Poultry Leader Guide

4-H

WASHINGTON STATE UNIVERSITY
EXTENSION

EM083E
Level 3

4-H Poultry Leader Notebook

Level III

Poultry Dating Game

Poultry Science, Level III

What Members Will Learn . . .

ABOUT THE PROJECT

- The physical behavior and secondary sex characteristics of chickens during courtship

ABOUT THEMSELVES:

- Their feelings about making friendships, communicating, dating, peer pressure

Materials Needed:

- Member Handout 1 - "Mating Behavior Diagrams: Chickens, Ducks"

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY

Leader Notes

Since reproduction is one of the main reasons for livestock breeding, 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

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 mallard sexual 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 mallard 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

1. Name the behavioral steps that chickens go through before mating.
2. Which steps are different or similar to other bird species?
3. What are some ways that human males and females react and communicate with each other when they are dating?
4. How do you react to peer pressure about dating?
5. Discuss voluntary and involuntary reactions you may have. How do you control your emotions and hormone-related stimuli?

GOING FURTHER

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

POULTRY DATING GAME
POULTRY SCIENCE, 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 - encourages

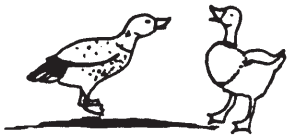
Mounting & treading → Moves tail to one side & everts cloaca

Spreads tail & everts cloaca → Vents meet

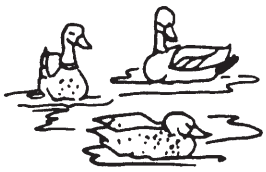
Ejaculation

Steps off, may circle or waltz → Stands, shakes, may run

DUCKS

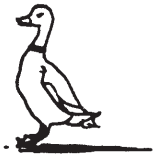


The "rab rab" chatter of a mallard pair (hen left; drake right) calms both members.



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

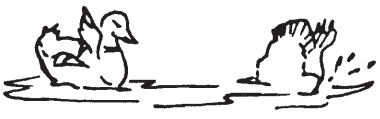
Rejection-gesture used by the female when harassed by drakes giving unwanted attention.



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

Headshake of the drake

Grunt-whistle of the drake



Head-up, tail-up of the drake

Reproduction and Fertilization of Poultry

Poultry Science, Level III

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:

- To understand development of newborn mammals as compared to birds
- Their feelings about sperm banks, cloning, and artificial insemination

Materials Needed:

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

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 that 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.

Leader Notes

Give each member the Activity Sheet "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 the activity sheet "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 consensus on correct labeling before asking group to explain and discuss their decisions.

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

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.

Hand out "Time Frame for Egg Formation."

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.

Give members handout on "Genital Organs: Cock and Hen."

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

1. Trace the route the egg takes after release from the ovary through shell formation to being laid.
   (The egg is released from the follicle and into the infundibulum where it is fertilized. It then travels through the magnum, isthmus, and uterus where shell formation occurs. The completed egg then moves to the vagina until it is laid through the cloaca.)
2. How many ova or yolks does a newborn chick have?
   (Several thousand.)
3. How does a hen's egg differ from a cow's egg?
   (A cow's egg is very small (not visible to the human eye) because it doesn't contain a food supply for the developing embryo. The cow's fetus gets its food from its mother's body.)
4. How is a bird's reproductive system different from that of mammals?
5. How does understanding reproduction in poultry help you understand your own sexuality?
6. How do you feel about sperm banks, artificial insemination, and the possibility of cloning in humans?

GOING FURTHER

1. Give a talk on the development of an egg to your class at school.
2. Visit a farm flock and take pictures or observe chickens mating.
3. Study the potential impact of sperm banks and cloning on future societies. Debate the issue at a future meeting.

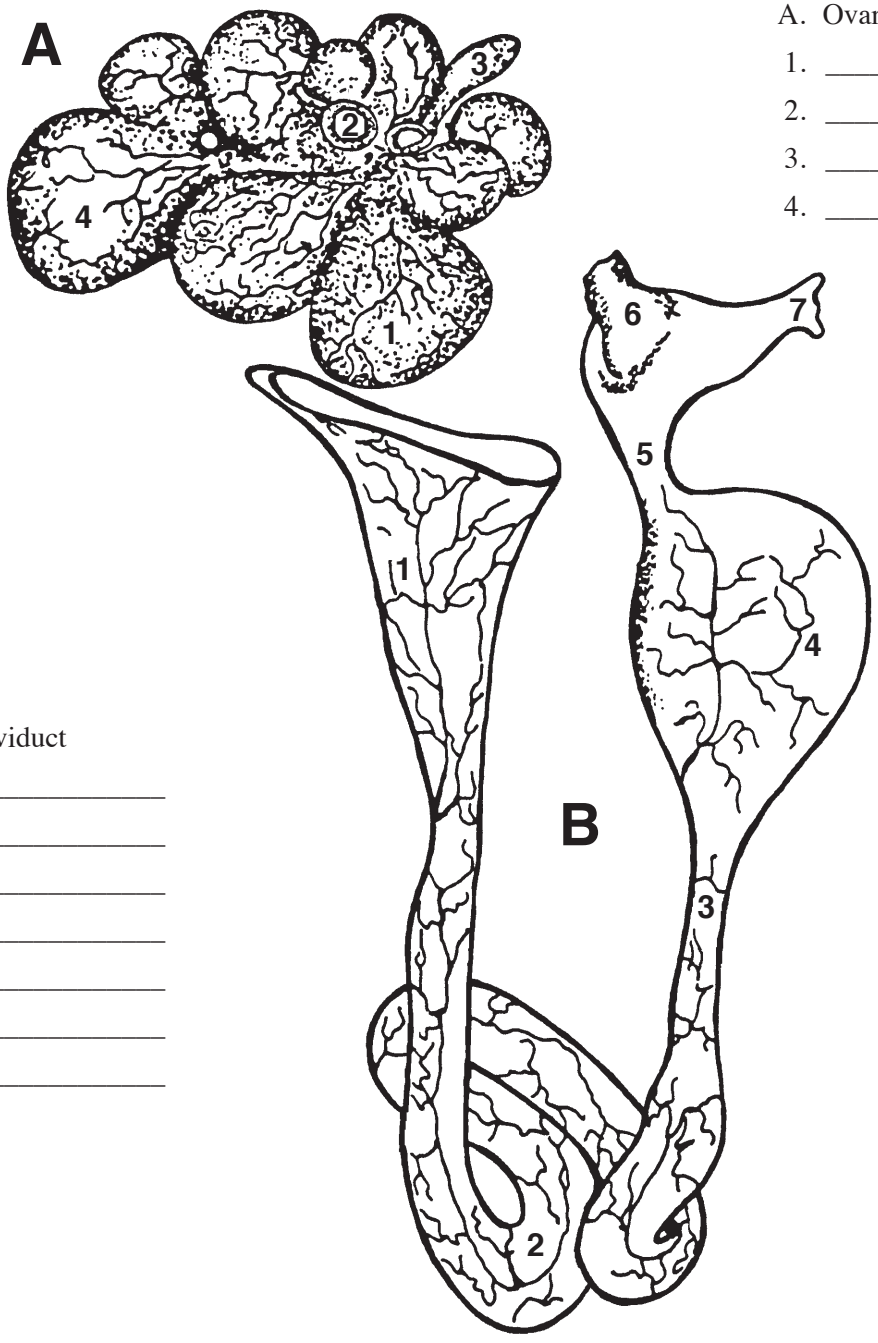
REPRODUCTION AND FERTILIZATION OF POULTRY

POULTRY SCIENCE, LEVEL III

Activity Sheet 1

Hen's Reproductive Tract

Label the parts of the ovary and oviduct.



A. Ovary

1. _____
2. _____
3. _____
4. _____

B. Oviduct

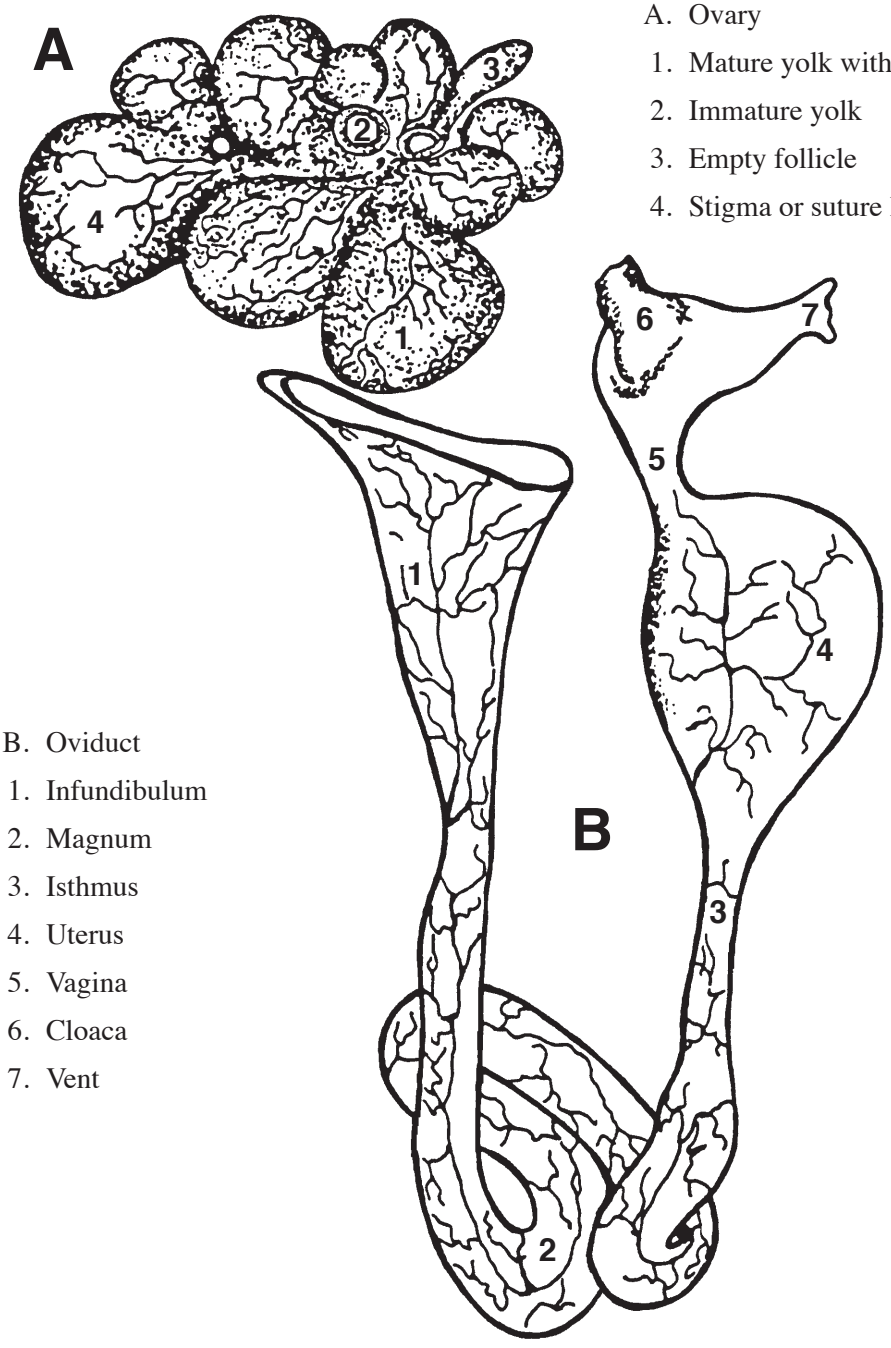
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

