss per day.

3. Projected 21-day loss of moisture: Average daily moisture loss _____ (2) × 21 = projected moisture loss.

**Think Back:**
What are the main concerns of the hatchery industry?
The Chicks are Here

Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
• How to care for newly hatched chicks
• Basic housing and equipment needs of newly hatched chicks
• Five common problems that might arise with new chicks

ABOUT THEMSELVES:
• Their feelings about preparation for an event or activity within the family

Materials Needed:
• Member Handout 5, Brooder Layout for Equipment Set-up
• Chalkboard or newsprint

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY:

To successfully raise a small flock of chickens, you must meet certain floor space, heating, brooding, ventilation, lighting and equipment needs. Today, we will identify and discuss these needs.

The ideal time to brood chicks is during the spring months as the days become warmer. But before the chicks arrive, you should consider these things:
1. Is the housing and equipment in good condition?
2. Is the housing and equipment cleaned and disinfected?
3. Have you put fresh litter down?
4. Is the equipment (brooder, waterers and brooder guard) in its proper place?
5. Is the brooder stove operating properly?
6. Are feed and water in place?
7. Is the housing and equipment adequate?

Brooding is a term used to describe the care of young poultry from the time of hatching or from the time received from the hatchery until they no longer need supplementary heat. This is the most important phase of the chick’s life.

Unlike newborn mammals that require feed and care from the mother, newly hatched chicks may go for up to three days without feed or water (except that which comes from the yolk). But the sooner they are given food and water, the better the chance for survival.
For small flocks, brooding can be done with an electric or gas brooder or infrared lamp. Infrared lamps will help prevent pecking. For very small flocks, two 100- or 150-watt incandescent light bulbs are sufficient during warm weather. Always use two bulbs so if one burns out, the chicks still have heat.

Place chicks under the brooder as soon as they arrive and check frequently. Hang the bulbs low enough so the chicks get all the heat they need, but not so low that you risk setting the litter on fire. The chick pattern around the heat source tells you if it’s at the correct height and setting. If too warm, the chicks will pant and stay as far away as they can. If too cold, they will huddle under the heat source, and the crowded conditions may cause the chicks to smother each other.

Set the brooder temperature at 90° to 95°F for day-old chicks and reduce 5°F weekly until 70°F is reached. The room temperature should be maintained at a minimum of 65°F.

Circle a barrier around the heat source to prevent chicks from wandering away from the heat and to block any floor drafts. The barrier should be 1 1/2 feet high and from 5 to 7 feet in diameter. Corrugated cardboard will do. The ring can be removed after one week. But before doing that, tack a screen or chicken wire across each corner of the brooder room so the chicks can’t bunch or pile up there.

**FLOOR SPACE**
Adequate space needs to be provided. The minimum space requirements for baby chicks is 3/4 square foot per chick.

**VENTILATION**
A poultry house should be ventilated to take in fresh air and exhaust stale air. Air vents should be designed so drafts will not blow directly on the birds.

**LITTER**
Litter should be 2 to 4 inches deep and of a material that is free of molds, has the ability to absorb moisture and doesn’t compact or cake. Good examples include wheat straw, ground corn cobs, soft wood shavings and dry sawdust. For chicks, place a 3- to 4-inch layer of new litter on the brooder house floor. Remove droppings and damp litter to prevent offensive odors and disease organisms. Build up litter by adding new litter to top of the old as needed.

**FEEDERS**
Start baby chicks on feed by placing some starter ration in a small feeder and some on an egg flat, piece of cardboard, newspaper, or old towel right next to the feeder. Put only a handful or two on the flat at one time. After about four days, use just the small feeder; and as soon as possible, switch to a larger feeder.
Two of the non-automatic feeders commonly used in small-flock operations are the trough type and the hanging-tube type. Although both work very well, there is usually less feed loss and the feed stays drier and cleaner with the hanging type.

Plan on at least 1 inch of feeder space per chick through 4 weeks of age. In other words, one 4-foot feeder open on both sides is adequate for 100 chicks. However, to ensure good pen distribution, two feeders would be better. After 4 weeks of age, provide at least 2 to 3 inches of feeder space per bird.

For the first four to six weeks, feed a starting mash. The type of starter mash you’ll need will depend on whether you’re feeding egg, dual-purpose, exhibition or broiler chicks. At six weeks, replace the starting mash with a growing mash and scratch grain for birds destined for the laying pen. The starting mash should be replaced with a finisher ration for broilers at five weeks of age.

WATERERS
Chickens need fresh, clean water available to them at all times. Start your chicks on small gravity-fed water fountains, after two weeks gradually switch to automatic waterers if you have them. To do this, put the fountains (with feeders between them) around the brooders before the chicks arrive. Each day, move the fountains toward the automatic waterers, and eventually begin removing them. Do not let the fountains go dry, even though the automatic units are being used.

There are several types of automatic waterers on the market, including nipple, cup and trough drinkers; all do a good job. If non-automatic fountains are used, they should be set on a wire platform about 2 to 3 inches off the floor to keep both water out of the litter and litter out of the water.

Plan on two 1-gallon size gravity-fed fountains for each 100 chicks up to 4 weeks of age. If you will not be using automatic waterers, add a third fountain per 100 birds after the fourth week.

LIGHTING
Although not essential, artificial lighting is recommended during the first three weeks of the brooding period. A common 10- to 15-watt night light lets the chicks find feed and water at all times and helps keep them from becoming frightened. Since baby chicks will be attracted to the light, locate it near the heat source.

SANITATION
Good sanitation is a must in all phases of poultry production to ensure top bird performance and to prevent the development and spread of disease. Sanitation practices are needed before a new batch of birds arrives and every day thereafter.
Diseases are usually transmitted to younger birds from the older ones. So, if you have flocks of different ages, raise them separately and always check on the youngest flock first. Have a shallow pan of disinfectant to walk through when entering the poultry house, and clean any manure from boots or shoes when leaving the building. Change the disinfectant at least once a week. If possible, keep visitors out of your facility, especially those who have poultry flocks, or who have been to other flocks.

If you follow these guidelines, you should be successful in raising your chicks; however, you should watch for these common problems:

SEVEN COMMON MANAGEMENT PROBLEMS:

1. **Cannibalism**
   Cannibalism is the vicious habit of one bird picking the feathers, toes or vents of another. It may start because of overcrowding, overheating, inadequate nutrition, excessive light, inadequate feeder space, and mixing strange birds. Beak trimming is the most effective preventative measure.

2. **Starve outs**
   Birds that die from failure to eat and drink are called starve outs. Contributing factors are inadequate feeder space, poor lighting and delayed placement of chicks after hatching. Death from starvation usually starts at 4 to 5 days of age.

3. **Piling**
   Insufficient heat or fright may cause the chicks to pile in corners, and leads to death from smothering.

4. **Wet litter**
   Main causes of wet litter are poor ventilation, excessive water spillage and high manure moisture content due to excess salt intake from water and/or feed.

5. **Feed wastage**
   Usually, feed wastage results from improper feeder design or adjustment, or filling the feeders too full.

6. **Poor feathering**
   Common causes of poor feathering are excessive brooder temperatures, insufficient amino acid levels in feed or birds have a genetic trait for slow feathering.

7. **Breast Blisters**
   This condition results from physical irritation of the tissue covering the keel bone of the fowl. Any factor that contributes to increasing irritation of the keel bone has the potential to increase the incidence of breast blisters. Common causes of breast blisters are wet, packed litter, poor feathering and any disease condition that causes the birds to spend abnormal time resting on their breasts. Breast blisters are most common in male broilers and turkeys.

*38-Poultry, Level III*
DIALOGUE FOR CRITICAL THINKING:

Share:
1. What are the major steps to prepare for receiving newly hatched chicks?
2. Which step do you think is the most important? Why?

Process:
3. What is the most important factor when brooding chicks? Why?
4. What common management problems might occur when raising newly hatched chicks?

Generalize:
5. How are baby chicks different from other newborns?
6. How important is preparation for major events? Why?

Apply:
7. How can you be prepared for future events in your life?
8. What effect does planning have on preparedness?

GOING FURTHER:
• Design a brooder facility for newly hatched chicks.
• Prepare and present a talk on taking care of newly hatched chicks to a 4-H group or school class.
• Compare a brooder facility to newborn facilities of other animals.
• Visit a commercial hatchery.

REFERENCES:
Raising Chickens for 4-H, Purdue University
Management of the Small Flock of Chickens, C-508, K-State Research & Extension
Leader Notes

Author:
Cynthia R. Siemens, Extension Assistant, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
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40-Poultry, Level III
THE CHICKS ARE HERE
POULTRY, LEVEL III
Member Handout 5, Brooder Layout for Equipment Set-up

- BROODER GUARD
- HEAT SOURCE
- SMALL FEEDER
- 1 GALLON Fount
Basic Nutritional Needs of Poultry

Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
• The importance of protein in a chick ration
• The importance of a balanced ration
• The basic functions of the six nutrient classes

ABOUT THEMSELVES:
• The importance of protein in their diet
• Symptoms of humans when basic nutrient needs are not met in their diet
• Their feelings about famine in the world

Materials Needed:
• Facilities to rear two groups of 10 chicks each
• Scales
• 22 percent protein ration
• 18 percent protein ration
• Member Handout 6, Chick Weigh Sheet and Nutrient Functions

ACTIVITY TIME NEEDED: 7 WEEKS

ACTIVITY:

All animals need a balanced diet to grow and develop. The diet must contain the proper amount of all nutrients or the animal will not grow to normal weight and size.

The following activity will demonstrate what happens when one of the six nutrient classes is not at its proper level.

Obtain 20 1-day-old broiler chicks and divide them into two groups of 10. Weigh the birds in each group and record their weights on the weigh sheet. Feed one group a standard broiler starter containing 22 percent protein. Feed the other group a starter containing 18 percent protein. Both rations should be the same except for the protein levels. At 4 weeks of age weigh the birds, record and compare the weights of the two groups. For the next three weeks feed both groups the 22 percent protein ration. Again weigh the birds, record and compare the weights.

On the weigh sheet list the six nutrient classes from Identifying Poultry Feed Ingredients (Level II) and give a function of that nutrient class. Discuss these functions with a friend or your leader.
DIALOGUE FOR CRITICAL THINKING:

Share:
1. What differences did/would you expect to see in chicks fed two different protein levels? Why?

2. How did expectations compare to actual observations?

Process:
3. What problems occurred when conducting the experiment? Why?

4. What happened to the 18 percent ration birds after they were switched to the 22 percent ration?

Generalize:
5. How do you think a shortage of protein in your diet would affect you?

6. What symptoms do malnourished children have?

Apply:
7. What can you do to help prevent famine in the world?

8. What do you think are the major causes of famine?

GOING FURTHER:
• Study the affects a lack of some of the other nutrients would cause on young chicks.
• Give a talk to your class or club on the results of your experiment.
• Balance a poultry ration using your own ingredients.
REFERENCES:
Author:
John Struwe, Extension Assistant, University of Nebraska; James P.
Adams, Extension Specialist, 4-H Youth Programs, Kansas State
University

Reviewed By:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State
University; R. Scott Beyer, Extension Specialist, Poultry Science,
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45-Poultry, Level III
**BASIC NUTRITIONAL NEEDS OF POULTRY**

**POULTRY, LEVEL III**

**Member Handout 6, Chick Weigh Sheet and Nutrient Functions**

<table>
<thead>
<tr>
<th>Nutrient Class</th>
<th>Functions</th>
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<tbody>
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</table>

**Chick Body Weights**

<table>
<thead>
<tr>
<th></th>
<th>22%</th>
<th>18%</th>
<th>22%</th>
<th>18%</th>
<th>22%</th>
<th>18%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>Day(s) old</td>
<td>4 weeks</td>
<td>7 weeks</td>
<td>Protein</td>
<td>Protein</td>
<td>Protein</td>
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<td>______</td>
<td>______</td>
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*46-Poultry, Level III*
What Members Will Learn . . .

ABOUT THE PROJECT:
- Five reasons for controlling body weight in replacement birds
- Three methods used to control bird weight

ABOUT THEMSELVES:
- The importance of proper body weight
- Proper weight control methods available to use

Materials Needed:
- Pencil
- Calculator (optional)
- Activity Sheet 4, 18 Week Body Weights
- Activity Sheet 5, Flock Body Weight Calculation Form

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY:
When birds are raised as breeder replacements or as layer replacements, their weight must be controlled during the growing period.

Birds are grown to meet their particular industry standard, which will vary from breed to breed or strain to strain. Most of the reasons for controlling weight are the same, regardless of breed. The correct weight has several advantages, one of which is a more uniform flock. These uniform flocks will give larger first eggs and an increase in egg production over their life cycle. Breeder flocks that are uniform will have eggs with increased fertility and hatchability. These flocks will have lower feed costs and reduced mortality during their production cycle. Heavy or light birds will not keep pace with the average weight bird.

A bird’s weight can be controlled during the growing period by several different methods. (1) The nutrients in the diet can be adjusted up or down according to the needs of the birds. (2) Energy level of the diet (the amount of fat and carbohydrates) can be reduced. (3) Bulk (such as oats) or fiber (non-digestible carbohydrate) can be added to the diet to reduce the concentration of nutrients which will slow a bird’s development.

