Cobb On-Farm Guide

Post-Mortem of Broiler Breeders

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This guide is a reference for farm post-mortem examinations of broiler breeders intended for use by farm managers.

It will provide information on the normal anatomy of broiler breeders and indicates primary areas of focus when doing a field post-mortem.

The guide illustrates the most common method of performing a post-mortem examination on broiler breeders.

User Notes

This post-mortem guide was created using healthy broiler breeder chickens that were humanely euthanized and then bled. As a result, the color and appearance of certain organs may be pale or flaccid.

This is not a diagnostic tool and only intended to be a guide for staff in the field to help communicate any issues on the farm.

In the case of abnormalities in the flock or observations from a post-mortem, always consult your veterinarian before taking any further actions.

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Preparation for Post-Mortem

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1.1 Reasons for Conducting a Post-Mortem

A post-mortem dissection (necropsy) of a broiler breeder is a procedure used by veterinarians, farm managers, or growers to investigate mortality of birds in a flock. First, an external visual exam is conducted for any obvious outward signs indicating the cause of death. Next, an internal visual examination is conducted to obtain further diagnostic information. Samples can be collected and sent to a laboratory for diagnostic tests.

Conducting a post-mortem regularly can help provide insightful information about flock mortality, be a useful assessment to provide feedback on poultry health programs, and be an important diagnostic tool when a disease is suspected in a flock. A good way to proceed is to do a post-mortem of all the mortality on a specific day and repeat this process weekly. Findings from routine post-mortems can be tracked in a graph with the results grouped into categories. Evaluation and tracking post-mortem findings will provide information regarding potential improvements to the flock health and management programs that can help reduce future mortality.

A post-mortem is recommended

- If there is a rise in mortality or culling
- If there is a rise in the number of ill birds or disease is suspected
- For quality control purposes

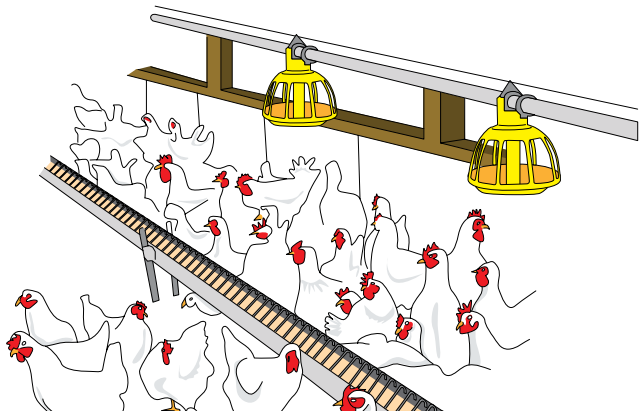
Chapter 2 provides guidance for sampling techniques. A veterinarian and/or a diagnostic laboratory can provide additional information on sampling techniques and shipping methods for diagnostic testing.

1.2 Bird Sampling for a Post-Mortem

When **mortality is unusually high,** a post-mortem exam should be conducted on birds that are recently deceased. A recently dead or euthanized bird can be refrigerated if a post-mortem cannot be conducted immediately. It is not recommended to conduct a post-mortem on a non-refrigerated bird that has been dead for more than several hours because decomposition may make diagnosis difficult.