REPRODUCTION AND FERTILIZATION OF POULTRY

POULTRY SCIENCE, LEVEL III

Leader's Key

Hen's Reproductive Tract



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

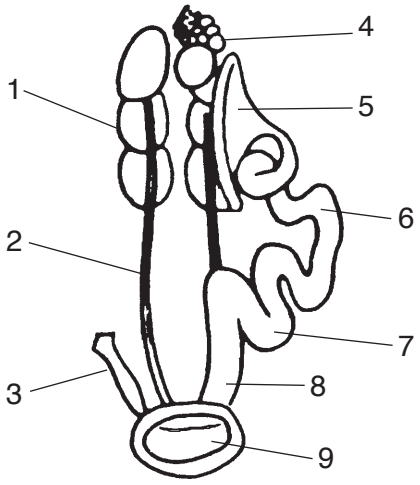
B. Oviduct
1. Infundibulum
2. Magnum
3. Isthmus
4. Uterus
5. Vagina
6. Cloaca
7. Vent

REPRODUCTION AND FERTILIZATION OF POULTRY

POULTRY SCIENCE, LEVEL III

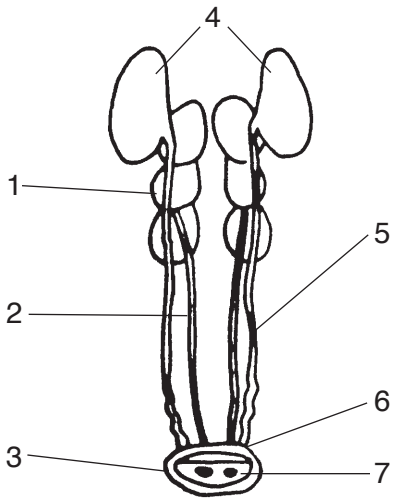
Member Handout 2

Genital Organs: Cock and Hen



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



Cock

1. Kidneys
2. Ureter
3. Cloaca
4. Testes
5. Ductus deferens
6. Seminal vesicle
7. Papillae

REPRODUCTION AND FERTILIZATION OF POULTRY
POULTRY SCIENCE, LEVEL III
Member Handout 3

Time Frame for Egg Formation

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

Proper Handling of Hatching Eggs

Poultry Science, 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 importance of prenatal care in humans
- Their feelings about the use of drugs during pregnancy

Materials Needed:

- Thirty eggs for hatching
- Activity Sheet 2 - "Egg Handling Activities and Problems"

ACTIVITY TIME NEEDED: 30 MINUTES

ACTIVITY

Leader Notes

Not all fertile eggs hatch into normal, vigorous young. 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, or 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 extremly 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. **Store your hatching eggs** in a clean area at 55° to 65°F and 70–80 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 prevent evaporation and an enlargement of the egg's air cell and improve hatchability. Turn the eggs slightly once per day if they are to be held longer than 7 days. This prevents the yolk from sticking to the shell.

4. **Hold eggs for minimum time**. Eggs should be set 7 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.

Give each member the "Egg Handling Activities and Problems" handout. Do these as a group or individually. Make observations and discuss as you incubate some eggs. Note: problem 4a. requires 1,000 pullets x 2 = 2,000 straight -run chicks. Divide 2,000 chicks by .90 hatchability = 2,222 eggs set

DIALOGUE FOR CRITICAL THINKING

1. Name three reasons that could cause poor hatchability in eggs.
2. Why is the relative humidity important when storing eggs?
3. Why should extremely soiled eggs not be used for hatching?
4. What problems have you experienced when trying to hatch eggs?
5. Relate the proper handling of hatching eggs to proper prenatal care in humans.
6. What other animals have you observed that require special prenatal care?
7. How does smoking and use of drugs affect decisions of prenatal care?

GOING FURTHER

1. Visit a hatchery and observe their egg handling procedures.
2. Obtain a small, still air incubator and incubate some eggs.

PROPER HANDLING OF HATCHING EGGS
POULTRY SCIENCE, 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. Observe differences in the appearance of the different ages of embryos. Break one egg open on each weigh date for further observation. Record your observations and discuss.

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 Science, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:

- Three critical periods of embryonic development
- Causes of embryonic mortality

ABOUT THEMSELVES:

- Their feelings about prenatal care to the human fetus
- Their feelings about the effects of alcohol, smoking, and drug use by pregnant women

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) 0-4 days, 2) 5-17 days, and 3) 18-21 days.

During the **early embryonic** stage (0-4 days), causes of **mortality** may be:

- Eggs held too long - eggs should be set by 7 to 10 days after laid for maximum hatchability.
- Eggs stored improperly - eggs should be stored in a clean area at 55°-65°F and 70-80 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

Leader Notes

Have each member incubate a certain number of eggs. Have each 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.

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.

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

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

DIALOGUE FOR CRITICAL THINKING

1. What are the three critical periods during embryonic development?
2. What good management practices prevent embryonic mortality?
3. What were major causes of embryonic mortality in your incubator?
4. What are some causes of infant mortality in humans?
5. Will your experience with this experiment change any views you have toward care of human fetuses?
6. How do you feel about pregnant women who smoke, drink alcohol, or use drugs?

General Hatchery Management Practices

Poultry Science, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:

- Pre- and post-hatch functions of an efficient hatchery
- Stages of embryonic development
- Record keeping

ABOUT THEMSELVES:

- Their feelings about hatchery management functions
- Their interest in business management
- Their feelings about the value of business records

Materials Needed:

- Member Handout 3 - "Embryonic Mortality and Development Stages"
- Member Activity Sheet 4 - "Hatchery Record Sheet"

ACTIVITY TIME NEEDED: 30 MINUTES

ACTIVITY

Leader Notes

Today'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 the incubation of eggs, and its finished product 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 parent birds, 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 70-80 percent. The eggs are moved into the incubator room several hours prior to setting to warm the eggs up to room temperature (70°-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 automatically. The following are general recommendations for chicken eggs incubated in a forced-draft incubator.

	Stage of Development	
	1 – 18 days	**18 – 21 days**
Temperature	99°-100°F	97°-98°F
Humidity		
Relative humidity	60%	75%
Wet bulb temperature	84°– 86°F	88°– 90°F
Oxygen level	21%	21%
Carbon dioxide level	.5%	.5%
Turning	3-8 times	Not necessary

Have members set 20-24 eggs in a small incubator and determine the fertility, hatchability, and moisture loss of the eggs using the member Activity Sheet "Hatchery Record Sheet." Moisture loss is a good indication of the proper relative humidity of the incubator. For example, chicken eggs should lose approximately 12 percent of their weight during incubation. Using the "Guidelines for Determining Age of Embryonic Mortality" portion of the "Embryonic Mortality and Development Stages" handout, have members determine the approximate age at which the embryos died and the presence of abnormal embryos.

TROUBLESHOOTING. 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 poults are usually beak-trimmed prior to leaving the hatchery.

Declawing. This procedure involves the surgical removal of the tips of the 2–3 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.

Visit a hatchery to see how many of the additional services are provided. Discuss the need and economics of each service.

DIALOGUE FOR CRITICAL THINKING

1. What was your first impression of hatchery management?
2. How did you feel about hatchery management as a potential job or career?
3. What is the biggest problem when operating a hatchery? Why?
4. What business concepts did you observe that would be similar to other businesses?
5. How important do you feel record keeping is when operating a business? Why?
6. What business principles did you learn that will help you no matter what business or career you choose.

GOING FURTHER

1. Study the potential for future broiler production in your area.
2. Give a presentation about the services provided by a hatchery.
3. Discuss consumer demand for poultry meat past, present, and future.

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

Early (0 to 4 days)	- 2 to 3%
Middle (5 to 17 days)	- 1%
Late (18 to 21 days)	- 3 to 4%

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 10-20 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 SCIENCE, LEVEL III
Activity Sheet 4

Hatchery Record Sheet

Source of Eggs_____ Date Eggs Set _____

When a lot of eggs are set, indicate the number set and 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) x 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) x 21 = projected moisture loss.

The Chicks Are Here

Poultry Science, 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:

- The differences between chicks and human babies in their dependency on the parent at birth
- Their feelings about preparation for an event or activity within the family

Materials Needed:

- Member Handout 5 - "Brooder Layout"
- 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.

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 the feed and water in place?
7. Is the housing and equipment adequate?

Leader Notes

Ask members what preparations need to be completed before newly hatched chicks arrive. Write their responses on a large piece of paper or chalkboard. Have each member prepare a checklist of things to do to prepare.

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 3 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.

Show example of brooder. Distribute "Brooder" handout and have members follow along as you describe the setup.

For small flocks, brooding can be done with an electric or gas brooder or infra-red lamp. Infra-red 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 that 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 one another.

Set the brooder temperature at 90°– 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 ½ 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
Provide adequate space. The minimum space requirements for baby chicks is ¾ 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– 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 4 days, use just the small feeder; and as soon as possible, switch to a larger feeder.

Two of the nonautomatic 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– 3 inches of feeder space per bird.

For the first 4 to 6 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 6 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 5 weeks of age.

WATERERS
Chickens need fresh, clean water available to them at all times. Start your chicks on small gravity-fed water fountains, then 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 remove the fountains gradually. 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 nonautomatic fountains are used, set them on a wire platform about 2-3 inches off the floor to keep 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

3 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.

Have members rank a list of needs for newly hatched chicks. Let them defend their list of priorities.

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. Starvation deaths usually occur at 4– 5 days of age.

3. **Piling**
   Insufficient heat or fright may cause the chicks to pile in corners, and lead 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 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.