Another method for controlling body weight is to restrict the amount of time that birds have to eat. This can be done by limiting the amount of time the lights are on, or by giving the birds a measured amount of feed each day, which is less than they would eat if full-fed. The birds could also be fed twice the normal limited feeding amount on an every-other-
day basis. If the bird is underweight, you reverse these procedures to help it grow faster.

It would require a project lasting several months to demonstrate the effect of weight on the productivity of live birds. Pullets must be grown to 18 to 19 weeks of age before egg production starts, and production records would need to be recorded for at least another 12 months to determine the effects of body weight on performance. An alternative is to calculate the uniformity of body weight and average body weight for a flock from simulated weights.

Management becomes more important when a bird’s feed intake is restricted. For example, if feeder space is inadequate, the more aggressive birds will eat first, resulting in less feed for the timid birds.

Most breeders recommend for good performance, 75 to 80 percent of the birds should weigh within plus or minus 10 percent of the average weight of the flock.

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. What did you learn from the simulated flock weight calculations? Why?

2. What was the most difficult concept to understand in the flock weight scenario? Why?

**Process:**
3. Why do producers want to control body weight in replacement birds?

4. What is significant about the range above and below average weight? Why do you think that 10 percent is the standard?

**Generalize:**
5. What did you learn about yourself by doing this activity? Why?

6. How does proper growth rate affect mature weight in humans?

**Apply:**
7. How will issues raised by this activity and discussion be useful to you in the future? Why?

8. What will you do differently in the future as a result of this lesson? Why?

Point out to the youth that a flock can have the correct average weight but lack uniformity of weight. Encourage cooperative learning by letting small groups do the activity together.

Handout Activity Sheet 4, 18 Week Body Weights, for a flock of egg-type pullets, and Activity Sheet 5, Flock Body Weight Calculation Form. Have the youth calculate the average body weight and uniformity of body weight for the flock.
GOING FURTHER:
• Invite a doctor or other professional to discuss youth weight control with your group.
• Study and analyze commercial diet programs.
• Review and discuss weight, height and frame tables for humans.

REFERENCES:
Author:
John Struwe, Extension Assistant, University of Nebraska; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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CONTROLLING BODY WEIGHT OF REPLACEMENT BIRDS
POULTRY, LEVEL III
Activity Sheet 4, 18 Week Body Weights

18 Week Body Weights (gm) of 80 Egg-type Pullets

| 1400 | 990 | 850 | 895 | 1100 |
| 900  | 1450| 1150| 1200| 1000 |
| 750  | 1100| 950 | 1500| 1550 |
| 850  | 930 | 1050| 1300| 800  |
| 800  | 1010| 1460| 960 | 1590 |
| 950  | 950 | 1010| 1425| 1060 |
| 790  | 810 | 1060| 940 | 1020 |
| 1470 | 1490| 1140| 870 | 740  |
| 850  | 890 | 1220| 1410| 1610 |
| 920  | 1520| 1160| 1280| 740  |
| 980  | 770 | 1340| 1240| 790  |
| 1530 | 890 | 1310| 1550| 1000 |
| 1350 | 1280| 780 | 1450| 870  |
| 960  | 780 | 1100| 950 | 740  |
| 990  | 1240| 1510| 1160| 1310 |
| 840  | 840 | 1060| 1260| 1520 |

Using the body weights above and the “Flock Body Weight Calculation Form,” calculate:

1. The average weight per bird
2. Uniformity of weight (%)
3. Ideal weight range
4. Percentage of birds within plus or minus 10% of average bird weight

Procedure:

1. Put a checkmark in a box opposite the appropriate weight range on the “Flock Body Weight Calculation Form” for each bird weight in the list. Example: 1400 would be opposite 1400–1449.
2. Count the number of checkmarks for each weight range and put the total in the “No.” column.
3. Multiply the “No.” column times the “Avg. wt.” column to get total weight of birds in that weight range.
4. Record the total birds weighed and the total weight in the appropriate boxes at the bottom of each column.
5. Calculate:

\[
\text{Avg. wt. per bird} = \frac{\text{total weight}}{\text{total birds weighed}}
\]

\[
\text{Uniformity of weight} = (\text{avg. wt. per bird}) \times (10\%)
\]

\[
\text{Ideal weight range} = (\text{avg. wt. per bird}) - (\text{uniformity}) \text{ to } (\text{avg. wt. per bird}) + (\text{uniformity})
\]

6. Count the number of birds that weigh within the ideal range.
7. Calculate the percentage of birds that weighed within plus or minus 10% of the body weight of the average bird in the flock:

\[
\% \text{ birds within plus or minus 10\% of avg. wt.} = \frac{\text{number birds within ideal wt. range}}{\text{total number of birds weighed}}
\]
CONTROLLING BODY WEIGHT OF REPLACEMENT BIRDS
POULTRY, LEVEL III
Activity Sheet 5, Flock Body Weight Calculation Form

<table>
<thead>
<tr>
<th>Weight Ranges (grams)</th>
<th>No.</th>
<th>Avg. wt.</th>
<th>Total wt.</th>
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Total Birds Weighed

Ideal weight range = __________ grams
Average weight per bird = __________ grams
Uniformity of weight = __________ %

51-Poultry, Level III
Think Back:
What are the main concerns when raising poultry?
The Comforts of Home

Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
• Major poultry housing improvements developed by man
• Why environmental control is important to commercial poultry producers

ABOUT THEMSELVES:
• The importance of environmental control
• The effect of the environment on performance at school, work

Materials Needed:
• Large sheet of paper
• Pencils or marking pens

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY:

Just as people have improved their own living environment, they have also made changes in the environment of the birds they raise. The improvements made in the quality of poultry housing has enabled the producer to be more efficient and continue to provide a comfortable living environment for the birds.

Years ago, nearly all chickens were raised outside. They were brooded indoors; but within a few weeks they were let loose to run in the yard, fenced or not. Many small flocks are still raised this way.

The main advantages to raising chickens outdoors are fresh air and space to exercise. The birds can also find extra food, such as insects, worms, grass, clover and weeds.

However, the drawbacks of outdoor rearing often outweigh the advantages. One disadvantage is weather. Another disadvantage is a threat of predators, such as coyotes, foxes, skunks, raccoons and owls. Parasite infestation is also more common, since internal parasites are usually present in the soil in a natural environment.

Today, most commercial poultry producers raise their birds under semi-controlled environments. Layers, broilers and pullets can be handled more efficiently when the heat, ventilation, light, feed and water are all controlled. Most tasks are done by automatic equipment, even egg gathering. Except for broilers and turkeys, the birds are usually kept in cages, each having a small but adequate amount of space.

Leader Notes

Have members list some of the changes or inventions that have been made in housing for people during the last 100 years. List their comments on a large sheet of paper or chalkboard.

Have members list environmental changes in poultry housing and the reasons for each.

Compare and discuss the human housing changes with those for poultry.
A semi-controlled environment does not mean that all problems are eliminated. In fact, when a problem does occur, it must be dealt with quickly because there are so many birds in a concentrated area. A semi-controlled environment does mean, however, that a large number of birds can be cared for by very few people.

Environmentally-improved buildings provide for the ultimate in bird comfort, health and efficiency of feed utilization. They lend themselves to automation, which results in labor efficiency.

Since the optimum temperature for layers is $55^\circ$ to $80^\circ$F and for broilers, $75^\circ$F, insulation and environmental temperature controls have been added to provide a more comfortable environment in which the birds can live and produce—cooler houses in the summer and warmer houses in the winter. Insulation has also resulted in energy conservation.

Artificial light was first used in the 1900s to stimulate egg production by providing a longer workday for the bird. Now it is known that controlled lighting has a physiological effect on production. Light enters the eye of the bird and stimulates the pituitary gland, which releases certain hormones that stimulate egg production. Artificial light has become very important in increasing egg and meat production.

Mechanical or a combination of natural and mechanical ventilation is used in most commercial poultry houses. Proper ventilation keeps moisture, odor, and dust levels to a minimum, resulting in maximum productivity, plus bird and caretaker well-being.

Poultry producers have also added automated equipment to eliminate most hand labor chores such as feeding, watering, egg gathering and cleaning. Self-feeders, feed augers and belts, labor-saving processing equipment, automatic waterers and manure disposal units are just a few of the automated devices that have been developed and put to use. Automatic feeders also help to keep feed fresh and cut down on waste.

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. What environmental poultry housing changes did you list? Why?
2. Which housing change do you think was the most significant? Why?

**Process:**
3. What are the advantages and disadvantages of raising birds outdoors?
4. Why are most birds raised in semi-controlled environments today?
Generalize:
5. How do you feel about controlling the environment in your house?

6. What environmental controls in your home are made for economic reasons? Comfort reasons? Why?

Apply:
7. Why is a semi-controlled environment important at school or in the workplace?

GOING FURTHER:
- Visit a commercial poultry farm and make a list of automatic equipment that is used.
- Examine a poultry magazine and compile a list of new poultry automation equipment and housing facilities being developed.
- Prepare a talk on improving the environment for domesticated animals or birds.

REFERENCES:
*Poultry Science*, Ensminger.

Author:
Cynthia R. Siemens, Extension Assistant, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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Light Sensitivity in Chickens

Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
• The effects of light on reproduction and growth in poultry
• The formula used to grow chicks that are hatched during fall or winter

ABOUT THEMSELVES:
• How light affects human behavior
• How they feel about regulating light via daylight-saving time

Materials Needed:
• Member Handout 7, Hypothalamus-Pituitary Relationship
• Activity Sheet 6, Lighting Problems

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY:

For many years it has been a common practice for poultry producers to supplement natural daylight with artificial light in the laying house. It was once thought that the favorable effect of artificial light was gained by providing more feeding time for the hens. Now we know that light striking the head of the chicken stimulates the hypothalamus gland, which, in turn, stimulates the pituitary gland. The pituitary gland releases hormones, which regulate body processes that affect growth, sexual maturity, egg production and molting.

The main factors that influence the degree of stimulation during the growing and laying periods are: (1) whether the amount of daylight is increasing or decreasing, (2) total daily light, (3) light intensity and (4) color of light. Increasing daylight has a stimulatory effect and decreasing daylight has a depressing effect. There are two important rules to observe in all lighting programs. They are:

1. Never increase daylight on growing pullets after 6 to 8 weeks of age because it speeds up sexual maturity (age at first egg) resulting in reduced egg size.

2. Never decrease daylight on hens during the laying cycle because it depresses egg production.

LIGHTING SYSTEMS
For Pullets. The type of house in which the pullets are grown and their hatch date determine the lighting program. The hatch date of pullets

Leader Notes

Distribute Member Handout 7, Hypothalamus-Pituitary Relationship. Review and discuss as a group.
reared in light-tight houses can be ignored. These birds should be grown on a constant amount of daylight, usually eight hours to sexual maturity. On the other hand, the hatch date of pullets reared in open-sided or windowed houses determines whether or not some type of light control is necessary during the growing period. Pullets hatched April 16 through August 15 need no supplementary light since they are growing during a period when natural daylight is decreasing, at least during the latter part of their growing period. Pullets hatched August 16 through April 15 are exposed to increasing daylight during at least the latter part of their growing period. These birds should be started on a long-light day with length reduced each week until sexual maturity.

**For Layers.** The minimum amount of light needed for stimulation of egg production is 11 to 12 hours of light, but 14 to 16 hours are needed for maximum egg production. Increasing light at sexual maturity can be done in one step or gradually. Using this plan, flocks reaching sexual maturity with less than 11 to 12 hours of daylight should have day length increased immediately to 11 to 12 hours, followed by weekly increases of 15 to 20 minutes until a day length of 14 to 16 hours is reached. At sexual maturity, pullets should have the amount of light gradually increased from 11 to 12 to 14 to 16 hours.

**Breeder Flocks.** Breeding flocks will respond to light in the same manner as a flock used for commercial egg production. Males and females should be reared on an identical lighting program, since semen production is believed to respond in a similar manner to egg production.

**Formula for a Decreasing Daylength Program.** Determine the number of hours of daylight when the flock reaches an age of 18 weeks. Add seven hours to this figure. The total will be the number of hours of light the chicks are to receive the first week. Each week thereafter, reduce the day length by 20 minutes until the pullets reach sexual maturity.

Light intensity and color of light also influence performance of poultry. The light intensity needed for maximum productivity varies between species. For example, layers need a lower light intensity than turkeys. Low light intensity is used in windowless houses to reduce cannibalism. Poultry are stimulated more by red than blue-green rays of the light spectrum. Blue light is sometimes used when catching chickens because it has a calming effect.

**DIALOGUE FOR CRITICAL THINKING:**
**Share:**
1. What did you learn about the effect of light on chickens?
2. What was the most difficult light-related concept to understand? Why?

Hand out Activity Sheet 6, Lighting Problems, for members to complete individually or as a group.
Process:
3. What light factors influence the growing and laying periods of birds?

4. Why are lighting systems more important in poultry production today as opposed to outdoor production in the past?

Generalize:
5. What are some of the effects of light on human behavior?

6. How do you feel about the use of daylight-saving time?

Apply:
7. What effect does light have on businesses or public use areas? (Consider street lights, parking areas, etc.)

GOING FURTHER:
- Present a talk on the use of light to your 4-H group or school class.
- List uses of artificial light in other animal operations.
- Study the benefits of artificial light to your family.