DIALOGUE FOR CRITICAL THINKING

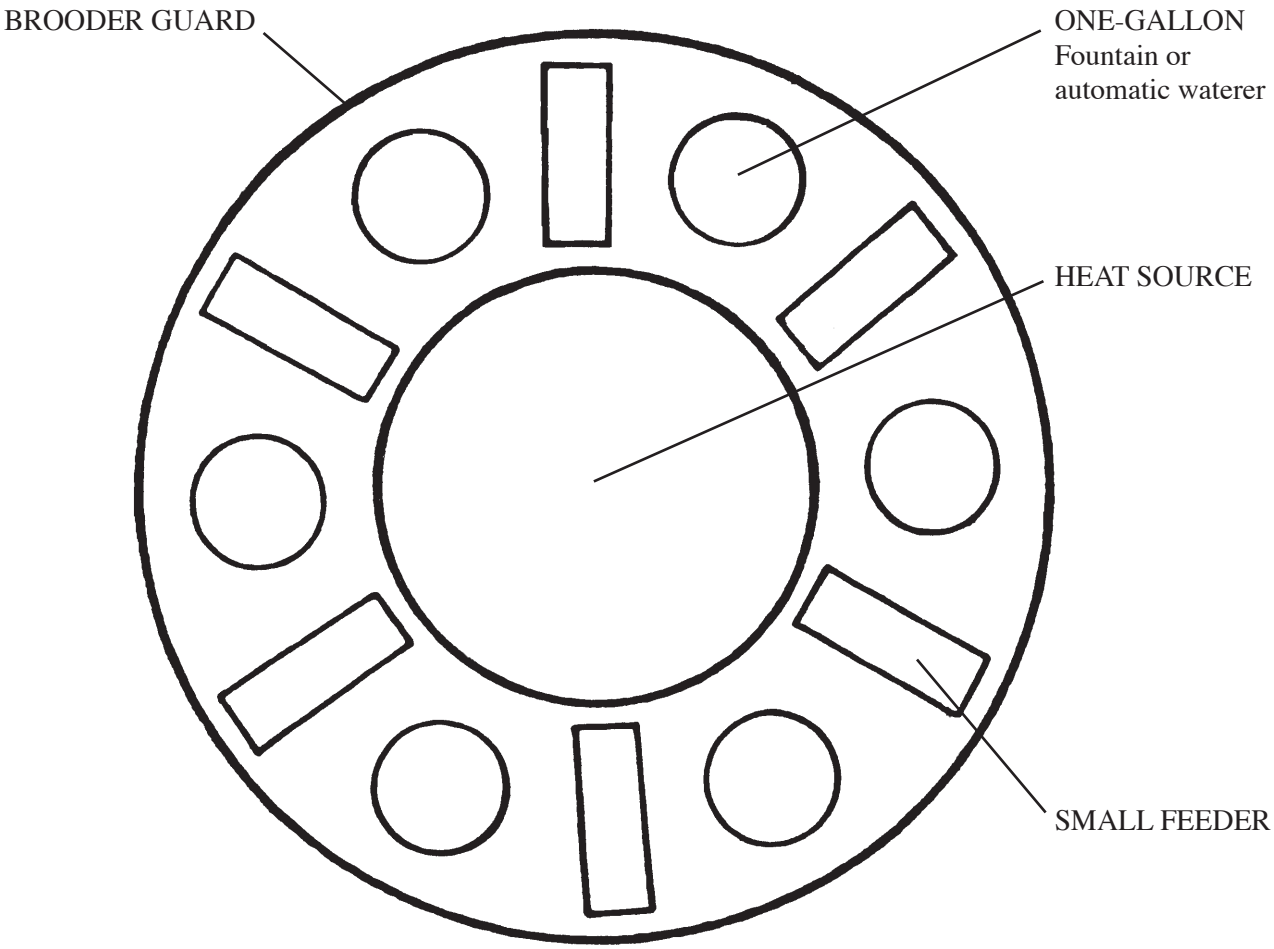
1. Name several steps in preparing for newly hatched chicks.
2. Name some equipment that is necessary in a brooder house.
3. List common problems to watch for when raising newly hatched chicks.
4. How are baby chicks different from other newborn animals or infants?

GOING FURTHER

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

THE CHICKS ARE HERE
POULTRY SCIENCE, LEVEL III
Member Handout 5

Brooder Layout for Equipment Setup



Basic Nutritional Needs of Poultry

Poultry Science, 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
- Basic functions of six nutrient classes in humans

Materials Needed:

- Facilities to rear two groups of 10 chicks each
- Scales
- 22 percent protein ration
- 18 percent protein ration
- Member Handout 5 - "Chick Weigh Sheet and Nutrient Functions"

ACTIVITY TIME NEEDED: SEVEN WEEKS

ACTIVITY

Leader Notes

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 one-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 four 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 2) and give a function of that nutrient class. Discuss these functions.

DIALOGUE FOR CRITICAL THINKING

1. What differences did you observe or find in the birds? At 4 weeks? At 7 weeks?

2. What problems occurred when conducting this experiment?
3. What happened to the 18 percent ration birds after they were switched to the 22 percent ration?
4. What did you learn about the value of protein?
5. How do you think a shortage of protein in your diet would affect you?
6. What symptoms do you see displayed by children from other countries who have not had enough to eat or have not had balanced diets?

GOING FURTHER

1. Study the effects a lack of some of the other nutrients would cause on young chicks.
2. Give a talk to your class or club on the results of your experiment.
3. Balance a poultry ration using your own ingredients.

BASIC NUTRITIONAL NEEDS OF POULTRY

POULTRY SCIENCE, LEVEL III

Member Handout 5

Chick Weigh Sheet and Nutrient Functions

Nutrient Class	Functions
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Chick Body Weights

____ day(s) old		**4 weeks**		**7 weeks**	
22% Protein	18% Protein	22% Protein	18% Protein	22% Protein	18% Protein
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Controlling Body Weight of Replacement Birds

Poultry Science, 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:

- How to control their body weight
- Proper weight control methods available to use
- Their physical condition compared to others their age

Materials Needed:

- Pencil
- Calculator (optional)
- Activity Sheet 6 - "18-Week Body Weights"
- Activity Sheet 7 - "Flock Body Weight Calculation Form"

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY

Leader Notes

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 cost 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 (nondigestible carbohydrate) can be added to the diet to reduce the concentration of nutrients.

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 the birds 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 between 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.

Handout Activity Sheet 6 - "18-Week Body Weights" for a flock of egg-type pullets, and Activity Sheet 7 - "Flock Body Weight Calculation Form." Have the youth calculate the average body weight and uniformity of body weight for the flock.

Point out to the members 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.

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 that 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

1. Identify and discuss five reasons for controlling body weight in replacement birds.
2. What method do you use to control body weight in your replacement birds?
3. What problems did you have when doing the body weight control problems?
4. How can you relate the information about weight control in poultry to leading a healthy lifestyle in humans?
5. What is the general physical condition of most people your age? What does the media tell you?
6. What weight control methods are available to youth your age that are different or similar to those used for poultry?

GOING FURTHER

1. Invite a doctor or other professional to discuss youth weight control with your group.
2. Study and analyze commercial diet programs.
3. Review and discuss weight, height, and frame tables for humans.

CONTROLLING BODY WEIGHT OF REPLACEMENT BIRDS

POULTRY SCIENCE, LEVEL III

Activity Sheet 6

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 SCIENCE, LEVEL III

Activity Sheet 7

Flock Body Weight Calculation Form

Weight Ranges (grams)											No.	Avg. wt.	Total wt.
0700-0749												0725	
0750-0799												0775	
0800-0849												0825	
0850-0899												0875	
0900-0949												0925	
0950-0999												0975	
1000-1049												1025	
1050-1099												1075	
1100-1149												1125	
1150-1199												1175	
1200-1249												1225	
1250-1299												1275	
1300-1349												1325	
1350-1399												1375	
1400-1449												1425	
1450-1499												1475	
1500-1549												1525	
1550-1599												1575	
1600-1649												1625	
1650-1699												1675	

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

Total Birds Weighed _____

Total Weight _____

The Comforts of Home

Poultry Science, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:

- Major poultry housing improvements
- Why environmental control is important to commercial poultry producers

ABOUT THEMSELVES:

- How they feel about environmental control
- How they feel about improving the environment of birds

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 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° to 80°F and for broilers, 75°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 increases egg and meat production.

Mechanical ventilation 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 keep feed fresh and cut down on waste.

DIALOGUE FOR CRITICAL THINKING

1. What do you feel is the most significant housing change for poultry? Why?
2. Can you think of any other improvements that could be made in poultry housing?
3. What have been some of the benefits due to automation of equipment to poultry? To humans?
4. How do you feel about controlling the environment in your house?
5. What environmental controls in your home are made for economic reasons? Comfort reasons?
6. Why should poultry producers be concerned about the well-being of their birds?

GOING FURTHER

1. Visit a commercial poultry farm and make a list of automatic equipment that is used.
2. Examine a poultry magazine and compile a list of new poultry automation equipment and housing facilities being developed.
3. Prepare a talk on people's rights and responsibilities to improve the environment for domesticated animals or birds.

Light Sensitivity in Chickens

Poultry Science, 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 savings time

Materials Needed:

- Member Handout 6 - "Hypothalamus-Pituitary Relationship"
- Activity Sheet 8 - "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 six to eight 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

Give each member the handout "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 8 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 11-12 to 14-16 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 Day-length Program. Determine the number of hours of daylight when the flock reaches an age of 18 weeks. Add 7 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.

Hand out Activity Sheet "Lighting Problems" for members to complete individually or as a group.

Light intensity and color of light also influence performance of poultry. The light intensity needed for maximum productivity varies between species. For example, chickens need a lower light intensity than turkeys. Low light intensity is used in windowless houses to reduce cannibalism. Poultry are stimulated more by the red than the 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

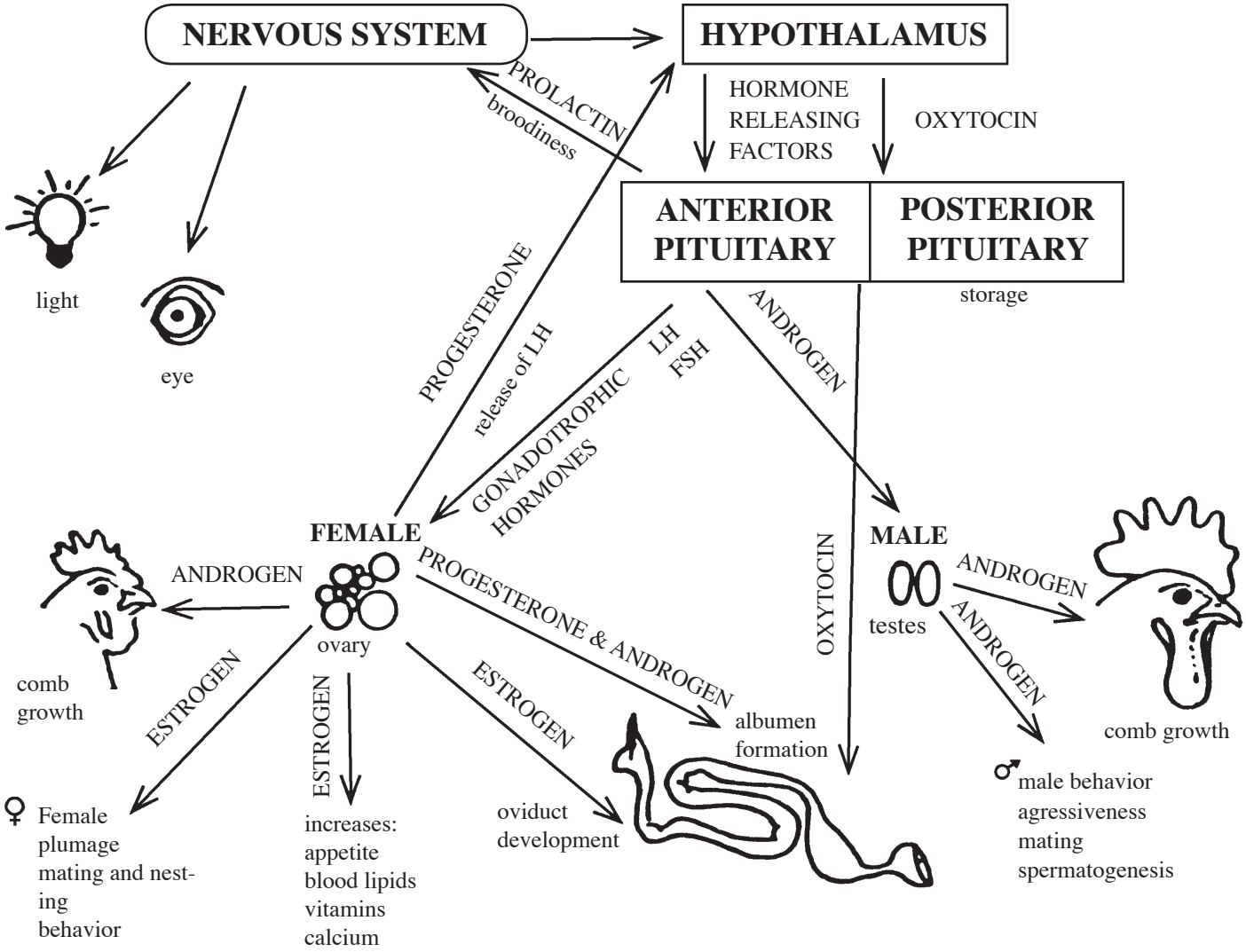
1. What body processes are affected by light in poultry?
2. Describe how the chicken's hypothalamus and pituitary gland react to light.
3. Why and how is artificial light used in commercial poultry operations?
4. What are some of the effects of light on human behavior?
5. How do you feel about the use of daylight savings time?

GOING FURTHER

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

LIGHT SENSITIVITY IN CHICKENS
POULTRY SCIENCE, LEVEL III
Member Handout 6

Hypothalamus-Pituitary Relationship



Relationship between the nervous system, endocrine glands, and the reproductive system in male and female fowl.

LIGHT SENSITIVITY IN CHICKENS
POULTRY SCIENCE, LEVEL III
Activity Sheet 8

Lighting Problems

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

2. Calculate the cost of electricity per month for a 40- x 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.

Managing a Small Laying Flock

Poultry Science, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:

- Decisions 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
- Their responsibility for maintaining their health and personal hygiene

Materials Needed:

- Building that is dry, well-ventilated, and protected from extreme temperature (optional)
- Activity Sheet 9 - "Planning for a Small Laying Flock"
- Activity Sheet 10 - "Small Laying Flock Budget" (2 pages)
- Activity Sheet 11 - "Small Laying Flock Record" (2 pages)

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY

Leader Notes

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.

Give each member Activity Sheet 9 "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.

This lesson will help you make decisions about starting a small laying flock. Use Activity Sheet 9 "Planning for a Small Laying Flock" as a guide.

Now let's consider planning for the costs and expected income of a small laying flock. You will need to consider 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 10 "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.

Leader Notes

Give each member planning to actually start a flock Activity Sheet 11 "Small Laying Flock Record." Make plans for the members to visit the flock locations to observe and discuss their experiences. Compare actual records with budget proposals at the end of the year.

If you decide to 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

1. How did you decide which breed or variety to purchase?
2. What type of building did you use?
3. How hard was it to prepare the building for the hens?
4. How did you decide who would and when to care for the hens? Who would and when to gather the eggs?
5. What did you learn about routines, habits, and responsibility?
6. What do you have to do daily to maintain your health and personal hygiene?
7. What other things are you responsible for on a daily basis?

GOING FURTHER

1. Discuss the advantages and disadvantages of dual-purpose vs. egg-type breeds.
2. Consider the possibilities of expanding a flock to supply eggs to a local restaurant, food market, etc.

MANAGING A SMALL LAYING FLOCK
POULTRY SCIENCE, LEVEL III
Activity Sheet 9

Planning for a Small Laying Flock

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 it?

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 the eggs?

15. How will you use or market the eggs?

16. What is your plan for fly, mite, louse, and worm control?

MANAGING A SMALL LAYING FLOCK
POULTRY SCIENCE, LEVEL III
Activity Sheet 10

Small Laying Flock Budget

Besides home consumption, the main outlet for eggs from a small flock is marketing directly 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, carefully consider the problems involved before deciding to market directly. Be sure you have the facilities, the time, the sales ability, a consistent supply of high quality eggs, and the market outlets before entering direct marketing.

A. PERFORMANCE GOALS OF DUAL PURPOSE HENS:	**Projections**
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 (if possible)	$_____
Equipment—used equipment (if possible)	$_____
TOTAL	$_____

C. INCOME:	
Eggs-__ doz. X __c/doz X __ hens housed	$_____
Old hens-$__ /hen X __hens	$ _____
TOTAL	$ _____

D. EXPENSES:	
Feed-__ doz/hen X __lb/doz X __$/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 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 "nest run" 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:

Activity Sheet 10 *(cont.)*

Small Laying Flock Budget *(cont.)*

Type of Cost	**Cents per Dozen**
Cartons	_____
Cases	_____
Delivery	_____
Equipment	_____
Other supplies	_____
Miscellaneous	_____

TOTAL _____

MANAGING A SMALL LAYING FLOCK
POULTRY SCIENCE, LEVEL III
Activity Sheet 11

Small Laying Flock Record

FINANCIAL SUMMARY
Project Income

Date	Items Sold or Used at Home (Indicate Which)	Quantity	Amount
_____	_____	_____	$ _____
_____	_____	_____	$ _____
_____	_____	_____	$ _____
_____	_____	_____	$ _____
_____	_____	_____	$ _____
_____	_____	_____	$ _____

- Ending Inventory (if appropriate) $ _____

Total Project Income $ _____

Project Costs

Date	Items Bought, Used, Labor Costs, Value of Homegrown Products	Quantity	Amount
_____	_____	_____	$ _____
_____	_____	_____	$ _____
_____	_____	_____	$ _____
_____	_____	_____	$ _____
_____	_____	_____	$ _____
_____	_____	_____	$ _____

- Beginning Inventory (if appropriate) $ _____

Total Project Costs $ _____

Summary

Total Project Income $_____

Total Project Costs $_____

How Much Money Made or Lost $_____

MANAGING A SMALL LAYER FLOCK
POULTRY SCIENCE, LEVEL III
Activity Sheet 11 *(cont.)*

Small Laying Flock Record (cont.)

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.

Date	Kind of Feed (grain, mash, supplement, etc.)	Quantity of Feed (lbs., bu., etc.)	Cost		Remarks: Beginning ration, feed changes, feeding problems, etc.
			$		
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

Month	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Totals or Avg.
No. Birds beginning of month													
No. birds removed													
No. birds end of month													
Avg. no. birds for month													
Total eggs laid													
Eggs per hen housed													
Avg. price per dozen													
Total value of all eggs produced													

Culling the Layer Flock

Poultry Science, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:

- Four reasons for culling nonlaying hens
- The "bleaching" order in a laying hen
- Physical characteristics that reflect a hen's state of productivity

ABOUT THEMSELVES:

- Qualities they feel are exhibited by a good friend
- How they use "good friend qualities" to select friends

Materials Needed:

- Pictures of birds that appear to be layers or nonlayers from magazines and advertising literature
- Leader Sheet - "Characteristics for Laying and Nonlaying Hens"
- Live birds from a laying flock (don't mix birds from different flocks)
- Chalkboard or newsprint
- 3" x 5" cards

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY

Leader Notes

On occasion, the flock will need to be culled. Culling is removing or selling poor quality, non-egg laying birds. There are four **reasons for culling** the laying flock: (1) to save the cost of feeding unproductive hens; (2) to remove nonlayers, providing more space for the remaining flock; (3) to salvage nonproducing 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 nonlayers, you will be able to have a more profitable poultry flock and use the meat by-products.

Ask members to identify reasons for culling. List on chalkboard or large paper and discuss.

Most breeds of chickens used in America 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 as follows: 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 pig-ment 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 repig-mentation or have a lot of yellow pigment in their skin are poor producers.

Using the Leader Sheet "Characteristics for Laying and Nonlaying Hens," make cards which list the individual characteristics. Have either individuals or teams sort the characteristics into laying and nonlaying lists. Score correctness of answers and/or speed in finishing the assignment.

Leader Notes

Using pictures or live birds, have each member or group place each bird in a laying or nonlaying category. Give reasons for placement. The characteristics or reasons could also be listed on chalkboard, flip chart, or sheet of paper by each individual.

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

1. What happens to a bird's comb when it goes out of production? Why does this happen?
   (It becomes small, shriveled, and scaly. The ovary reduces its secretion of the male sex hormone androgen, which causes enlargement and reddening of the comb and wattles.)

2. What is the order of appearance of the pigment as it returns to the body parts of a hen of the yellow-skinned breeds as she goes out of egg production?
   (1) vent, 2) eye ring, 3) ear lobe, 4) beak, and 5) feet and shanks.)