REFERENCES:
Author:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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LIGHT SENSITIVITY IN CHICKENS
POULTRY, LEVEL III
Member Handout 7, Hypothalamus-Pituitary Relationship

Relationship between the nervous system, endocrine glands and the reproductive system in male and female fowl.
LIGHT SENSITIVITY IN CHICKENS
POULTRY, LEVEL III
Activity Sheet 6, Lighting Problems

1. Using the formula, prepare a lighting program for chicks hatched on October 15 that will be reared in an open-sided house.

2. Calculate the cost of electricity per month for a 40- × 400-foot cage layer house. Assume there are 300 light fixtures in the house, each with a 40-watt bulb, and the lights are on 14 hours per day. Contact your local power company for the cost of electricity.
What Members Will Learn . . .

ABOUT THE PROJECT:
• Decisions that must be made before starting a small laying flock
• Costs involved in starting a small laying flock
• Records needed to figure production efficiency of small laying flock

ABOUT THEMSELVES:
• Their feelings about routines, habits and responsibilities
• Importance of planning, budgeting and record keeping

Materials Needed:
• Building that is dry, well ventilated, and protected from extreme temperature (optional)
• Activity Sheet 7, Planning for a Small Laying Flock
• Activity Sheet 8, Small Laying Flock Budget
• Activity Sheet 9, Small Laying Flock Record

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY:

A small backyard flock of chickens can provide your family with a source of high quality food, added income, and can serve as an excellent learning experience. Remember though, a flock of chickens can restrict family activities since it must have daily feed, water and care.

Most farms and many suburban residences have facilities suitable for a flock of chickens. Before you start raising poultry, particularly in suburban areas, investigate local ordinances since some areas have restrictions on keeping poultry. Noise, dust, feathers, odors or flies from your flock can quickly cool neighborhood friendships. Good management and a visit with your neighbors explaining details of your project will go a long way toward preventing problems.

This lesson will help you make decisions about starting a small laying flock. Use Activity Sheet 7, Planning for a Small Laying Flock, as a decision-making guide.

Now let’s consider planning for the costs and expected income of a small laying flock. You will need to consider some hen performance goals, investments in a building and equipment, plus income and variable expense projections. This budget will help you determine the feasibility of this project.

Give each member Activity Sheet 7, Planning for a Small Laying Flock. Divide the members into groups of two or three to discuss the planning sheet questions. Have each group report its findings for total group discussion.

Give each member Activity Sheet 8, Small Laying Flock Budget, to discuss in their small groups before reporting back to the entire group. You may want to give members the planning and budget sheets a week prior to this meeting to give them time to find some information from the local community.
If you decide to actually start a small laying flock, you will need to keep accurate records to determine if you are within your projected budget and if you can produce enough eggs for your family needs and still sell enough to make a profit.

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. What was your first reaction or thought when using the planning sheet questions for a small laying flock?

2. What was the most difficult item to plan for? Why?

**Process:**
3. How did you decide which breed or variety to purchase?

4. What type of building did you plan to use? Why?

5. Why is a budget and record keeping important for flock management?

**Generalize:**
6. What did you learn about routines, habits and responsibility?

7. What do you do daily to maintain your health and personal hygiene?

**Apply:**
8. What other things are you responsible for on a daily basis?

9. When do you think you will need planning, budgeting and record-keeping skills in the future? Why?

**GOING FURTHER:**
- Discuss the advantages and disadvantages of dual-purpose versus egg-type breeds.
- Consider the possibilities of expanding a flock to supply eggs to a local restaurant, food market, etc.
REFERENCES:
Management of the Small Flock of Chickens, Circular 507, Kansas State University, (Revised) 1985

Author:
James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University
MANAGING A SMALL LAYING FLOCK
POULTRY, LEVEL III
Activity Sheet 7, Planning for a Small Laying Flock

Questions to Answer:
1. Will you purchase an egg-type or a dual-purpose breed?
2. What breeds of each type are available in your area?
3. Will you start the flock with day-old chicks or ready-to-lay pullets or hens? Consider price differences and facilities. If chicks, will they be straight-run or sexed?
4. How much housing space will you need for the number of birds in your flock?
5. Do you have space for an outdoor pen?
6. How many waterers and feeders will you need for the type and number of birds you are buying?
7. What type and number of nests will you need?
8. Will you use roosts? If so, how much space will be needed?
9. What type of litter will you use?
10. Will you use artificial lighting to maintain production? How much? How will you control?
11. What types of feeds and rations will be needed?
12. Where will you get your feed?
13. How will you control cannibalism?
14. Where will you store eggs?
15. How will you use or market the eggs?
16. What is your plan for fly, mite, louse and worm control?
Besides home consumption, the main outlet for eggs from a small flock is marketing direct to individuals, restaurants, institutions and stores which distributors can’t economically serve. Also, some customers are willing to pay a premium for what they consider farm fresh or farm produced eggs and meat. However, you should carefully consider the problems involved before deciding to market direct. Be sure you have the facilities, the time, the salesmanship ability, a consistent supply of high quality eggs and the market outlets before entering direct marketing.

A. PERFORMANCE GOALS OF DUAL PURPOSE HENS:

- Saleable eggs/hen housed: 20 dozens
- Mortality: 12%
- Grade A large eggs: 70%
- Grade A eggs: 90%
- Feed conversion: 4.2 lb./dozen
- Live weight of old hens: 4.5 lb.

B. INVESTMENT:

- Building—use an existing shed: $ __________
- Equipment—used equipment: $ __________
- TOTAL: $ __________

C. INCOME:

- Eggs: ___ doz. × __ c/doz × _hens housed: $ __________
- Old hens: ___ /hen × _hens: $ __________
- TOTAL: $ __________

D. EXPENSES:

- Feed: ___ doz/hen × __ lb/doz × __$/lb. $ __________
- Variable costs (supplies, utilities, etc.): $ __________
- Repairs: $ __________
- Cost of chicks or hens: $ __________
- TOTAL: $ __________

E. RETURN TO LABOR AND MANAGEMENT: $ __________

Producers have a tendency to underprice their eggs and to not count all processing and marketing costs. Base your selling price to customers on a local market or nearby graded market. Add to this quoted price all processing and marketing costs above production costs, plus the amount of profit you expect to make. Processing and marketing costs are minimal if eggs are sold as gathered at your home, but add 10 to 15 cents per dozen if the eggs are washed, graded, cartoned and delivered to the customer. Also the cost of grade loss (not all eggs are Grade A large) must be taken into consideration. Insert your projected processing costs for the following items:
MANAGING A SMALL LAYING FLOCK
POULTRY, LEVEL III
Activity Sheet 8, Small Laying Flock Budget, continued

<table>
<thead>
<tr>
<th>Type of Cost</th>
<th>Cents per Dozen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartons</td>
<td></td>
</tr>
<tr>
<td>Cases</td>
<td></td>
</tr>
<tr>
<td>Delivery</td>
<td></td>
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<tr>
<td>Equipment</td>
<td></td>
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<tr>
<td>Other supplies</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
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<tr>
<td>TOTAL</td>
<td></td>
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</tbody>
</table>

Regulations. The Kansas Egg Law regulates the sale of eggs to consumers. A producer selling eggs of his/her own production direct to the consumer is exempt from the law. All other transactions fall under the law. Major provisions of the Law are: eggs must be Grade B quality or higher; the carton must plainly show the size, quality, and name of vendor, retailer or food purveyor and the inspection fee stamp. Information about the Kansas Egg Law can be obtained by contacting the Meat and Poultry Inspection Division, Kansas Department of Agriculture, 109 Kansas, 7th Floor, Topeka, KS 66612 (785-296-3511).

## MANAGING A SMALL LAYING FLOCK

### POULTRY, LEVEL III

#### Activity Sheet 9, Small Laying Flock Record

**FINANCIAL SUMMARY**

#### Project Income

<table>
<thead>
<tr>
<th>Date</th>
<th>Items Sold or Used at Home (Indicate Which)</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>$ ______</td>
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<td>$ ______</td>
</tr>
</tbody>
</table>

- Ending Inventory (if appropriate) $ ______

**Total Project Income** $ ______

#### Project Costs

<table>
<thead>
<tr>
<th>Date</th>
<th>Items Bought, Used, Labor Costs, Value of Home-Grown Products</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>$ ______</td>
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</tbody>
</table>

- Beginning Inventory (if appropriate) $ ______

**Total Project Costs** $ ______

#### Summary

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Total Project Income</td>
<td>$ ______</td>
</tr>
<tr>
<td>Total Project Costs</td>
<td>$ ______</td>
</tr>
<tr>
<td>How Much Money Made or Lost</td>
<td>$ ______</td>
</tr>
</tbody>
</table>
MANAGING A SMALL LAYER FLOCK
POULTRY, LEVEL III
Activity Sheet 9, Small Laying Flock Record, continued

FEED RECORD
Record the kind, amount, and value of feed each time a purchase is made or a quantity of home-raised feed is set aside for the project.

<table>
<thead>
<tr>
<th>Date</th>
<th>Kind of Feed (grain, mash, supplement, etc.)</th>
<th>Quantity of Feed (lbs., bu., etc.)</th>
<th>Cost</th>
<th>Remarks: Beginning ration, feed changes, feeding problems, etc.</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Total Feed Costs $

1. Date birds purchased _______________________
2. Date project started: _______ ended: _________
3. Number of days of project __________________
4. Number of birds started (a) ________________
   Number of birds raised (b) ________________
   Number of birds that died (c) ______________
5. Percent death loss __________ %  
   (divide line 4c by line 4a x 100)
6. Pounds of feed used _______________________
7. Dozens of eggs produced __________________
8. Pounds of feed to produce a dozen eggs ______
   (divide line 6 by line 7)

EGG PRODUCTION RECORD

<table>
<thead>
<tr>
<th>Month</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Totals or Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. birds beginning of month</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>No. birds removed</td>
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<tr>
<td>No. birds end of month</td>
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<tr>
<td>Ave. no. birds for month</td>
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<td></td>
<td></td>
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<tr>
<td>Total eggs laid</td>
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<td></td>
<td></td>
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<tr>
<td>Eggs per hen housed</td>
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<tr>
<td>Ave. price per dozen</td>
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<tr>
<td>Total value all eggs produced</td>
<td></td>
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</tbody>
</table>

70-Poultry, Level III
Culling the Layer Flock

Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
- Four reasons for culling non-laying hens
- The bleaching order in a laying hen
- Physical characteristics that reflect a hen’s state of productivity

ABOUT THEMSELVES:
- Criteria needed to make decisions
- The importance of planned decision making

Materials Needed:
- Pictures of birds that appear to be layers or non-layers from magazines and advertising literature
- Leader Sheet, Characteristics for Laying and Non-Laying Hens
- Live birds from a laying flock (don’t mix birds from flocks)
- Chalkboard or newsprint
- 3 x 5-inch cards

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY:

On occasion, the flock will need to be culled. Culling is removing or selling poor quality, non-egg laying birds. There are several reasons for culling the laying flock: (1) to save the cost of feeding unproductive hens; (2) to remove non-layers to provide more space for the remaining flock; (3) to salvage non-producing birds for stewing or other poultry meat uses, and (4) to select birds for a second year of production if desired. By learning how to tell layers from non-layers, you will be able to have a more profitable poultry flock and use the meat by-products.

Most breeds of chickens used in the United States to produce eggs have yellow-pigmented skin and shanks. This pigment, which is in feeds such as yellow corn and green grass, is deposited in the skin, beak, shanks, and feet of the growing pullet. When the pullet starts to lay eggs, the pigment, instead of being deposited in the skin and shanks, is deposited in the egg yolk. This results in loss of pigment (bleaching) in a definite order from the pullet’s body. The order is vent, eye ring, ear lobe, beak, bottom of the foot, front of the shank, back of the shank, and the hock and top of the toes. When a hen stops egg production, the pigment returns to the skin in the same order it was bleached. After a flock has been in production for several months, hens that show signs of repigmentation or have a lot of yellow pigment in their skin are poor producers.
Certain external physical characteristics of a hen will also accurately reflect her state of productivity. As a pullet prepares for egg production, the levels of the sex hormones increase in her body causing enlargement and reddening of the comb and wattles, enlargement and moistening of the vent, spreading of the pubic bones, softening of the abdominal skin and enlargement of the abdominal cavity. The latter is necessary to accommodate the extra space required by an enlargement of the digestive and reproductive systems.

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. What do you think is the most obvious laying hen characteristic to identify? Why?
2. Which non-laying hen characteristic was most difficult to identify? Why?

**Process:**
3. What are the main reasons for culling non-laying birds?
4. What is the bleaching (loss of pigment) order in a pullet’s body when she begins egg production?
5. What are some of the characteristics, or criteria that indicate a hen is producing eggs?

**Generalize:**
6. What criteria do you use to make decisions about items you buy?
7. How important is it to be consistent in your decision making approach?

**Apply:**
8. How will this activity affect your decisions in the future?
9. What future decisions will require a criteria list? Why?