3. Where does the yellow pigment go when hens are laying?
   (egg yolk)

4. How does the space between the pubic bones differ between a layer and a nonlayer? Why?
   (The pubic bones are rigid and close together in the nonlayer; two-finger spread or more between the pubic bones in a good layer. The egg must pass between the pubic bones when it is laid.)

5. What characteristics do you feel make a good friend?

6. How do you use these characteristics to choose your friends?

GOING FURTHER

1. Go into the chicken house and pick out birds that you suspect are nonlayers. This is often best done at night with a flashlight. You will disturb the birds less. Examine those birds that appear to be nonlayers 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 nonlayers.
2. Identify parts of a chicken that reflect its reproductive state.
3. Participate in a judging contest and judge egg production hens.

CULLING THE LAYER FLOCK
POULTRY SCIENCE, LEVEL III
Leader Sheet

Characteristics Identifying Layers and Nonlayers

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

Adaptations for Flight

Poultry Science, Level III

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 vs. mammals

ABOUT THEMSELVES:

- Adaptations or physical characteristics unique to humans
- Abilities that can be used to cooperate with others

Materials Needed:

- Member Handout 7 - "Bird's Respiratory System"
- Flight feathers
- Microscope or magnifying glass
- Leg bone of a bird
- Chalkboard or newsprint

ACTIVITY TIME NEEDED: 45 MINUTES

ACTIVITY

Leader Notes

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 that enable them to fly.

Before starting this lesson see how many flight adaptations of a bird's anatomy the members can name and explain to the group.

Hand out the diagram "Bird's Respiratory System" and point out the air sacs in a bird's body.

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.

Have a member examine a leg bone of a bird and notice the hollow core.

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.

As you discuss the skeletal system, have members follow along on the skeletal diagram.

List on chalkboard or newsprint a summary of main flight adaptations of birds.

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 other 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 which 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 15–20 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 that there are many barbs which 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 1000 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.

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 2, Lesson "Types of Feathers and Their Functions."

DIALOGUE FOR CRITICAL THINKING

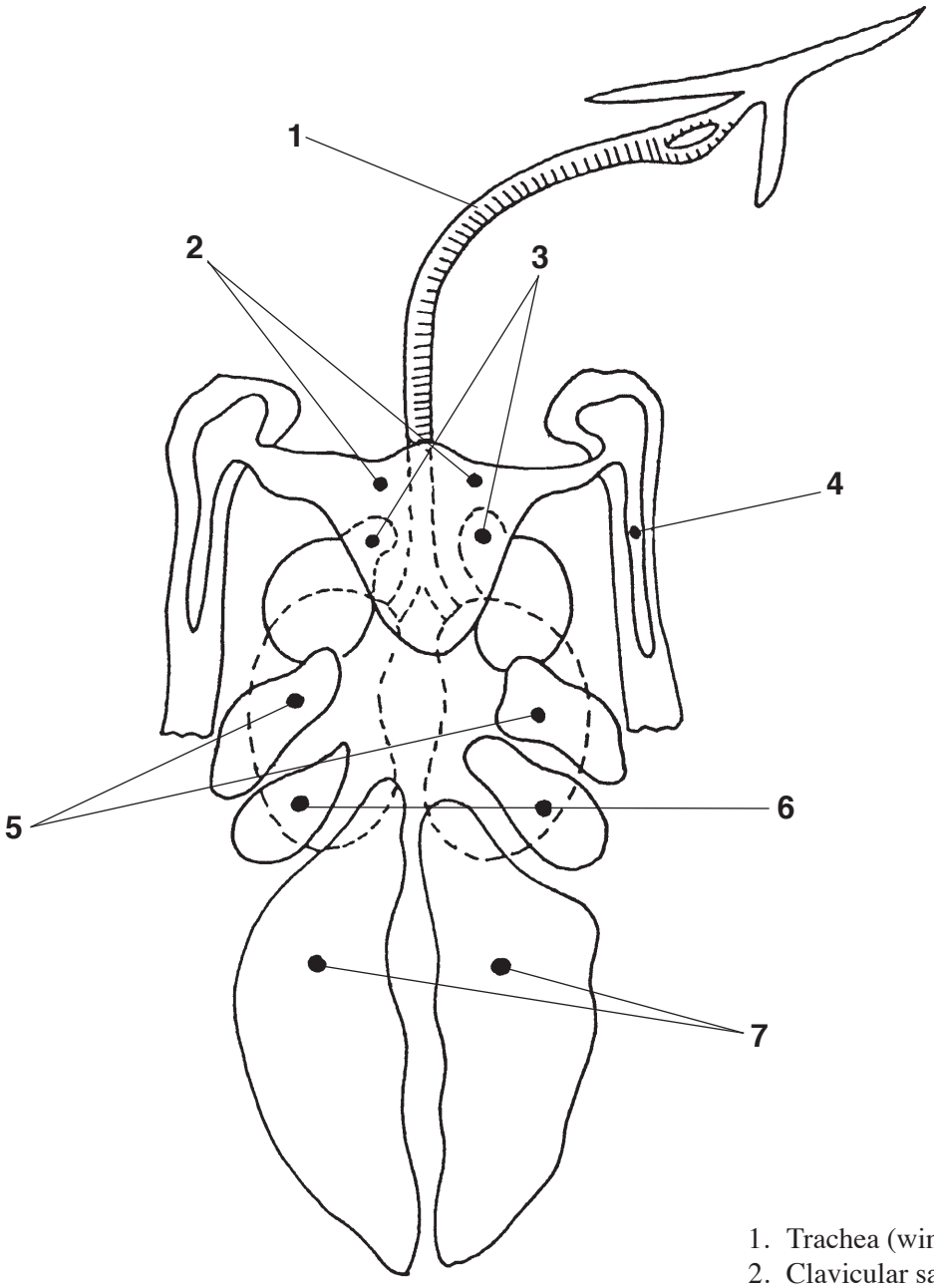
1. How is a bird's respiratory system different from that of humans and other mammals?
   (The bird has a system of air sacs, air cavities in the bones, and a system of tubes which carry air from the lungs to all parts of the body.)
2. How is the skeleton adapted for flight?
   (Cervical vertebrae are formed in an S-shape to minimize impact when landing. The vertebrae of the trunk and body of the bird are fused together, making it very rigid and strong to support the wings.)
3. What similarities and differences can you list between birds and humans?
4. What adaptations for flight do birds have that humans do not?
5. What makes people different from other mammals?
6. List and discuss abilities that vary from one person to another. How does this relate to the need to work together on many projects or activities?

GOING FURTHER

1. Research the role air sacs have during courtship of some male birds.
2. Compare a bird's flight adaptations to those of an airplane and share with your group or class at school.

ADAPTATIONS FOR FLIGHT
POULTRY SCIENCE, LEVEL III
Member Handout 7

Respiratory System of the Fowl



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

Flight Prevention

Poultry Science, 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

ABOUT THEMSELVES:

- The purpose of child (infant) restraints
- Their feelings about limiting or restraining animals or birds

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 8 - "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 one-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 2 to 3 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

Leader Notes

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).

sharp hatchet and chopping block. Feather clipping is a temporary measure. 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 handout 7 - "Feather and Wing Clip Locations"). This method can be done from day-old to 5- to 7-weeks of age.

DIALOGUE FOR CRITICAL THINKING

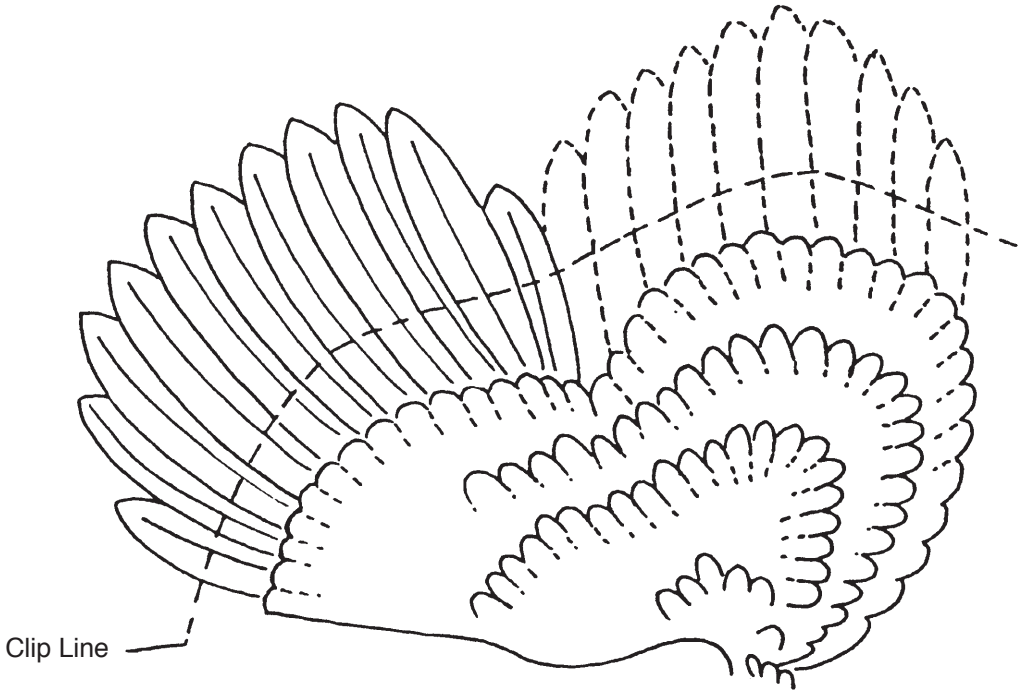
1. Why is feather clipping of adult birds a temporary method of flight control?
2. How does the structure of a bird's wing differ from the structure of a human's arm and why?
3. How did you feel about limiting the flying capability of a chicken?
4. Can you think of situations where permanent flight prevention would not be desirable?
5. What are some restraint devices used for infants? Why are they used?

GOING FURTHER

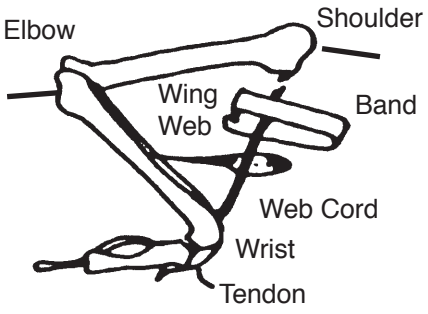
1. Discuss the rights of production or food animals as opposed to companion animals.
2. Invite someone with a different perspective to discuss flight prevention with your group.

FLIGHT PREVENTION
POULTRY SCIENCE, LEVEL III
Member Handout 8

Feather and Wing Clip Locations



Feather Clip - Adult



Sever wing or tendon at wrist.

Wing Clip and Notch - Chick

Eggs: Normal and Irregular

Poultry Science, 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 and birth defects in humans

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 a person or animal with a birth defect? 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 that 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 people or 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 that 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 which 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

1. Name some of the irregularities that you might find in an egg. Have you ever seen these before today?
2. How did you feel about the hen that might have laid an abnormal egg?
3. How might you manage your flock to prevent some of the abnormalities from occurring?
4. How do you feel when you see a person with a birthmark (scar, patch of white hair, etc.)?
5. Do physical features change the worth of people?
6. How do you feel about federal laws requiring handicap accessibility?

GOING FURTHER

1. Attend a judging contest where eggs are graded.
2. Visit a store and observe physical differences in eggs, particularly between Grade A and Grade B eggs.
3. Give a presentation to a group or class about normal and irregular eggs.

Marketing Eggs and Poultry Products

Poultry Science, Level III

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 or sell

Materials Needed:

- Activity Sheet 12 - "Consumer Product Evaluation"
- Clipboards or hard writing surface
- Pens or pencils for members
- Activity Sheet 13 - "Product Pricing"

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY

Leader Notes

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 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 and interior qualities.

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

Class	Minimum weight/ dozen (ounces)	Minimum net weight/ 30 dozen (lb.)
Peewee	15	28
Small	18	34
Medium	21	39 ½
Large	24	45
Extra Large	27	50 ½
Jumbo	30	56

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 sales 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.

Hand out Activity Sheet 13 - "Product Pricing." Explain each of the types of costs with members.

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.

Grocery Store Search
Take members to a grocery store, split them up into groups, and have them search and make a list of egg products that are sold. Have them write down product name, location of product in store, weight, and unit price of each item. (Use Activity Sheet 12 - "Consumer Product Evaluation.")

After 15-20 minutes, gather group back together and find out what the members found. Walk through the store and look at the items members located. Have members discuss what products they would buy and why.

As you examine each product, go over all the information asked for on the activity sheet.

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 foodborne illnesses. Nearly all reported cases of foodborne illnesses associated with eggs or foods containing eggs have been associated with improper handling. Following these handling practices will reduce the danger of foodborne illness from eggs.

- Store eggs at 45°F or below.
- Don't use dirty or cracked eggs.
- Store eggs away from strong odors.

- 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.
- Don't use recipes that contain raw eggs.
- Hold cooked eggs below 40°F or above 140°F.
- Avoid cross-contamination of cooking utensils.

DIALOGUE FOR CRITICAL THINKING

1. How many poultry products did you find?
2. What attracts you to buy certain products?
3. If you had eggs to sell, how would you determine what price to sell them at?
4. Where are some places you might sell your products?
5. Why should you be concerned about the quality and wholesomeness of the poultry products that you sell?
6. How will this pricing exercise help you with future purchases?

GOING FURTHER

1. Tour a poultry farm and an egg processing facility to see how they process eggs for packaging and shipping.
2. Learn how to determine egg quality grades
3. Ask a grocery store owner where he or she purchases eggs and how he or she determines where to buy them.

MARKETING EGGS
POULTRY SCIENCE, LEVEL III
Activity Sheet 12

Consumer Product Evaluation Worksheet

Name of Product	Size of Pkg., Amt., Wt., Etc.	Cost	Nutritional Information	Quality Grade	Inspection Stamp

MARKETING EGGS
POULTRY SCIENCE, LEVEL III
Activity Sheet 13

Product Pricing

Use the information below to determine 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.

Type of Cost*	**Cents per Dozen**
Cartons	_____
Cases	_____
Labor in Egg Room	_____
Transportation Expense	_____
Miscellaneous**	_____
Total	_____

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

**Includes processing and storage equipment, utilities, storage, and supplies.

Food Safety

Poultry Science, Level III

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 foodborne illnesses
- Pencils
- Activity Sheet 14 - "Food Safety Article Survey"
- Activity Sheet 15 - "Food Safety Field Trip Summary"
- Activity Sheet 16 - "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 14 - "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** prepare 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 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 may use approved chemicals to prevent spoilage or improve the taste, texture, appearance, or freshness of poultry products. Government regulations strictly control the use of such additives.

Plan a food safety trip to a local food store. Use Activity Sheet 15, "Food Store Field Trip Summary" to record your observations and highlights.

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.

Have members ask their parents how they ensure safe handling of poultry products. Then have members suggest ways their families can handle poultry products more safely.

5. **Consumers** should 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.

Ask members what kind of poultry products they typically help prepare. Ask them to identify any food safety violations they realize they have made in the past. How will they change their behavior in light of what they have learned?

Examples of chemicals used in the poultry production 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. Here are five common bacteria.

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. *Salmonella* microorganisms that are ingested, live and grow in the intestinal tract of people causing diarrhea, headaches, chills, fever, nausea, vomiting, and abdominal (stomach) pain. *Salmonella* can be picked up at any time during the various stages of production, processing, storage, and preparation of poultry products.

2. ***Campylobacter 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 that 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*** 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 2 hours in the danger zone of 40° to 140°F.

3. Keep all food preparation surfaces and equipment clean.

Hand out the "Problem Kitchen Exercise" and have members list the food safety mistakes they see. Then hand out the picture of the safe kitchen and discuss corrections that were made.

Leader Notes

DIALOGUE FOR CRITICAL THINKING

1. Name three groups of people responsible for food safety.
2. What are the three basic rules to reduce food-related illnesses?
3. What did you learn about the types of food safety issues that are covered by the media?
4. Have you ever had a food-related illness? How sick were you? What caused it?
5. How do you feel about the regulations and inspections required for food products?
6. Was there anything you learned from this lesson that will change your food handling procedures? If so, what are they?

GOING FURTHER:

1. Share your findings with other groups, clubs, consumers, etc.
2. Prepare a store display for a local food store to remind consumers of the process and how safe the products are.

FOOD SAFETY
POULTRY SCIENCE, LEVEL III
Activity Sheet 14

Food Safety Article Survey

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

Title	Source	How Factual or Accurate	Number of Sides of Issue Presented	Biased or Unbiased
1.				
2.				
3.				
4.				
5.				
6.				
7.				

FOOD SAFETY
POULTRY SCIENCE, LEVEL III
Activity Sheet 14

Food Store Field Trip Summary

1. List poultry product handling procedures that 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, that you have observed in the media?

FOOD SAFETY
POULTRY SCIENCE, LEVEL III
Activity Sheet 16

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 out 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?

_____

_____

_____

_____

_____

Egg Grading

Poultry Science, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:

- 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 labeling people

Materials Needed:

- Member Handout 9 - "Parts of an Egg Diagram and Air Cell Depth Gauge"
- Member Handout 10 - "Interior and Exterior Quality"
- Egg Candler
- Member Handout 11 - "Broken-out Egg Quality Chart, USDA"
- Eggs of different quality

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY

Each egg is graded on its individual 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, break any eggs you are in doubt about and observe them.

Leader Notes

Give members "Parts of an Egg" handout. Cover the words before copying. See how many parts they can label. Then review the parts of the egg that 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:

Refer to Member Handout 9 - "Air Cell Depth Gauge" for assistance.

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 $\frac{1}{8}$ 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 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 $\frac{1}{8}$ inch in diameter are classified as Inedible. Eggs with small spots less than $\frac{1}{8}$ inch in diameter are 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. It 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 $\frac{1}{8}$ 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 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.

Have members examine the exterior quality of eggs and determine their grades. After everyone is done compare answers and discuss.

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-dimensional) 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. Pull your fingernail across a calcium deposit. If a good-sized hole would result if the deposit 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 thick shells 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.

Give each member a copy of Member Handout "Interior and Exterior Quality Grades."

Have members examine broken-out eggs and determine their quality grade.

BROKEN-OUT QUALITY

Eggs broken-out will be Grades AA, A, B, and Inedible. Eggs with spots (blood and meat) more than $\frac{1}{8}$ inch in diameter will be classified as Inedible. Eggs with spots less than $\frac{1}{8}$ 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.

Give each member a copy of Member Handout 11 "Broken-Out Egg Quality Chart" or acquire a colored chart from USDA.

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

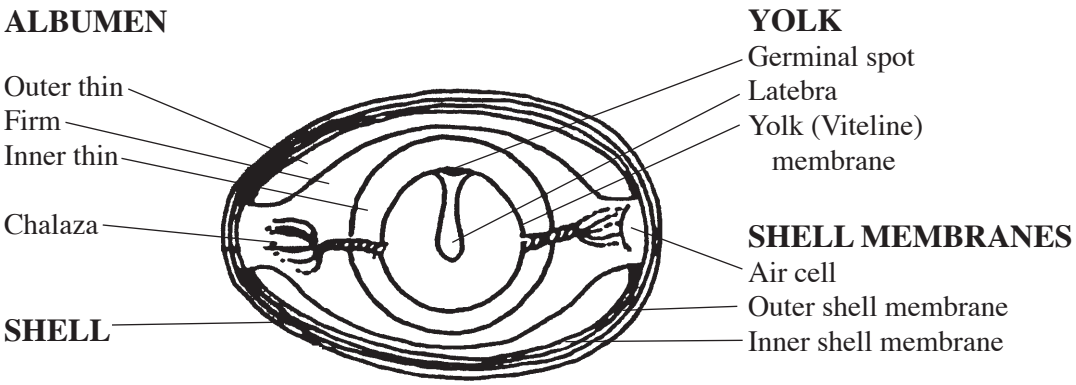
1. What should you look for in assigning a quality grade to an egg?
2. What are the four USDA interior quality grades of eggs?
3. What could cause an egg classified as Grade AA in interior quality to be graded lower overall?
4. What criteria do you use to select friends? How easy are these criteria to measure?
5. Do all of your friends have the same qualities? Why? Why not?
6. How do you feel about being judged or labeled as a person? Are your people "Quality Grades" positive or negative? Why?