**GOING FURTHER:**
- Go into the chicken house and pick out birds that you suspect are non-layers. This is often best done at night with a flashlight. You will disturb the birds less. Examine those birds that appear to be non-layers by looking for the egg-laying indicators. Have an experienced poultry raiser check your reasoning, or if possible, put the birds you cull into a separate area and check their egg production for a week to determine your ability to sort layers from non-layers.
- Identify parts of a chicken that reflect its reproductive state.
- Participate in a judging contest and judge egg-production hens.
REFERENCES:
Poultry Judging, 4-H 92, Nebraska Cooperative Extension

Author:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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**CULLING THE LAYER FLOCK**
**POULTRY, LEVEL III**
**Leader Sheet, Characteristics Identifying Layers and Non-Layers**

<table>
<thead>
<tr>
<th>Laying Hen Characteristics</th>
<th>Character</th>
<th>Non-Laying Hen Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large, red, waxy</td>
<td>Comb, wattles</td>
<td>Small, scaly, shriveled</td>
</tr>
<tr>
<td>Bleached or bleaching</td>
<td>Beak</td>
<td>Yellow or growing yellow</td>
</tr>
<tr>
<td>Bright, prominent</td>
<td>Eyes</td>
<td>Dull, sunken</td>
</tr>
<tr>
<td>Bleached</td>
<td>Eye ring</td>
<td>Yellow-tinted</td>
</tr>
<tr>
<td>Flexible, wide apart, thin</td>
<td>Pubic bones</td>
<td>Rigid, close together, blunt</td>
</tr>
<tr>
<td>Soft, pliable</td>
<td>Abdomen</td>
<td>Hard, contracted</td>
</tr>
<tr>
<td>Large, moist, bleached</td>
<td>Vent</td>
<td>Dry, puckered, yellow</td>
</tr>
<tr>
<td>Worn, some broken or missing</td>
<td>Feathers</td>
<td>Maybe molting, new appearance</td>
</tr>
<tr>
<td>Short, deep</td>
<td>Head</td>
<td>Thin, shallow</td>
</tr>
<tr>
<td>None, or if in progress, a rapid molt</td>
<td>Molt</td>
<td>In progress, slow</td>
</tr>
</tbody>
</table>

Note: After the activity, give a copy of this sheet to each member as a handout to put in their record book.

**Think Back:**
What are the most significant factors affecting egg production in a laying flock? Why?
What Members Will Learn . . .

ABOUT THE PROJECT:
- How a bird’s skeleton is adapted for flight
- Parts of a flight feather
- The difference in bone density of birds versus mammals

ABOUT THEMSELVES:
- Adaptations or physical characteristics unique to humans
- Their abilities that can be used to cooperate with others

Materials Needed:
- Member Handout 8, Bird’s Respiratory System
- Flight feathers
- Microscope or magnifying glass
- Leg bone of a bird
- Chalkboard or newsprint

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY:

Flight is not usually one of the first thoughts we have when we’re working with domesticated birds, but it is still important and interesting to look at the adaptations of the bird’s skeletal and respiratory systems which enable them to fly.

First of all, as we look at a diagram of the bird’s respiratory system, you will notice that they have more than a pair of lungs like mammals. In addition to their lungs, birds have an air sac system where air is stored and warmed. Most birds have eight air sacs. Unlike mammals whose lungs expand and contract when they breathe, the lungs of birds do not expand and contract. When a bird inhales, air is drawn through the lungs into the air sacs. When a bird exhales, air is forced out of the air sacs, back through the lungs where air exchange takes place, and then out of the body.

Birds also have air cavities in the principal bones of the body, such as the skull, humerus, keel, clavicle, and lumbar and sacral vertebrae. These bones, which are hollow and connected to the respiratory system, also serve as a storage site for air and reduce the weight of the bird for flight.

The skeletal system of birds is designed specifically for flight. It is light in weight because of the air cavities within the bones, which we talked about before.
Although a bird’s skeletal system is similar to a mammal’s, there are several differences. First, birds possess an extra pair of bones in the shoulder area, called the coracoids. This pair of bones allows wing movement and offers additional support of the wings.

If you look at the spine, you will see several differences from the spine of mammals. The cervical vertebrae (neck bones) form an S-shaped column connecting the body to the head. This S-shaped column acts as a spring to cushion the head when a bird lands. Unlike mammals who can bend their backs, the vertebrae along the trunk and body of the bird are fused together, making them stiff and rigid. This provides additional support for the wings.

A bird’s skeleton is also different from that of mammals in that the skeleton of the bird’s neck does not always have the same number of vertebrae. A dog has just as many cervical vertebrae as a giraffe—seven, but long-necked birds may have as many as 25 vertebrae, while short-necked birds may have only 11.

A bird’s wing consists of bone, muscle, tendons, nerves, connective tissue and many feathers. The forelimb is modified into a wing. If you look closely, you will see that birds have only a few bones in the outermost part of the wing skeleton. This is called the hand part of the wing since it is similar to the human hand. The inner part of the wing skeleton, which consists of the humerus, radius and ulna, is called the proximal wing or arm.

Skin and muscle are also important in the wing’s structure. The skin forms membranes joining the different parts of the wing and fills in the spaces between the bones.

Another adaptation for flight in birds is the extensive development of the pectoral (breast) muscles that are attached to the wings and breast bone. These muscles have been called a powerful air-cooled motor, designed for flight. The greater portion of these muscles appears to be on the body proper because of their extensive attachment to the sternum. It is estimated that muscles in this region weigh about as much as do all the rest of the muscles and may account for 15 to 20 percent of the bird’s weight as compared to less than 1 percent of a human’s total weight. Although the ability to fly is not of primary consideration in poultry, the ratio of breast meat to total body weight is important since breast (white) muscle is preferred by most consumers.

The breast muscle of chickens is very light in color due to a low level of the pigment myoglobin. This pigment, which is similar in structure to hemoglobin, carries oxygen to the muscle cells. The amount of myoglobin depends on the flight pattern of the bird and the level and duration of muscular activity. Reduction in muscular activity lowers the level of myoglobin and causes the lighter color of the muscle. This is the reason why the breast muscle of chickens and turkeys is lighter in color than that of ducks.
Now, let’s take a look at the flight feathers. If we look at a flight feather under a microscope or magnifying glass, we can see there are many barbs that branch out from either side of the shaft. Each of these branches in turn branches out into many barbules. In a flight feather of a pigeon, about 1,000 barbs branch from either side of the shaft, which in turn branch out into 550 barbules. The total number of barbules in a single feather of a pigeon could total nearly a million. On the tips of the barbules are tiny hooks called barbicels. These hooks interlock and give rigidity to the feather fibers. When the wings are furled, the individual flight feathers lie one over the other like shingles. The many air spaces left between them make the whole structure very light and insulate it against heat loss. The muscles of a bird in flight extend the wing, and the feathers slide past one another to maintain a thin surface, resembling a fan.

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. What flight adaptations were new to you?

2. Which flight adaptations do you think are unique? Why?

**Process:**
3. What is significant about a bird’s respiratory system?

4. How is a bird’s skeleton adapted for flight?

5. What is significant about a bird’s muscle structure? Why?

6. What are the unique characteristics of flight feathers that greatly enhance flight?

**Generalize:**
7. What did you learn about yourself through this activity?

8. What adaptations or characteristics do humans have that other mammals do not?

**Apply:**
9. What learning, knowledge or social skills do you have that will prepare you for future jobs or careers?

10. What abilities do you think will be needed to work well with others? Why?

**GOING FURTHER:**
- Research the role air sacs have during courtship of some male birds.
- Compare a bird’s flight adaptations to those of an airplane and share with your group or class at school.

Have members look at a flight feather under a magnifying glass or microscope and identify the barbs and barbules. Refer to member handout, Parts of a Feather, from Level II Lesson, Types of Feathers and Their Functions.
REFERENCES:
*Poultry Science*, Ensminger

Author:
Cynthia R. Siemens, Extension Assistant, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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ADAPTATIONS FOR FLIGHT
POULTRY, LEVEL III
Member Handout 8, Bird’s Respiratory System

1. Trachea (windpipe)
2. Clavicular sacs
3. Cervical sacs
4. Wing skeleton sac
5. Pre-thoracic (diaphragmatic) sacs
6. Post-thoracic (diaphragmatic) sacs
7. Abdominal sacs
Leader Notes

Flight Prevention
Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
• Three methods of preventing flight of chickens
• The difference between temporary and permanent methods of flight prevention
• Why flight prevention is desirable or used

ABOUT THEMSELVES:
• The purpose of prevention or safety in their lives
• How they feel about mandated safety or health prevention

Materials Needed:
• Day-old chicks, if available
• Cardboard drawing of the wing of a chick showing the location of the tendon and the outermost section of the wing
• Pair of sharp scissors or dewinging attachment on an electric beak trimmer
• Several adult birds
• Pair of hedge clippers or heavy shears
• Cardboard replica of chick and adult bird wings (actual size)
• Member Handout 9, Feather and Wing Clip Locations

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY:

It is desirable to discourage birds from flying when they are in fenced outdoor pens or range areas. The methods used to prevent flight involve altering the structure of one wing in a manner that unbalances the bird, making flight difficult. Some of the methods are temporary, some should be done when chicks are 1 day old. Some methods may result in lowered market quality of meat-type birds, and all may interfere with mating, particularly with the males.

All flight prevention methods subject the birds to stress, thus the operation should not be performed when the birds are sick, during vaccination or during hot weather. If possible, administer a stress medicine two to three days prior to and after the operation.

FLIGHT PREVENTION METHODS:
1. Feather clipping involves cutting the flight or large wing feathers of the adult bird about two-thirds of the way down from the tips of the feathers with sharp, heavy shears, hedge clippers, or with a sharp hatchet and chopping block. Feather clipping is a temporary measure.

Demonstrate the flight prevention procedures and allow members to practice on cardboard replicas of wings. After practice, let members do some of the procedures on live birds (if possible).
Two people are required to feather clip a bird. One person should hold the bird’s feet in one hand and spread its wing with the other hand by pressing on the wing next to the bird’s body. The other person then can clip the feathers of the extended wing.

2. **Wing clipping** involves removing the outermost section of one wing of a day-old bird with a vertical hot wire or hot steel bar on an electric debeaking device. Sharp scissors can also be used, but there will be some bleeding from the wound.

3. **Wing notching** uses the same type of equipment as wing clipping. It involves severing the tendon that crosses the center of the outermost wing joint (see illustration on Member Handout 8, Feather and Wing Clip Locations). This method can be done from day-old to 5 to 7 weeks of age.

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. What did you use to clip bird feathers? Cardboard? Why?

2. Did you try any wing clipping or notching on young birds? If so, what was the most difficult? Why?

**Process:**
3. Why is feather clipping of adult birds a temporary method of flight control?

4. When would permanent flight prevention not be desirable?

**Generalize:**
5. Flight prevention is a restraining device; what other restraining devices are used with other animals? Why?


**Apply:**
7. How do you feel about mandated use of safety devices?

8. What areas of prevention do you think should be an individual choice as opposed to mandated by law? Why?

**GOING FURTHER:**
- Discuss the rights of production or food animals as opposed to companion animals.
- Invite someone with a different perspective to discuss flight prevention with your group.

*82-Poultry, Level III*
REFERENCES:
Author:
Cynthia R. Siemens, Extension Assistant, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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FLIGHT PREVENTION
POULTRY, LEVEL III
Member Handout 9, Feather and Wing Clip Locations

Think Back:
What is the importance of flight in wild birds as compared to domestic birds?
Eggs—Normal and Irregular

**Poultry, Level III**

**What Members Will Learn . . .**

**ABOUT THE PROJECT**
- The abnormalities in the physical characteristics of eggs and what causes them

**ABOUT THEMSELVES:**
- Their feelings about abnormalities

**Materials Needed:**
- Samples or pictures of abnormalities and irregularities of eggs
- Chalkboard or large paper

**ACTIVITY TIME NEEDED:** 30 MINUTES

**ACTIVITY:**

Today, we’ll take a look at some of the abnormalities and learn what might have caused them. But first let’s consider what a normal egg should look like.

How many of you know or have seen an animal with a birth defect? The causes of these birth defects may be caused by a variety of things, such as poor nutrition, use of drugs, genetics, physical trauma, etc.

Malfunction of the hen’s reproductive system may also result in abnormalities such as double-yolk eggs, eggs with bloodspots, yolkless eggs, shell-less eggs, an egg within an egg and eggs with defective shells.

Let’s discuss some of these abnormalities:

**Soft-shelled egg**—This is an egg the hen lays after the shell membranes have been added in the isthmus but before the hard shell is added in the uterus. Many times if a hen is frightened she will lay the egg before the hard shell is added.

What causes a **bloodspot** in an egg? A bloodspot occurs in an egg when the membrane holding the yolk doesn’t rupture along the suture line, resulting in hemorrhaging (or bleeding) from breaking of a blood vessel. Hemorrhaging may occur if a hen is frightened or handled roughly when the yolk is leaving the sack. Factors contributing to this problem are genetics, excessive fright (wild birds, rodents, etc. scaring the birds), lack of vitamin K and access to rodent poisons containing anticoagulant drugs.

**Leader Notes**

Use Level II lesson, Cracking Up—What’s In An Egg to review normal egg physical characteristics. List on chalkboard or newsprint.

Have members identify some abnormalities or birth defects in other animals.

If possible, show samples or pictures of these abnormalities while you discuss these with your members.
What causes abnormal eggs such as **double-yolk eggs**, yolkless eggs, and an egg within an egg? The most common cause is two yolks are released from the ovary at the same time. Then, these two yolks are picked up by the oviduct and made into one egg.

**Yolkless eggs**—something foreign to the oviduct, such as a piece of tissue, stimulates the oviduct to secrete thick white that is then surrounded by the other parts of the egg as it travels down the oviduct.

**Egg within an egg**—a completely formed egg in the uterus for some unexplainable reason goes back up the oviduct and has the thick albumen, thin albumen, shell membranes and hard shell added as it returns.

**Defective or severely misshaped eggshells**—caused by a defect of the oviduct, or two eggs touching each other in the oviduct. Usually, it is the same hens in a flock that consistently lay eggs with deformed shells.

**Worm in an egg**—very infrequently, a roundworm will get into the oviduct and be incorporated into the egg.

**Variability in egg yolk color**—the color in egg yolks and the skin of yellow skinned breeds of chickens comes from the pigment called xanthophyll which is found in green plants and yellow corn. If hens are fed a ration that has very little of these ingredients, their yolks will be light yellow in color and vice versa. Variability of yolk color in a flock can be due to disease and from hens fed free choice which causes variability in the intake of pigmented ingredients between hens.

**DIALOGUE FOR CRITICAL THINKING:**

**Share:**
1. How many abnormalities have you observed in eggs? When? How often?

**Process:**
2. What are the causes of various egg irregularities?
3. What can a producer do to prevent egg irregularities?

**Generalize:**
4. What other abnormalities have you observed? When? Where?
5. Does physical appearance change the value of an item? How? When?

**Apply:**
6. What are the issues included in the Americans With Disabilities Act? (Discuss)
7. How will you act differently in the future as a result of this activity?
GOING FURTHER:
• Attend a judging contest where eggs are graded.
• Visit a store and observe physical differences in eggs, particularly between Grade A and Grade B eggs.
• Give a presentation to a group or class about normal and irregular eggs.

REFERENCES:
*Poultry Handbook*, Department of Animal Sciences, Kansas State University

Author:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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What Members Will Learn . . .

ABOUT THE PROJECT:
• Forms of eggs sold
• Ten poultry products found in most food stores
• Factors that affect egg and poultry meat quality
• How to determine a fair price for products you sell

ABOUT THEMSELVES:
• Their own consumer shopping skills when buying clothing, food, etc.
• How they feel about quality of products they buy and/or sell

Materials Needed:
• Activity Sheet 10, Consumer Product Evaluation Worksheet
• Clipboards or hard writing surface
• Pens or pencils for members
• Activity Sheet 11, Product Pricing

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY:

The egg is one of nature’s most versatile food products. Nutritionally, it is one of nature’s most completely packaged food products. To the egg producer, the egg is the major source of income.

Marketing eggs involves the process of getting the egg from the farm to the consumer. Eggs are a perishable product that must be collected from wide areas of production and transported to major centers of consumption without losing egg quality.

Most shell eggs are sold by the dozen directly from the producer or on a weight and grade basis commercially. Eggs that are converted into egg products are sold on a net weight and liquid yield basis.

The number of businesses involved in marketing eggs and the length of time between when the egg is laid and its arrival in the food market have declined in recent years. A typical egg marketing chain is producer-processor-retailer-consumer. Most eggs are transported on filler flats or cartons in 30-dozen cardboard cases in refrigerated trucks.

Processing Shell Eggs
Eggs pass through many processes on their journey from the hen house to the food store. First, the eggs are cleaned, which involves washing in a sanitizing solution.
Next, the eggs are **graded for quality**. Egg quality is based on certain characteristics that affect the egg’s **physical appearance**, **functional properties** (uses) and **nutritional content**. Grading eggs involves sorting them into similar groups according to standard quality and weight standards. Grading encourages orderly marketing. Most eggs purchased by consumers are graded according to USDA standards. Grade quality factors are divided into two categories.

**Exterior** quality factors affect the outside appearance of the egg shell and the ability of the egg to reach the final consumer unbroken. Factors are shell **shape** and texture, **soundness**, **cleanliness** and **color**. The consumer’s first impression of a carton of eggs is their exterior quality or appearance.

**Interior quality** factors affect the broken-out appearance and the **functional properties** of the egg. When grading an egg’s interior quality, the **position** and **movement** of the yolk are considered. Egg quality is related to the thickness of the albumen. Thick albumen permits limited movement of the yolk and an indistinct yolk shadow results. The opposite is true of thin albumen. Appearance of the yolk involves the presence of foreign materials such as blood and meat spots, and the size and shape of the yolk. Eggs that are rotten, show blood rings, or contain large blood and meat spots are **loss** eggs, and are unfit for human consumption. Eggs with dirty or cracked shells are called **restricted** eggs, and must be broken and the liquid pasteurized before being used for human consumption. The **depth** of the air cell is a measure of loss of moisture from the egg.

Eggs are graded by **candling**, which is observing the exterior and interior quality of unbroken eggs by rotating the eggs while a beam of light passes through them. Candling is either done by hand or by a mass scanning machine. Consumer grades for small eggs are AA, A, and B. All other edible eggs are classified as **undergrades**. Specific tolerances are allowed in a pack of eggs so that not every egg in a case of grade A eggs has to be a grade A egg. This allows for some variations in quality as eggs move through marketing channels.

Next, the eggs are individually weighed into six consumer weight classes.

### Consumer Weight Classes of Eggs

<table>
<thead>
<tr>
<th>Class</th>
<th>Minimum weight/ dozen (ounces)</th>
<th>Minimum net weight/ 30 dozen (pounds)</th>
</tr>
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<tbody>
<tr>
<td>Peewee</td>
<td>15</td>
<td>28</td>
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<tr>
<td>Small</td>
<td>18</td>
<td>34</td>
</tr>
<tr>
<td>Medium</td>
<td>21</td>
<td>39 ½</td>
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<tr>
<td>Large</td>
<td>24</td>
<td>45</td>
</tr>
<tr>
<td>Extra Large</td>
<td>27</td>
<td>50 ½</td>
</tr>
<tr>
<td>Jumbo</td>
<td>30</td>
<td>56</td>
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</tbody>
</table>

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*90-Poultry, Level III*
Processing Eggs on the Farm
There are limited opportunities, particularly in the less populated areas of the state, for producers to process and sell their eggs or poultry directly to consumers, institutions, restaurants or retailers.

Direct marketing of your eggs or poultry can be profitable, but it can also be time-consuming. You need to be sure that you have the facilities, the time, the salesmanship ability, a consistent supply of high quality products and the market outlets before entering direct marketing.

There are many things to take into consideration when pricing your product for sale. Producers tend to underprice their eggs and poultry and fail to count all of their processing and marketing costs. Base your selling price to customers on a local market or nearby graded market. Add to this quoted price your processing and marketing costs above production costs, plus the amount of profit you expect to make.

Kansas Egg Law
The Kansas Egg Law regulates the sale of eggs to consumers. A producer selling eggs of his/her own production direct to the consumer is exempt from this law. A producer may sell eggs to consumers at the producer’s farm or on a route to individuals or to institutions such as nursing homes. Local health requirements may take precedence over this law in the case of institutions.

Major provisions of the Kansas Egg Law are:
- Eggs must be “Grade B” quality or higher
- The container (carton) must be plainly marked to show the size, quality, and name of vendor, retailer, or food purveyor and the inspection fee stamp.

Egg Products
About 20 percent of all eggs are broken-out and processed into egg products for inclusion in various food products. These products are used in foods not only to enrich the foods nutritionally, but because of the egg’s functional properties of foaming, leavening, thickening, binding and emulsifying.

Eggs that are to be broken are candled and cleaned like eggs for the shell egg market. Then the eggs are broken by a machine that separates the liquid from the shell and also can be set to separate yolk and albumen. Next, the liquid is mixed or homogenized into a stable liquid. The albumen is stabilized by desugaring by enzymatic or bacterial fermentation. Regulations require that all liquid egg be pasteurized to destroy pathogenic microorganisms. Lastly, the liquid is put in cans for freezing or dried and stored as a powder. Pan-dried albumen is used by confectioners. Albumen, whole egg, and yolk are spray dried for use by the baking industry.

Many different types of egg products are made. Examples are frozen or dried albumen, whole egg, whole egg blends that contain sugar, salt and added yolk, plain yolk, yolk with added salt and yolk with added sugar.
Proper care and handling of eggs by consumers

The same nutrients that make eggs a high-quality food for humans can also be a good growth medium for bacteria that have the potential to cause food-borne illnesses. Nearly all reported cases of food-borne illnesses associated with eggs or foods containing eggs have been associated with improper handling. Following these handling practices will reduce the danger of food-borne illness from eggs.

- Store eggs at 45°F or below
- Don’t use dirty or cracked eggs
- Cook eggs until white is completely firm and yolk begins to thicken
- Use pasteurized egg products in recipes that call for large quantities of eggs
- Serve egg dishes within 1 to 2 hours
- Store eggs away from strong odors
- Don’t use recipes that contain raw eggs
- Hold cooked eggs below 40°F or above 140°F
- Avoid cross-contamination of cooking utensils

Information about the Kansas Egg Law and the Kansas Meat and Poultry Inspection Law can be obtained by contacting the Division of Inspections—Meat and Poultry, State Department of Agriculture, 901 S. Kansas, 7th Floor, Topeka, KS 66612, (785) 296-3511.

DIALOGUE FOR CRITICAL THINKING:

Share:
1. How many poultry products did you find in the store search?
2. What products were found the most often? Least often? Why?

Process:
3. What quality factors affect the value of eggs?
4. What are some food handling practices that will reduce the danger of food-borne illnesses?
5. If you had eggs to sell, how would you determine your selling price?

Generalize:
6. How important is quality and wholesomeness in the products you purchase? Why?
7. What affect does quality have on price?

Apply:
8. How will the store search pricing exercise help you with future purchases?
9. In what other areas of your life can you use this pricing procedure?
GOING FURTHER:
• Tour a poultry farm and an egg-processing facility to see how they process eggs for packaging and shipping.
• Learn how to determine egg quality grades.
• Ask a grocery store owner where he/she purchases his/her eggs and how he/she determines where to buy them.

REFERENCES:
Author:
Cynthia R. Siemens, Extension Assistant, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University
MARKETING EGGS AND POULTRY PRODUCTS
POULTRY, LEVEL III
Activity Sheet 10, Consumer Product Evaluation Worksheet

<table>
<thead>
<tr>
<th>Name of Product</th>
<th>Size of Pkg., Amt., Wt., Etc.</th>
<th>Cost</th>
<th>Nutritional Information</th>
<th>Quality Grade</th>
<th>Inspection Stamp</th>
</tr>
</thead>
<tbody>
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</table>
MARKETING EGGS AND POULTRY PRODUCTS
POULTRY, LEVEL III
Activity Sheet 11, Product Pricing

Below is information that should be considered in determining the price to charge for your products. Cost will vary depending on volume, type of equipment, distance from market, number of deliveries and labor efficiency.

Using these cost items as a guide, insert your actual costs.

<table>
<thead>
<tr>
<th>Type of Cost*</th>
<th>Cents per Dozen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartons</td>
<td></td>
</tr>
<tr>
<td>Cases</td>
<td></td>
</tr>
<tr>
<td>Labor in Egg Room</td>
<td></td>
</tr>
<tr>
<td>Transportation Expense</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous**</td>
<td></td>
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</tbody>
</table>

| Total                  |                 |

*These costs are in addition to the cost of producing eggs.

**Includes processing and storage equipment, utilities, storage and supplies.
What Members Will Learn . . .

ABOUT THE PROJECT:
- Five members of the food safety team
- Five bacteria that cause foodborne illnesses
- Three basic rules to reduce food related illnesses

ABOUT THEMSELVES:
- How they feel about food safety issues covered by the media
- How they feel about the need for government regulations and inspections
- How safe their family’s food handling procedures are

Materials Needed:
- Publications about food additives and sources of food-borne illnesses
- Pencils
- Activity Sheet 12, Food Safety Article Survey
- Activity Sheet 13, Food Safety Field Trip Summary
- Activity Sheet 14, Problem Kitchen Exercise

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY:
America’s food supply is one of the safest in the world, yet it is estimated between 21 and 81 million Americans suffer from a food-related illness each year. A large number of these illnesses can be prevented by proper food handling at home.

Two concerns related to food safety are chemical contamination and microbiological contamination. Because a large number of food-related illnesses are caused by improper food handling at home and are preventable, it is important to learn safe food handling practices.

Food Safety Team—These are the people responsible for protecting the American consumer.
1. Government agencies, such as the Animal and Plant Health Inspection Service (APHIS) and Food and Drug Administration (FDA) make the food safety regulations, or rules, and ensure that everyone follows them. All phases of poultry production, processing and marketing are regulated by governmental agencies. Government officials inspect the processing of poultry products (eggs and meat) to ensure they are safe and wholesome; they keep records of the chemicals used, and they test products in response to complaints from consumers.

Leader Notes
Have members collect newspaper and magazine articles about food safety in the poultry industry. Use Activity Sheet 12, Food Safety Article Survey, to evaluate and summarize each article.

Discuss the differences between chemical and microbiological contamination.
2. **Producers** use the safest and most modern methods to assure a plentiful and disease-free supply of poultry products. They follow strict rules on how to administer drugs to keep their flocks healthy without the meat or eggs containing harmful residues.

3. **Processors** process the poultry products that producers sell to them. Processors put labels on their products to inform consumers about their products. The term “inspected for wholesomeness” means the product is edible. The term “Grade A” indicates the quality of the meat. Both terms appear on the wrapper of most ready-to-cook poultry products. The term “Grade A” or “B” on a carton of eggs indicates the quality of the eggs and “Medium, Large, Extra Large, etc.,” indicates the size or net weight of the eggs.