GOING FURTHER

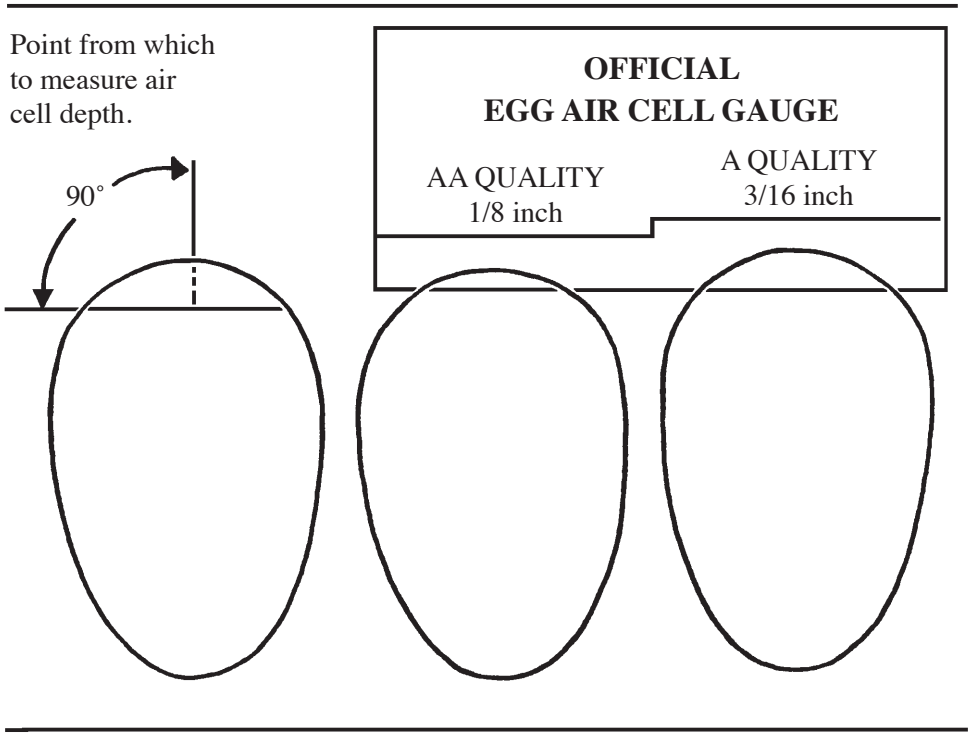
1. Participate in a judging contest.
2. Examine eggs from different breeds or strains of poultry and see if there is any difference in egg quality.
3. Go to a grocery store and do a price comparison of various grades and sizes of eggs.

EGG GRADING
POULTRY SCIENCE, LEVEL III
Member Handout 9

Parts of an Egg



Air Cell Depth Gauge



EGG GRADING
POULTRY SCIENCE, LEVEL III
Member Handout 10

Interior and Exterior Quality Grades

Standard for Interior Quality of Eggs

Quality Factor	AA Quality	A Quality	B Quality	Inedible
Air Cell	1/8 inch or less in depth	3/16 inch or less in depth	More than 3/16 inch	Doesn't apply
White	Clear, firm	Clear, may be reasonably firm	Clear, may be weak and watery	Doesn't apply
Yolk	Outline slightly defined	Outline may be fairly well-defined	Outline clearly visible	Doesn't apply
Spots (Blood or meat)	None	None	Blood or meat spots aggregating not more than 1/8" in diameter	Blood or meat spots aggregating more than 1/8" in diameter

Standard for Exterior Quality of Eggs

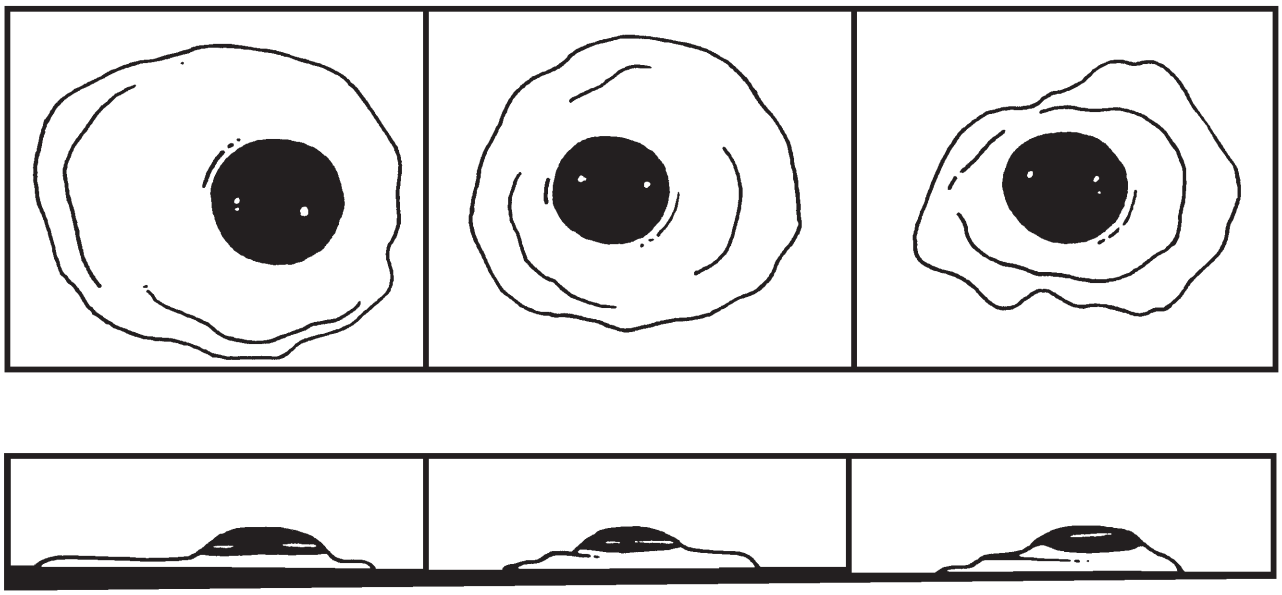
Factor	Grade AA or A	Grade B	Dirty
Stain	Clean-may show small specks, stains or cage marks that do not detract from general clean appearance of the egg-may show traces of processing oil.	Slight, or moderate localized stains less than 1/32 of shell or scattered stains less than 1/16 of shell.	Prominent stains. Moderate stains covering more than 1/32 if localized and 1/16 of the shell if scattered.
Adhering Dirt or Foreign Material	NONE	NONE	Adhering dirt or foreign material (1.0 mm in area or greater).
Egg Shape	Approximately the usual shape.	Unusual or decidedly misshapen (very long or distorted).	
Shell Texture	May have rough areas and small calcium deposits that do not materially affect shape or strength.	Extremely rough areas that may be faulty in soundness or strength. May have large calcium deposits.	
Ridges	Slight ridges that do not materially affect shape or strength.	May have pronounced ridges.	
Shell Thickness	Free from thin spots.	May show pronounced thin spots.	

EGG GRADING
POULTRY SCIENCE, LEVEL III
Member Handout 11

Broken-out Egg Quality Chart

Specifications for broken-out eggs

AA or Fresh Fancy Quality | **A** Quality | **B** Quality



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.

Processing Poultry Meat

Poultry Science, Level III

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:

- Their feelings toward raising animals for food
- How meat contributes to their diet
- The value of poultry products in their life

Materials Needed:

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

ACTIVITY TIME NEEDED: 60 MINUTES

ACTIVITY

Leader Notes

Home processing 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°–140°F), and a container full of cold or ice water for cooling the carcass.

Show items needed as you explain.

Let's identify and place the steps of processing in order. Here are a group of cards. Try to arrange them in the order that they would be followed.

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.

PREPARATION OF BIRDS

Birds should be taken off feed 8 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 slaughter. 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

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.

SLAUGHTERING AND DRESSING PROCESS

The processing procedure is divided into three steps. It is the purpose of this lesson to explain and identify the slaughter 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

Using a live or model bird, demonstrate the procedure as you go through the steps.

1. Hang the bird by its feet by 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. Hold the bird's head firmly so it will not scatter blood while bleeding.

Point out the parts of the bird as you go through the process and have members try to identify.

2. After the bird stops struggling, immerse it in hot water (135°–140°F) for 30 to 40 seconds. Move the bird 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.

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, cut-up, 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 4 days).

DIALOGUE FOR CRITICAL THINKING

1. Name the steps in processing poultry.
2. Why is it important to check the health of a bird before processing?
3. What do you think is most difficult in the processing of poultry for meat?
4. How do you feel about killing a bird to eat?
5. Discuss whether or not meat is important to your diet and why.
6. How important are poultry products to your life?

GOING FURTHER

1. Learn about and compare the processing procedures and methods used in other livestock.
2. Prepare and present a talk or demonstration at a 4-H meeting or school classroom.
3. Contact a poultry processing plant and find out the procedures they use to process poultry for meat.
4. Participate in a poultry judging contest and learn how to grade ready-to-cook poultry.
5. Have a "taste party" where you can sample various types of poultry and poultry recipes.

PROCESSING OF POULTRY MEAT
POULTRY SCIENCE, 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°–140°F) for 30–40 seconds.
- Hang the bird by the rope after scalding.
- Remove the feathers by rubbing the carcass.
- Use an open flame to burn (singe) off feathers.
- 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 carcass in ice water to lower the temperature of the carcass to below 40°F.
- Remove the chilled carcass from the ice water; allow 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 4 days).

Grading Ready-to-Cook Poultry

Poultry Science, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:

- The physical characteristics used in grading ready-to-cook poultry carcasses
- Types of poultry products sold in supermarkets

ABOUT THEMSELVES:

- How it feels to be "graded" as a person
- The importance of food grading systems in one's life

Materials Needed:

- Large sheet of paper or chalkboard
- Marking pen
- Member Handout 12 - "Guide for Estimating the Size of Tears, Cuts, and Discolorations"
- Member Handout 13 - "Summary of Specifications of Quality for Individual Carcasses"
- Pictures of actual carcass of different quality grades or actual carcasses

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, & 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.

Leader Notes

Ask members what differences they might see in different poultry carcasses. Write on a large sheet of paper or chalkboard.

Have members break into groups of 2 or 3 and examine carcasses for some of the characteristics looked for when grading.

Cuts, tears, or trims must be completely through the skin so that 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 nonprotruding. When the bone penetrates the skin, it is called protruding.

Grade A Carcass
The Grade A carcass is not permitted to have any cut, 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 lbs., there may be up to a 1½"area of flesh exposed on the back or wings, compared to only 1" for a carcass under 2 lbs.

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 ⅓ of flesh exposed on each part of the carcass provided that the meat yield is not affected. A slight cut into the meat not more than ⅛" 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 ⅓ of the flesh showing on the carcass. If the trim into the meat is more than ⅛" 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.

After going through grade specifications, have members grade sample carcasses.

DIALOGUE FOR CRITICAL THINKING

1. What might be some causes for quality grades of carcasses to be different?
2. Why do you think it is important for USDA to have poultry carcass grades?
3. What other grading systems are you familiar with?
4. Do you feel people "grade" you? Do you grade others? What criteria is often used to grade people?
5. Is "grading" or classifying food better or worse than grading people? Why?