Processors also follow government regulations that are made to protect consumers. Processors also may use approved chemicals to prevent spoilage and/or improve the taste, texture, appearance, or freshness of poultry products. Government regulations strictly control the use of such additives.

4. **Retailers** are the store owners who sell poultry products to consumers. They train store personnel in safe handling of poultry products. They make sure storage and display areas are clean and that the products are not too old or unsafe to eat. For example, a carton of eggs has a pull date on it which indicates the date the eggs should be removed from the case and reprocessed.

5. **Consumers** are the best line of defense against the bacterial contamination of food. It is the responsibility of consumers to properly prepare and store poultry products.

**FOOD SAFETY AND CHEMICALS**

Chemicals in poultry products are a controversial subject. One reason is current analytical methods are so powerful, very small amounts (parts per billion—ppb) of chemicals can be detected. In most cases, the concentrations detected are so low that they present little or no health risk to consumers.

Examples of chemicals used in the production of poultry products are drugs to prevent disease outbreaks and to make the birds grow faster or to produce more eggs; food additives to prolong freshness and to prevent spoilage; and color additives to improve the appearance of the products.

**FOOD SAFETY AND FOODBORNE ILLNESSES**

Food-related illnesses are caused by a combination of naturally occurring foodborne bacteria and the unsafe handling of food. The most common foodborne illnesses are caused by bacteria. Five common bacteria are:

1. **Salmonella** bacteria cause 40 percent of all foodborne illnesses. There are over 2,000 different types of salmonella microorganisms, but only a few cause foodborne illness in humans. Salmonellae
microorganisms that are ingested, live and grow in the intestinal tract of people causing diarrhea, headaches, chills, fever, nausea, vomiting, and abdominal (stomach) pain. Salmonellae can be picked up at any time during the various stages of production, processing, storage and preparation of poultry products.

2. **Campylobactor jejuni** causes a foodborne illness called campylobacteriosis. The bacteria sometimes is found on poultry meat. Symptoms are fever, headache, muscle pains, diarrhea, abdominal pain and nausea. Important characteristics of this organism are that it prefers a low-oxygen environment and will survive longer in foods at refrigeration temperature than at room temperature.

3. **Clostridium perfringens** sometimes is a problem in the mass food service industry. The organism grows best in the absence of oxygen, on foods high in protein (meats) and at temperatures above 115°F. Unfortunately, this temperature is where many warm holding areas in food services are set to keep food warm.

4. **Clostridium botulinum** produces one of the most deadly toxins known to humans. Scientists estimate one cupful of this purified toxin would kill all the people on the earth. The toxin is formed when heat-resistant spores of the organism survive and germinate during storage, usually at temperatures above 38°F and in foods with a pH above 4.5. Illness from the toxin occurs mainly from ingesting improperly canned foods.

   Initial symptoms are difficulty in swallowing, slowed speech and respiration, and double vision. Treatment includes administration of antitoxins.

5. **Staphylococcus aureus** foodborne illness occurs when the organism multiplies and forms toxins called enterotoxins in cooked foods that are high in protein such as poultry meat. Illness occurs when the food containing the toxin is eaten by people.

**FOOD SAFETY AND PREVENTION**
Consumers can significantly reduce the risk of acquiring food-related illnesses by following these three basic rules:

1. Keep hot foods hot (above 140°F). Hot foods containing poultry products should be cooked to a temperature of 160°F.

2. Keep cold food cold (below 40°F). Neither hot or cold foods should be held for more than two hours in the danger zone of 40° to 140°F.


**DIALOGUE FOR CRITICAL THINKING:**
Share:
1. What unusual or common items did you find in the news article survey?
2. What are the common safety themes related to poultry products in stores and the media? Why?

**Process:**
3. What are some groups that have food safety responsibilities?

4. What are the three basic rules to reduce food-related illness?

**Generalize:**
5. Have you ever had a food-related illness? How sick were you? What caused it?

6. How do you feel about regulation and inspections required for food products?

**Apply:**
7. Was there anything you learned from this lesson that will change your food-handling procedures? What? Why?

**GOING FURTHER:**
- Share your findings with other groups—clubs, consumers, etc.
- Prepare a store display for a local food store to remind consumers of the process and how safe the products are.

**REFERENCES:**
*Play It Safe: Goals for Food Safety*, P.O. Box 1400K, Dayton, Ohio 45414
*Consumer Guide to the Care and Cooking of Chicken*, National Broiler Council, 1155 15th St., NW, Suite 614, Washington, DC 20005

**Author:**
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**Reviewed By:**
R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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FOOD SAFETY
POULTRY, LEVEL III
Activity Sheet 12, Food Safety Article Survey

Directions: Use newspaper and magazine articles discussing food safety in the poultry industry to fill out the Food Safety Survey.

<table>
<thead>
<tr>
<th>Title</th>
<th>Source</th>
<th>How Factual or Accurate</th>
<th>Number of Sides of Issue Presented</th>
<th>Biased or Unbiased</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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</tbody>
</table>
1. List poultry product handling procedures you observed.

2. What government regulations and inspections does the store observe for poultry products?

3. How does the store promote food safety? Display cases? Product wrappings, etc.?

4. What are the most recent food-safety issues, relating to poultry products, you have observed in the media?
FOOD SAFETY
POULTRY, LEVEL III
Activity Sheet 14, Problem Kitchen Exercise

Directions: Cut along the dotted line. Hand out the “Problem Kitchen” picture first. Have members list and discuss problems. After members have had time to record observations, hand out the “Safe Kitchen” picture to compare responses.

Problem Kitchen

What might happen if the problem kitchen is not made into a safe kitchen?

Safe Kitchen

Bonus Question
Find the difference in cooking methods between a microwave and a conventional oven. Why does cooking with a microwave contribute to the increased risk of bacterial contamination?
What Members Will Learn . . .

ABOUT THE PROJECT:
• The consumer grades of eggs
• How to candle eggs
• The steps in judging interior and broken-out quality of an egg
• To recognize differences in egg quality
• How to classify eggs into their correct grade

ABOUT THEMSELVES:
• To make qualitative subjective decisions
• Their feelings about criteria and standards for decision making

Materials Needed:
• Member Handout 10, Parts of an Egg Diagram and Air Cell Depth Gauge
• Member Handout 11, Interior and Exterior Quality Grades
• Egg Candler
• Member Handout 12, Broken-out Egg Quality Chart, USDA
• Eggs of different quality

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY:
There are several factors that help determine the grade of an egg. Each egg is graded on its individual merits of quality (interior and exterior) according to the United States Department of Agriculture grades. The grades are AA, A, B, and Inedible. Knowledge of the parts of the egg is essential to understanding candling and grading.

Candling is used to judge exterior and interior egg quality. Although other factors help determine the grade of an egg, the interior quality is the most important.

HOW TO CANDLE
Hold the egg up to the candling light in a slanting position. You can see the air cell, the yolk and the white. The air cell is nearly always in the large end of the egg. Therefore, put the large end next to the candling light.

Hold the egg between your thumb and first two fingers. Then, by turning your wrist quickly, you can cause the inside of the egg to whirl. This will tell you a great deal about the yolk and white. When you are learning to candle, you will find it helpful to break any eggs you are in doubt about and observe them.

Leader Notes
Give members Parts of an Egg, Member Handout 10. Cover the words before copying. See how many parts they can label. Then review the parts of the egg you will be looking at when grading.

Have members take turns candling eggs. Place them in quality grades and then discuss as a group.
STANDARDS OF JUDGING INTERIOR QUALITY OF EGGS
The grade of an egg is determined by several factors:

1. **Air Cell Depth**—the distance from its top to its bottom when the egg is held with the air cell up. In a fresh egg, the air cell is small, not more than 1/8-inch deep. As the egg ages, evaporation of moisture takes place and the air cell becomes larger and the egg is downgraded.

2. **Yolk**—the yolk of a fresh, high-quality egg will be surrounded by a rather thick layer of albumen or white. Therefore, it moves only slightly away from the center of the egg when it is twirled before the candler. Because of this, the yolk outline is only slightly defined or partially visible. As the egg ages or deteriorates in quality, the albumen thins and the yolk tends to enlarge to move more freely and to approach the shell more closely. The yolk then becomes more visible when candled.

3. **White or Albumen**—The character and condition of the white or albumen is determined largely by the behavior of the yolk of the egg when the egg is candled. When the egg is twirled, if the yolk retains its position in the center, the white is usually firm and thick.

Eggs with blood or meat spots more than 1/8-inch in diameter are classified as inedible. Eggs with small spots less than 1/8-inch in diameter should be classified as Grade B. Bloodspots should not be confused with the chalaza, a string of albumen that helps hold the yolk in the center of the egg. The chalaza may be prominent in some eggs. The chalaza is distinguished from a bloodspot by a bright area of refracted light that accompanies the darker shadow of the chalaza.

When grading eggs by candling, the lowest rated quality factor determines the grade. The quality factors considered are: air cell depth, yolk and albumen. For example, an egg may have a clearly defined yolk that is flat and at the bottom of the egg while the air cell is less than 1/8-inch in depth. This egg would be a B grade.

The following will not be considered as quality factors when candling eggs for interior quality:
- Loose, bubbly or out-of-position air cell
- Exterior stains or dirt
- Faulty egg shell shape or texture
- Exterior quality

In commercial egg-processing plants, eggs are graded simultaneously for exterior and interior quality. However, in judging contests, it is necessary to grade eggs for exterior quality separately, because handling of eggs by contestants can change the grade. Exterior quality standards reduce the number of eggs with defects that detract from the appearance of the egg or that would have a low chance of surviving the rigors of handling in commercial plants.

Refer to Member Handout 10, Air Cell Depth Gauge, for assistance.
normal market channels. In other words, we want the consumer to have clean, unbroken eggs that may have only minor defects. This is especially important when judges have gained experience in evaluating eggs with various degrees of abnormalities.

**EXTERIOR QUALITY GRADES**

Let’s look at the chart and identify some of the descriptive terminology used in the USDA Egg Grading Manual to help determine the grade of an egg by exterior quality. For 4-H Poultry Judging Contests, eggs will be assigned the grades of A, B and Dirty. Grades AA and A have identical exterior quality standards.

**Stains**—Grade A eggs must be clean. These eggs can show traces of processing oil (used to preserve freshness). This processing oil may give a shiny or opaque appearance. Eggs with slight or moderate stains covering less than $\frac{1}{32}$ of the shell, in one localized area, or $\frac{1}{16}$ of the shell surface, if the stains are scattered, are assigned Grade B.

**Adhering Dirt or Foreign Material**—Grade A and B eggs cannot have any adhering dirt or foreign material. Eggs with adhering material (3-di- mensional) larger than a speck should be classified as Dirty. Small specks of dust or lint that may have settled out of the air should not be considered.

**Egg Shape**—There is a considerable range of egg shapes that could be considered approximately the usual shape of Grade A eggs. Eggs that are perfectly spherical (round) or too long to fit in the egg carton should be graded B quality. B quality grade for egg shape will include eggs that are clearly misshapen, or have definite flat areas.

**Shell Texture**—Eggs with faulty texture are much weaker in shell strength and may be broken during distribution. Shells with large calcium deposits (greater than $\frac{1}{8}$-inch in diameter) should be classified as Grade B. Eggs with small calcium deposits are classified as Grade A. There is no standard for number of calcium deposits which means that small calcium deposits over the entire shell may be classified as Grade A if otherwise qualified. A good rule of thumb is if you were to pull your fingernail across a calcium deposit and there would be a good size hole if it came off, it would be classified as Grade B.

**Ridges**—Ridges can result in weakened shells. Many eggs show small ridges and most of these should be classified as Grade A. Those eggs with large ridges are Grade B.

**Shell Thickness**—The shell should appear thick enough to withstand reasonable handling without breaking. Grade A eggs must have a thick shell with no thin spots. Thin shells or thin spots would place an egg in Grade B. In all cases the shell must not be broken.

Have members examine the exterior quality of eggs and determine their grades. After everyone has completed the examination, compare answers and discuss.

Give each member a copy of Member Handout 11, Interior and Exterior Quality Grades.
BROKEN-OUT QUALITY

Eggs broken-out will be Grades AA, A, B and Inedible. Eggs with spots (blood and meat) more than ¼-inch in diameter will be classified as inedible. Eggs with spots less than ¼ inch will be classified as Grade B.

The only other criterion that should be used to grade broken-out eggs is the height of the thick albumen relative to the size of the egg. The size, flatness, or position of the yolk should not be considered. Broken-out grade determination must be based on “U.S. Standards for Quality of Shell Eggs” from the USDA. Representative AA, A and B grade eggs from this chart are provided in the handout. The thick albumen retains the shape of the egg in a Grade AA and is thick, whereas there is a flattening and rounding of edges in a Grade A egg. The thick white in a Grade B egg is flat and barely visible.

You can learn to assign the proper grade by comparing actual broken-out eggs with the USDA broken-out egg chart. The diameter of the outline of thick white may give an indication as to grade; however, the height of the thick albumen is the most important factor in determining grade. For example, an extra large egg may have a rather large, thick albumen outline and also sufficient height of thick albumen to be Grade AA.

DIALOGUE FOR CRITICAL THINKING:

Share:

2. What part of egg grading is most difficult? Why?

Process:
3. What are the major factors to determine interior egg quality?

4. What are the exterior egg-quality factors?

5. What criteria are used to grade broken-out eggs?

Generalize:
6. What did you learn about yourself through this activity?

7. What criteria do you use to select friends? How easy are these criteria to measure?

Apply:
8. Do all your friends have the same qualities? Why? Why not?

9. What basic standards do you apply to your decisions? Why?
GOING FURTHER:
• Participate in a judging contest.
• Examine eggs from different breeds or strains of poultry and see if there is any difference in egg quality.
• Go to a grocery store and do a price comparison of various grades and sizes of eggs.

REFERENCES:
_Poultry Judging_, 4-H 92, Nebraska Cooperative Extension

Author:
Adapted from above reference by Cynthia R. Siemen, Extension Assistant, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University
EGG GRADING
POULTRY, LEVEL III
Member Handout 10, Parts of an Egg Diagram and Air Cell Depth Gauge

Parts of an Egg

![Diagram of Parts of an Egg]

- ALBUMEN
  - Outer thin
  - Firm
  - Inner thin
  - Chalaza

- YOLK
  - Germinal spot
  - Latebra
  - Yolk (Vitelline) membrane

- SHELL MEMBRANES
  - Air cell
  - Outershell membrane
  - Inner shell membrane

Air Cell Depth Gauge

![Diagram of Air Cell Depth Gauge]

- Point from which to measure air cell depth.
- 90°
- OFFICIAL EGG AIR CELL GAUGE
  - AA QUALITY
    - ⅛ inch
  - A QUALITY
    - ⅜ inch

110-Poultry, Level III
**EGG GRADING**
**POULTRY, LEVEL III**
**Member Handout 11, Interior and Exterior Quality Grades**

### Standard for Interior Quality of Eggs

<table>
<thead>
<tr>
<th>Quality Factor</th>
<th>AA Quality</th>
<th>A Quality</th>
<th>B Quality</th>
<th>Inedible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Cell</td>
<td>⅛ inch or less in depth</td>
<td>⅛ inch or less in depth</td>
<td>More than ⅛ inch</td>
<td>Doesn’t apply</td>
</tr>
<tr>
<td>White</td>
<td>Clear, firm</td>
<td>Clear, may be reasonably firm</td>
<td>Clear, may be weak and watery</td>
<td>Doesn’t apply</td>
</tr>
<tr>
<td>Yolk</td>
<td>Outline slightly defined</td>
<td>Outline may be fairly well-defined</td>
<td>Outline clearly visible</td>
<td>Doesn’t apply</td>
</tr>
<tr>
<td>Spots (Blood or meat)</td>
<td>None</td>
<td>None</td>
<td>Blood or meat spots aggregating not more than ⅛ inch in diameter</td>
<td>Blood or meat spots aggregating more than ⅛ inch in diameter</td>
</tr>
</tbody>
</table>

### Standard for Exterior Quality of Eggs

<table>
<thead>
<tr>
<th>Factor</th>
<th>AA or A</th>
<th>Grade B</th>
<th>Dirty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stain</td>
<td>Clean—may show small specks, stains or cage marks that do not detract from general clean appearance of the egg—may show traces of processing oil.</td>
<td>Slight, or moderate localized stains less than ⅛ of shell or scattered stains less than ⅛ of shell.</td>
<td>Prominent stains. Moderate stains covering more than ⅛ of the shell if localized and ⅛ of the shell if scattered.</td>
</tr>
<tr>
<td>Adhering Dirt or Foreign Material</td>
<td>NONE</td>
<td>NONE</td>
<td>Adhering dirt or foreign material (1.0 mm in area or greater)</td>
</tr>
<tr>
<td>Egg Shape</td>
<td>Approximately the usual shape.</td>
<td>Unusual or decidedly misshapen (very long or distorted)</td>
<td></td>
</tr>
<tr>
<td>Shell Texture</td>
<td>May have rough areas and small calcium deposits that do not materially affect shape or strength.</td>
<td>Extremely rough areas that may be faulty in soundness or strength. May have large calcium deposits.</td>
<td></td>
</tr>
<tr>
<td>Ridges</td>
<td>Slight ridges that do not materially affect shape or strength</td>
<td>May have pronounced ridges.</td>
<td></td>
</tr>
<tr>
<td>Shell Thickness</td>
<td>Free from thin spots.</td>
<td>May show pronounced thin spots.</td>
<td></td>
</tr>
</tbody>
</table>

---

111-Poultry, Level III
EGG GRADING
POULTRY, LEVEL III
Member Handout 12, Broken-out Egg Quality Chart

Specifications for broken-out eggs

<table>
<thead>
<tr>
<th>AA or Fresh Fancy Quality</th>
<th>A Quality</th>
<th>B Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="AA or Fresh Fancy Quality Image" /></td>
<td><img src="image2.png" alt="A Quality Image" /></td>
<td><img src="image3.png" alt="B Quality Image" /></td>
</tr>
<tr>
<td><img src="image4.png" alt="AA or Fresh Fancy Quality Image" /></td>
<td><img src="image5.png" alt="A Quality Image" /></td>
<td><img src="image6.png" alt="B Quality Image" /></td>
</tr>
<tr>
<td><img src="image7.png" alt="AA or Fresh Fancy Quality Image" /></td>
<td><img src="image8.png" alt="A Quality Image" /></td>
<td><img src="image9.png" alt="B Quality Image" /></td>
</tr>
</tbody>
</table>

Contestants should learn to assign the proper grade by comparing actual broken-out eggs with the USDA broken-out egg chart. The diameter of the outline of the thick white (top view) may give an indication as to grade; however, the height of the thick albumen (side view) is the most important factor in determining grade. For example, an extra large egg may have a rather large, thick albumen outline and also sufficient height of thick albumen to be Grade AA.

Contestants should evaluate each egg on its own merit and not compare it with other eggs in the class. If you set an incorrect standard, your grade scale could be off, causing you to incorrectly grade several eggs. Learn by comparing to the USDA chart for broken-out eggs.

Think Back:
Why are quality factors important in the egg or any other industry? Compare quality with price.
What Members Will Learn . . .

ABOUT THE PROJECT:
• The procedures for processing live poultry for meat
• The purposes of each step in the processing procedure

ABOUT THEMSELVES:
• The importance of meat in their diet
• The importance of sequence and order in life

Materials Needed:
• Two sets of notecards with processing steps written on them (Leader Guide)
• Rope with 1-inch block of wood tied to one end
• Sharp knife
• Bucket or tank of hot water (135° to 140°F)
• Container full of cold water
• Live bird or model of bird

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY:
Home processing of poultry is not difficult and requires a minimum of equipment: a rope with a 1-inch block of wood tied to one end, a sharp knife, a bucket or tank of hot water (135° to 140°F), and a container full of cold or ice water for cooling the carcass.

Let’s see if we can identify and place the steps of processing in order. I’m going to hand you a group of cards and I want you to try and arrange them in the order they would be followed.

PREPARATION OF BIRDS
Birds should be taken off feed eight to 10 hours before slaughter to reduce the amount of material in the digestive tract.

Check for Health of Birds
Some birds in the flock may show symptoms that raise questions about their health at the time of processing. Do not use birds that have any of the following:
• lumps or spots of any size on the surface of the liver
• any measurable quantity of fluid in the body cavity
• fat in poorly fleshed bird which is orange rather than yellow or white
• any internal organ that is abnormally large

Leader Notes
Show items needed as you explain.
Hand out cards with processing steps written on them. Let members arrange them in the order they think should be followed. After they have completed this task, begin explaining the steps and have members place another set of cards in the order as presented. At the end of the lesson, have members compare their original list with the steps presented. Note: Best to have two sets of cards for every three to five members.
These conditions are symptoms of one or more diseases that make the flesh unsuitable for human food.

- breast meat with the same coloration as meat of the thighs and legs
- meat showing white streaks or an area of abnormal enlargement

Birds with defects such as bruises, blisters and skin tears can be processed into wholesome carcasses by removing the damaged tissue.

**POULTRY PROCESSING PROCEDURE**

The processing procedure is divided into three steps. It is the purpose of this lesson to explain and identify the home dressing process. Therefore, it will be simpler to handle each step separately. If at any time you become ill or uncomfortable, please feel free to lower your head or leave.

**Step One: Killing, Scalding, Picking and Singeing**

1. Hang the bird by its feet by using the rope and block. Gently take the head of the bird in one hand with the comb in the palm, and with a very sharp knife cut the jugular veins that come down each side of the neck. Hold the bird’s head firmly so it will not scatter blood while bleeding.

2. After the bird is dead, immerse it in hot water (135° to 140°F) for 30 to 40 seconds. Move the birds up and down in the water to help the water penetrate through the feathers to the skin. Adding detergent to the scalding water improves the water penetration and subsequent feather removal.

3. Hang the bird by the rope after scalding. Remove the feathers by rubbing the carcass. The skin will be slightly cooked and tear easily if the water is too hot. Mature chickens and turkeys may have a few hairs. Use an open flame to burn these off.

4. Place the carcass in cool water until all birds are processed. Keeping the carcasses wet also prevents browning of the skin from dehydration.

**Step Two: Eviscerating and Washing**

1. When you are ready to eviscerate (removing the internal organs from the carcass), take it out of the cool water and lay on a flat, solid surface. Cut off the feet at the hock joint and remove the head.

2. Eviscerate carcass for use whole, cutup, or split:
   a. Slit the skin on the top of the neck from the head to the body and remove the windpipe and crop.
   b. Remove the oil gland at the base of the tail.
   c. Carefully make an incision around the vent into the body cavity and gently pull the viscera (intestines, gizzard, heart) toward you. Remove the lungs, which are imbedded in the ribs.
   d. Clean and wash the gizzard, liver and heart. Wash the carcass.
Step Three: Chilling, Packaging and Storing
1. Place the carcass in ice water to lower the temperature of the carcass to below 40°F. Chilling retards bacterial decomposition and allows aging of the muscles.

2. Remove the chilled carcass from the ice water; allow carcass to drain before further processing and packaging.

3. Cut up according to preference (split for barbecuing, pieces for frying).

4. Place in freezer bags for long-term storage or the refrigerator for short-term storage (less than four days).

KANSAS MEAT INSPECTION LAW
The processing of most poultry in Kansas for sale comes under the Kansas Meat and Poultry Inspection Act. Producers may slaughter and sell directly to household consumers not more than 250 turkeys or 1,000 broilers per year they have raised on their own farm without coming under the inspection law.

DIALOGUE FOR CRITICAL THINKING:
Share:
1. If you processed a live bird, what was your general reaction to the procedure? Why?

2. If you used a model, what was your reaction to the proposed procedure? What do you think your reaction would have been to the real procedure? Why?

3. How difficult was it to arrange the processing steps in order? Why?

Process:
4. What are the major steps in poultry processing?

5. Why is it important to check the health of the bird before and during processing?

Generalize:
6. What did you learn about yourself through this activity?

7. How important is meat in your diet? Why?

Apply:
8. How will you act differently in the future as a result of this activity? Why?

9. How important is sequence when doing various activities? (List several different activities and discuss sequence.)
GOING FURTHER:
- Learn about and compare the processing procedures and methods used in other livestock.
- Prepare and present a talk or demonstration at a 4-H meeting or school classroom.
- Contact a poultry processing plant and find out the procedures they use to process poultry for meat.
- Participate in a poultry judging contest and learn how to grade ready-to-cook poultry.
- Have a taste party where you can sample various types of poultry and poultry recipes.

REFERENCES
Home Processing of Poultry, L-769, K-State Research & Extension

Author:
Albert W. Adams, Professor Emeritus, Poultry Sciences, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
R. Scott Beyer, Extension Specialist, Poultry Science, Kansas State University

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116-Poultry, Level III
PROCESSING OF POULTRY MEAT
POULTRY, LEVEL III
Leader Guide for Notecards

Poultry Processing Procedure:

• Hang the bird by its feet using the rope and block.

• Take the head of the bird in one hand with the comb in the palm, and cut the jugular veins that come down each side of the neck.

• Immerse it in hot water (135° to 140°F) for 30 to 40 seconds.

• Hang the bird by the rope after scalding.

• Remove the feathers by rubbing the carcass.

• Use an open flame to burn (singe) feathers off.

• Place the carcass in cool water.

• Take carcass out of the cool water and lay on a flat, solid surface.

• Cut off the feet at the hock joint and remove the head.

• Slit the skin on the top of the neck from the head to the body and remove the windpipe and crop.

• Remove the oil gland at the base of the tail.

• Make an incision in the body cavity and gently pull the viscera (intestines, gizzard, heart) toward you. Remove the lungs, which are imbedded in the ribs.

• Clean and wash the gizzard, liver and heart. Wash the carcass.

• Place the carcasses in ice water to lower the temperature of the carcasses to below 40°F.

• Remove the chilled carcasses from the ice water; allow carcasses to drain before further processing and packaging.

• Cut up carcass according to preference.

• Place in freezer bags for long-term storage or the refrigerator for short-term storage (less than four days).
What Members Will Learn . . .

ABOUT THE PROJECT:
• The physical characteristics used in grading ready-to-cook poultry carcasses
• Types of poultry products that are sold in supermarkets

ABOUT THEMSELVES:
• The importance of grading systems in your life

Materials Needed:
• Large sheet of paper or chalkboard
• Marking pen
• Member Handout 13, Guide for Estimating the Size of Tears, Cuts and Discolorations
• Member Handout 14, Quality Specifications for Ready-to-Cook Poultry
• Pictures or actual carcasses demonstrating the different quality grades

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY:
Poultry carcass quality is determined by the following differences: size and weight, cuts and tears, missing parts, broken and/or disjointed bones.