GOING FURTHER

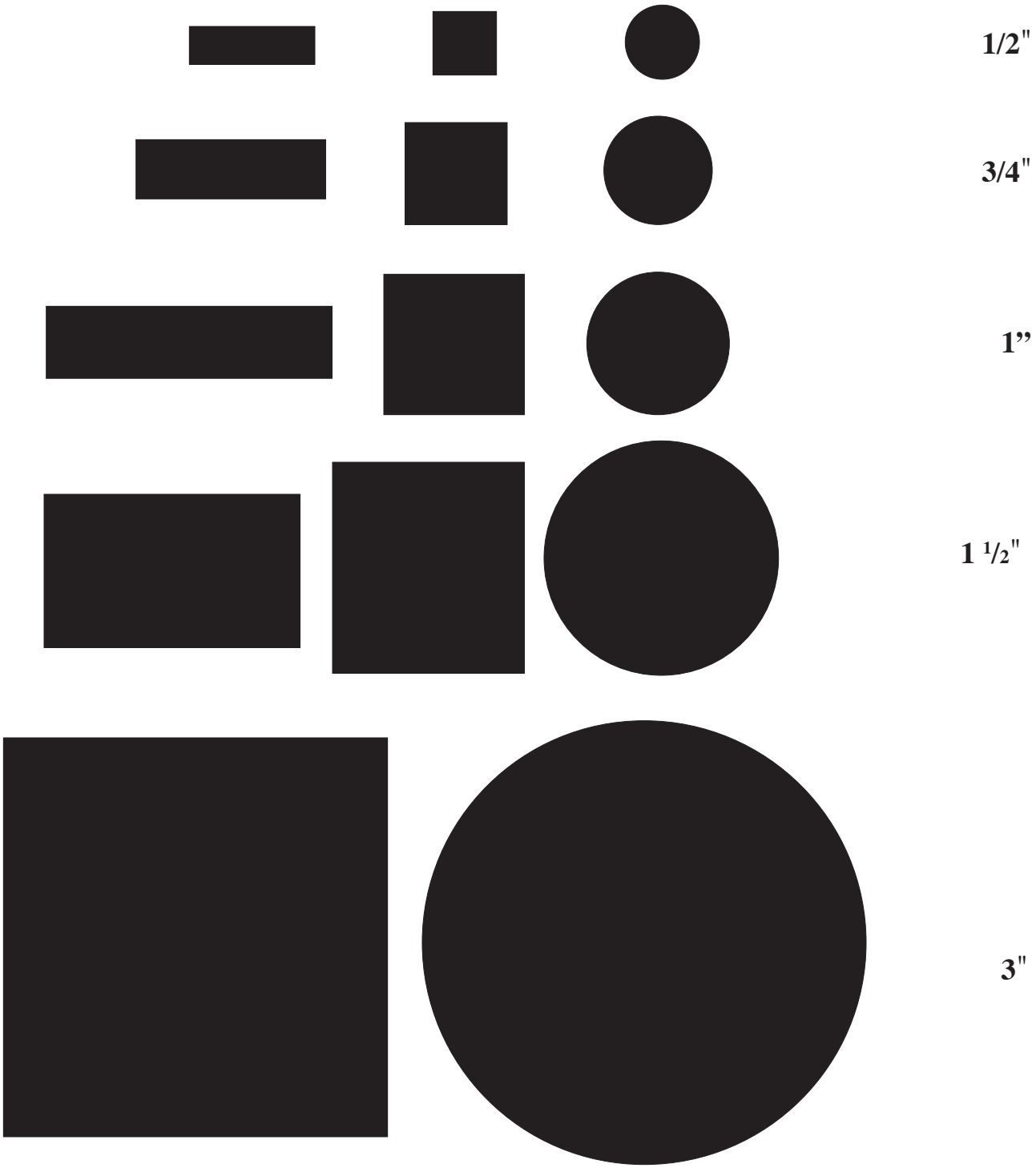
1. Participate in a poultry judging contest.
2. Obtain information from USDA regarding quality grades and inspection requirements.
3. Prepare an illustrated talk and present to a group.
4. Visit a grocery store and identify types of poultry products that are sold.
5. Invite a poultry meat inspector to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

GRADING READY-TO-COOK POULTRY

POULTRY, LEVEL III

Member Handout 12

Guide for Estimating Size of Cuts, Tears, and Dislocations



GRADING READY-TO-COOK POULTRY

POULTRY SCIENCE, LEVEL III

Member Handout 13

Summary of Specifications of Quality for Individual Carcasses of Ready-to-Cook Poultry

Factor		A Quality		B Quality	C Quality
Exposed Flesh Carcass Weight		Breast[1] & Legs	Else-where[2]	Breast & Legs	
Min.	Max.	None	1”	$\frac{1}{3}$ of flesh exposed on each part of carcass provided meat yield not appreciably affected.	NO LIMIT
None	2 lbs	None	1 $\frac{1}{2}$"		
Over 2 lbs	6 lbs	None	2"		
Over 6 lbs	16 lbs	None	3"		
Over 16 lbs	None				
Disjointed bones		1 disjointed		2 disjointed and no broken or 1 disjointed and 1 nonprotruding broken.	NO LIMIT
Broken bones		None			NO LIMIT
Missing parts		Wing tips and/or tail removed at the base.		Wing(s) to 2nd joint. Back area not wider than base of tail and extending halfway between base of tail and hip joints.	Entire wing(s) Back area not wider than base of tail extending to area between hip joints.

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

Integration and Specialization in the Poultry Industry

Poultry Science, Level III

What Members Will Learn . . .

ABOUT THE PROJECT:

- Nine segments of 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 14 - "Typical Integrated Broiler Firm"

ACTIVITY TIME NEEDED: 30 MINUTES

ACTIVITY

Leader Notes

The production and marketing of eggs and poultry meat in the United States is a highly specialized industry. In addition to the producers who care for the birds, the firms that manufacture 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.

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.

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 are 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 incubators. Because the main source of income for a hatchery is the sale of day-old or started birds, its success depends 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 are 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 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 load 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.

Have individual or groups of members select a segment of the industry for further study. They should interview someone in that segment and then report the findings to the total group. If the group is interested, each segment could be studied at a separate meeting and include a guest speaker or discussion leader.

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

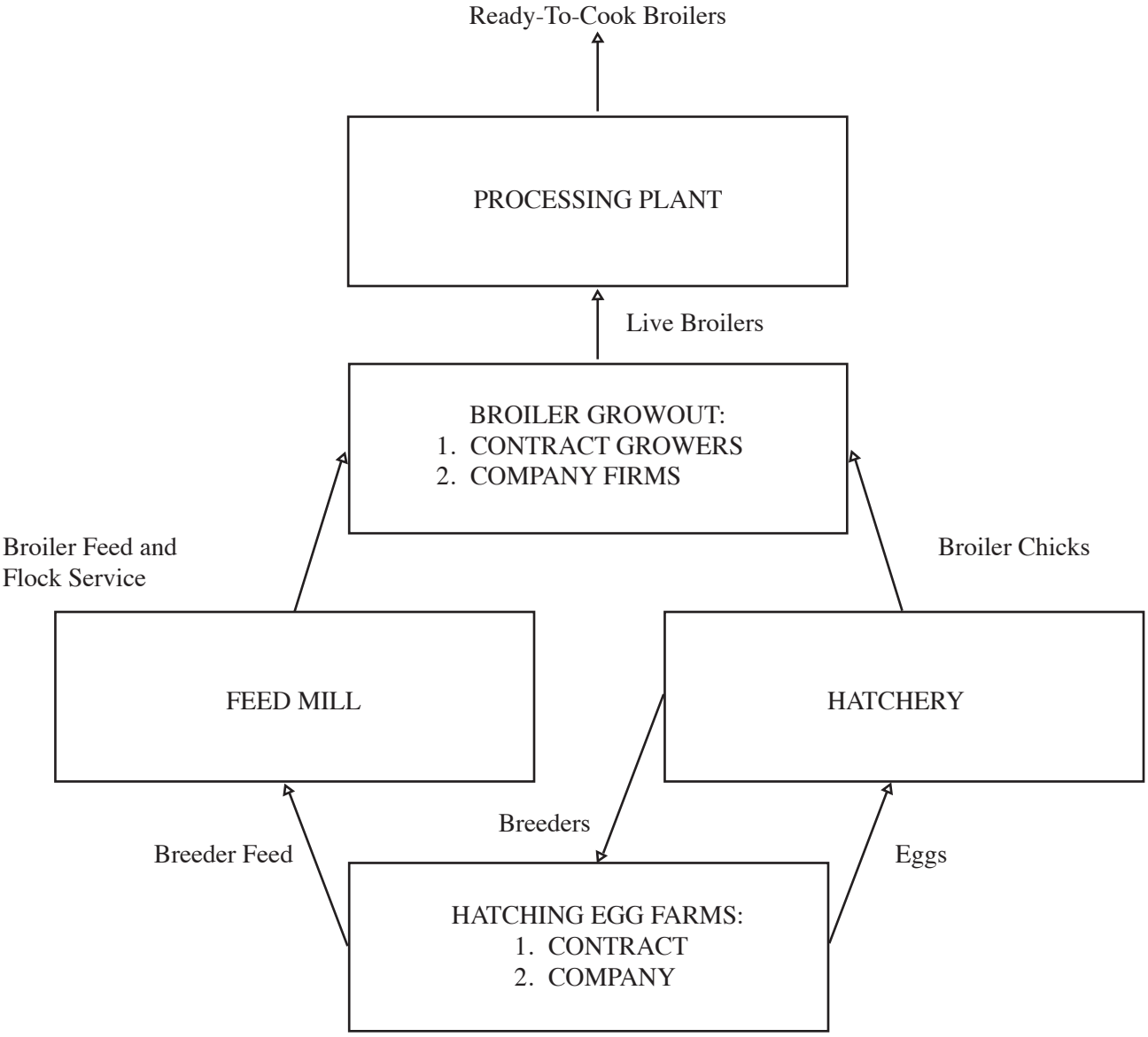
1. List the major segments of the poultry industry.
2. What industry segments are of most interest to you? Why?
3. What do you think are some of the major advantages of the poultry industry? Disadvantages?
4. Which segments of the industry have the best career opportunities?
5. How do poultry careers compare to other livestock careers?
6. What are some ethical issues involved with the poultry industry?

GOING FURTHER

1. Ask poultry businesses for information on careers.
2. Check out more specialized careers such as poultry artificial inseminators, or poultry veterinarians.

INTEGRATION AND SPECIALIZATION IN THE POULTRY INDUSTRY
POULTRY SCIENCE, LEVEL III
Member Handout 14

Functions of a Typical Integrated Broiler Firm



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4-H

WASHINGTON STATE UNIVERSITY
EXTENSION

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