Now let’s take a look at some carcasses and examine them for some of these defects.

CARCASS GRADES:
Carcasses are graded A, B or C (no grade) quality. Factors used in judging ready-to-cook carcasses in a 4-H poultry judging contest are exposed flesh due to cuts, tears, and trims, broken and disjointed bones, and missing parts. A carcass is graded according to the lowest grade defect found on the carcass.

CUTS, TEARS AND TRIMS:
Cuts, tears and trims are a result of a miscut with a knife, tearing of the skin during the processing operation, or trimming to remove a defect such as a breast blister. When ready-to-cook poultry is downgraded for the severity of cuts, tears and trims, it is based on the weight of the carcass and the part.
Cuts, tears or trims must be completely through the skin so the meat, called flesh, can be seen in order to put the carcass in a lower grade. The grade is determined by the amount of exposed flesh, length of cut or amount of skin missing. Sometimes, there may be more than one cut, tear or trim on the same carcass or part. If this is the case, add the length, or amount missing, to determine the grade based on that part only. Each part is graded separately and the grade is determined by the part having the lowest grade on that carcass.Exposed flesh from the continuation of an evisceration cut at the front and back of the breast should not be considered in determining carcass grade.

MISSING PARTS:
Missing parts to be considered when determining quality grade are the wings, tail and part of the back area if it is no wider than the base of the tail. The weight of the carcass is not considered.

DISJOINTED OR BROKEN BONES:
A disjointed bone is where the joint is out of the socket. The bone is still whole, not broken. You will be able to see the end, or knobby part of the joint underneath the skin.

Broken bones occur between the ends of bones. They can be broken so that the bone either does or does not show through the skin. When the broken bone does not come through the skin it is called non-protruding. When the bone penetrates the skin, it is called protruding.

Grade A Carcass
The Grade A carcass is not permitted to have any cuts, tears or missing skin on the breast and legs. On other parts of the carcass a few cuts or tears are allowable depending on the carcass weight. For example, if a carcass weighs between 2 to 6 pounds, there may be up to a \( \frac{3}{4} \) inch area of flesh exposed on the back or wings, compared to only 1 inch for a carcass under 2 pounds.

A Grade A carcass can have only the tail at the base of the body and the wing tips removed.

A Grade A carcass can have one disjointed bone, but no broken bones.

Grade B Carcass
A carcass of Grade B quality may have up to one-third of flesh exposed on each part of the carcass provided the meat yield is not affected. A slight cut into the meat, not more than the thickness of a nickel (\( \frac{3}{4} \) inch) so that the appearance of the part does not look bad, is permitted in Grade B.

A Grade B carcass may be missing the wing up to the second joint, as well as the tail and back less than halfway to the hips.

If a carcass has no more than two disjointed bones or one disjointed and one nonprotruding broken bone, it can be classified as a Grade B carcass.
Grade C Carcass
A Grade C carcass has more than one-third of the flesh showing on the carcass. If the trim into the meat is more than the width of a nickel (⅛ inch) or the trim definitely alters the appearance of the meat, then it is a Grade C.

In a Grade C carcass the wing may be cut off at the third joint at the juncture of the body. It may also be missing the tail and back, more than halfway to the hip.

More than two disjointed and one or more broken, protruding bones, make a carcass Grade C.

DIALOGUE FOR CRITICAL THINKING:
Share:
1. What carcass grades did you see most? Why?
2. What was your most difficult aspect of grading poultry carcasses? Why?

Process:
3. What are the major factors that determine poultry carcass grades?

4. Why do you think it is important for USDA to have poultry carcass grades?

Generalize:
5. What other grading systems are you familiar with?

6. What are the purposes for grading systems? Are they different? Why?

Apply:
7. How important do you feel grading systems or standards are in your life? Why?

8. What effect will grading systems and standards have in the future? Will they be needed more? Or less? Why?

GOING FURTHER:
- Participate in a poultry judging contest.
- Obtain information from USDA regarding quality grades and inspection requirements.
- Prepare an illustrated talk and present to a group.
- Visit a grocery store and identify types of poultry products that are sold.
- Invite a poultry meat inspector to your meeting.

After going through grade specifications, have members grade sample carcasses. Provide Member Handout 13, Guide for Estimating the Size of Tears, Cuts and Discolorations, and Member Handout 14, Quality Specifications for Ready-to-Cook Poultry, to assist members in learning to grade and for their record book.
Leader Notes

REFERENCES:
*Poultry Judging, 4-H 92, Nebraska Cooperative Extension*

Author:
Adapted from above reference by Cynthia R. Siemens, Extension Assistant, Kansas State University; James P. Adams, Extension Specialist, 4-H Youth Programs, Kansas State University

Reviewed By:
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122-Poultry, Level III
GRADING READY-TO-COOK POULTRY
POULTRY, LEVEL III
Member Handout 13, Guide for Estimating Size of Tears, Cuts and Discolorations
### GRADING READY-TO-COOK POULTRY

**POULTRY, LEVEL III**

Member Handout 14, Quality Specifications for Ready-to-Cook Poultry

<table>
<thead>
<tr>
<th>Factor</th>
<th>A Quality</th>
<th>B Quality</th>
<th>C Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposed Flesh</td>
<td>Breast &amp;</td>
<td>Breast &amp;</td>
<td></td>
</tr>
<tr>
<td>Carcass Weight</td>
<td>Legs</td>
<td>Elsewhere</td>
<td></td>
</tr>
<tr>
<td>Min.</td>
<td>Max.</td>
<td>None</td>
<td>1”</td>
</tr>
<tr>
<td>None</td>
<td>2 lbs</td>
<td>None</td>
<td>1½”</td>
</tr>
<tr>
<td>Over 2 lbs</td>
<td>6 lbs</td>
<td>None</td>
<td>2”</td>
</tr>
<tr>
<td>Over 6 lbs</td>
<td>16 lbs</td>
<td>None</td>
<td>3”</td>
</tr>
<tr>
<td>Over 16 lbs</td>
<td>None</td>
<td></td>
<td>NO LIMIT</td>
</tr>
<tr>
<td>Disjointed bones</td>
<td>1 disjointed</td>
<td>2 disjointed and no</td>
<td>NO LIMIT</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>broken or 1 disjointed</td>
<td></td>
</tr>
<tr>
<td>Broken bones</td>
<td>None</td>
<td>1 nonprotruding broken</td>
<td>NO LIMIT</td>
</tr>
<tr>
<td>Missing parts</td>
<td>Wing tips and/or</td>
<td>Wing(s) to 2nd joint.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tail removed at the</td>
<td>Back area not wider than</td>
<td>Entire wing(s)</td>
</tr>
<tr>
<td></td>
<td>base</td>
<td>base of tail and extending</td>
<td>Back area not</td>
</tr>
<tr>
<td></td>
<td></td>
<td>halfway between base of</td>
<td>wider than</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tail and hip joints.</td>
<td>base of tail</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>extending</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>to area between</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>hip joints.</td>
</tr>
</tbody>
</table>

1. Longest length for a cut and total area for tears and missing skin based on the whole part.
2. For purposes of definition, the parts of the carcass shall be each wing, leg, entire breast and entire back.
Integration and Specialization in the Poultry Industry

Poultry, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:
• Nine segments of the poultry industry
• A purpose for each of the nine industry segments

ABOUT THEMSELVES:
• Their feelings about the value of integration in the industry
• Their feelings about their interest in various industry segments as possible careers.

Materials Needed:
• Member Handout 15, Typical Integrated Broiler Firm

ACTIVITY TIME NEEDED: 30 MINUTES

ACTIVITY:

The production and marketing of eggs and poultry meat in the United States is a highly specialized industry. In addition to the producers that care for the birds, the firms that manufacturer feed, and firms that process and market eggs and meat, a number of highly specialized poultry businesses are vital to the success of the poultry industry. The industry is highly integrated, which means that most phases of production and marketing are controlled by one firm. Examples of major specialized poultry businesses are:

Hatching Egg Business
Breeder flocks are kept to supply hatching eggs for hatcheries. The seed or parent stock is usually obtained from the foundation breeder. Management of breeders in most respects is similar to that for an egg production or market turkey flock. However, it costs more to produce hatching eggs than market eggs because breeders lay fewer eggs, the breeders have to be tested for various egg-borne diseases, and males require more feed and space than females.

Control of body weight of breeders is important. Birds, particularly meat-type stocks, have a tendency to put on excess weight in the form of fat. Overweight breeders consume more feed and lay fewer eggs than lean birds. Some type of feed restriction is used to prevent overweight birds.

Not all potential breeders are good enough to be breeders. Particular emphasis is placed on defects that will be passed on to the offspring and those that will have negative effects on performance. Examples of serious defects are a lack of vigor, deformed legs and back, crossed beaks, and evidence of disease.
Leader Notes

**Foundation Breeder Industry**
These firms develop the parent stocks that are used to produce the chicks and poults that are used in the commercial production industry. Because of the large financial investment that is required to develop new lines, this industry is controlled by a few major breeders.

**Started Pullet Growers**
Many commercial egg producers rely on other firms to grow their replacement pullets. The reasons for this is the lack of growing facilities, labor and experience, disease problems, and a desire to concentrate on egg production. A common practice is for the pullet grower and egg producer to have a written contract which specifies such things as sale price, and feeding, lighting, vaccination and debeaking programs. Started pullets are usually delivered to the egg producer between 18 and 20 weeks of age.

**Hatchery Industry**
Hatcheries are firms that convert fertile hatching eggs into day-old poultry in machines called incubators. Because the main source of income for a hatchery is the sale of day-old or started birds, its success is very dependent on the fertility and hatchability of the eggs. Hatcheries that sell most of their birds to owners of small flocks usually hatch only during the spring months. Hatcheries that supply birds to commercial producers hatch throughout the year. Major factors that affect hatchability of hatching eggs are fertility, proper handling and storage of eggs, nutrition of the breeders, and proper incubation of the eggs. A specialized business within the hatchery industry is crews that artificially inseminate commercial turkey breeder flocks.

**Feed Industry**
Poultry is a major consumer of manufactured feed. For example, a laying hen will consume 75 to 80 pounds of feed a year. The quality and cost of feed is very important because feed is the largest cost in producing eggs and meat. A feed manufacturer purchases feed ingredients, such as grain, soybean meal, vitamins and minerals, and combines them to make a complete feed for the birds. The amounts of each ingredient used in a feed depends on the age and type of poultry that will be fed.

**Pharmaceutical (Drug) Industry**
Even under the best of management, drugs are needed. Drugs promote growth, and treat or prevent disease. Examples of drugs for poultry are antibiotics, chemobiotics, wormers and insecticides. The use of drugs in poultry production is closely supervised by the Food and Drug Administration. This agency requires that any drug that is used on poultry must not pose a threat to human health.

**Communication Industry**
Publishers of journals, magazines and newspapers serve the industry by providing current information to the industry. Can you name a few of the more prestigious journals?
Loading Crews
These crews serve a very important function in the poultry industry by loading live birds for processing.

Transportation Industry
In most cases, eggs and poultry are not grown close to major population centers or major sources of feed ingredients. Transportation is needed to transport feed ingredients to the feed mill, live birds and eggs to the processing plant, the finished products to the food stores, and feed and other supplies to the farm.

Housing and Equipment Industry
Most poultry is housed in well-constructed, highly automated buildings. Many of these buildings are as well-constructed, lighted and ventilated as your home. These features provide both the birds and caretakers a good environment in which to live and work. These houses are usually well insulated, ventilated by fans, and equipped with lights, automatic feeders, waterers, egg collection belts, and manure disposal equipment. There are firms that specialize in constructing and equipping poultry houses.

DIALOGUE FOR CRITICAL THINKING:
Share:
1. What segments of the poultry industry are you most interested in? Why?
2. Which segment of the poultry industry do you think is the most complex or hard to understand? Why?

Process:
3. What is the most significant aspect of the poultry industry?
4. What are the advantages and the disadvantages of the poultry industry? Why?

Generalize:
5. Which segments of the poultry industry do you feel have the best career possibilities? Why?
6. What personal characteristics or interests do you feel would be needed to succeed in a particular segment of the poultry industry? Why?

Apply:
7. How do poultry careers compare to livestock careers?
8. If you were to study other industries, what would you do differently? Why?
Leader Notes

GOING FURTHER:
- Ask poultry businesses for information on careers.
- Check out more specialized careers such as poultry artificial inseminating, or poultry veterinarians.

REFERENCES:
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128-Poultry, Level III
INTEGRATION AND SPECIALIZATION IN THE POULTRY INDUSTRY
POULTRY, LEVEL III
Member Handout 15, Typical Integrated Broiler Firm

Ready-to-Cook Broilers

PROCESSING PLANT

Live Broilers

BROILER GROWOUT:
1. CONTRACT GROWERS
2. COMPANY FIRMS

Broiler Feed and Flock Service

FEED MILL

Broiler Chicks

HATCHERY

Breeder Feed

Breeders

HATCHING EGG FARMS:
1. CONTRACT
2. COMPANY

Eggs

129-Poultry, Level III
Think Back:
What standards and efficiencies do you see in the meat production portion of the poultry industry? Are they different from other food industries? Why? Why not?