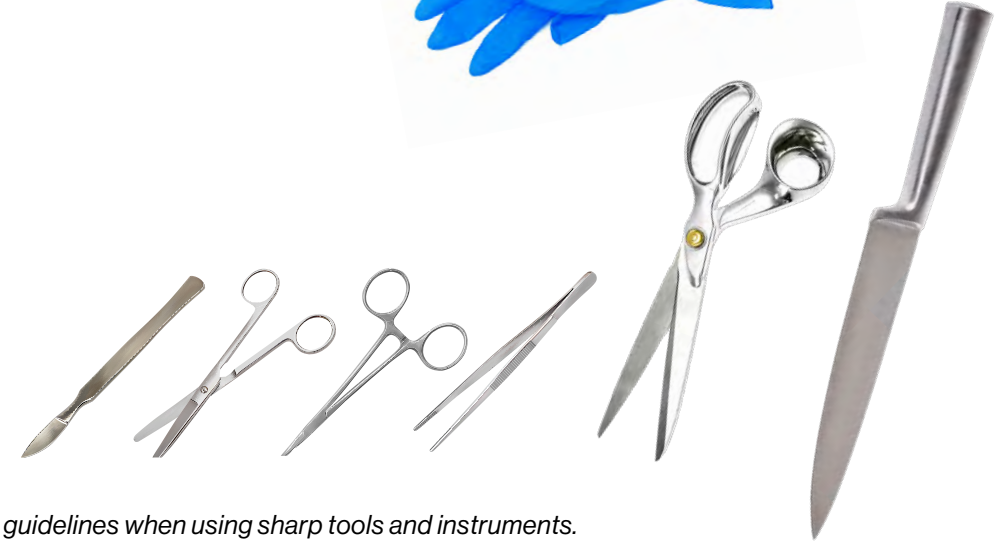
If the goal is to understand the main cause of **incidental mortality**, then it is best to look at all the dead birds for a given day and repeat the process on a weekly or bi-weekly basis. It is important to repeat the post-mortem regularly. Repeating the process regularly and graphing the data provides a better understanding of the main cause of mortality which, in turn, allows targeted adjustments to a management program.

If a bird is ill or a disease is suspected in the flock, make notes of your observations prior to euthanizing. Include observations regarding breathing patterns, posture, feather ruffling, discharge from the nose or eyes, general bird condition and appearance, and bird mobility. Also make notes regarding general flock distribution and behavior within the house, any unusual sounds (i.e., coughing or snicking), and any unusual fecal observations.



1.3 Equipment for a Post-Mortem

- Gloves
- Forceps
- Scissors
- Knife and/ or scalpel
- Bone shears (may be necessary for older birds)
- Tweezers
- Well-lit area with a flat surface
- Access to soap and water
- Paper towels
- Bag or bin for disposables



Safety first! Always follow safety guidelines when using sharp tools and instruments.

1.4 Tools for Submitting Samples

- Plastic bags with closures
- Sampling jars and tubes
- 10% Formalin
- Swabs
- Transport medium (bacteria, viral)
- Cooler with ice or cold pack to transport samples
- Syringes and tubes (blood samples)
- FTA cards
- Marking pens

Safety first! Always follow safety guidelines when using chemicals.

Exam Overview

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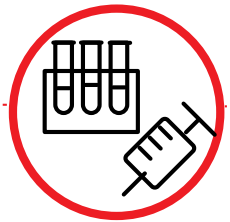
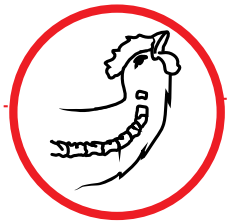
Exam Sequence

1 Collect flock health and history



2 Prepare sampling plan and materials



3 Euthanasia

4 External visual exam

5 Internal visual exam

6 Correct disposal and thorough cleaning and disinfection of surfaces

2.1 Collecting Flock History and Health

To understand mortality, it is critical to **collect as much historical information** about the flock as possible. This information will support an accurate diagnosis. An example of a flock history record form is given in chapter 8 of this guide. The form has some specific information requested such as age, breed or line, vaccinations and medications delivered. It is helpful to provide notes on management practices, feed form, and water consumption. Additionally, disease characteristics such as recurring issues and mortality patterns should be noted.

Closely examine the live birds in the house prior to the post-mortem if the issue or disease appears to afflict most of the flock. Make note of the **flock health and history** (see chapter 8 for an example form) that includes the general appearance of birds (feathering, weight, body condition, pigmentation), the incidence of any injuries, appearance of fecal and cecal droppings, respiratory characteristics (discharge, inflammation, breathing patterns), skeletal issues, and any other abnormalities (behavioral observations, flock distribution and activity level, etc.).

Collecting the flock health and history information will also provide direction about **which samples to collect.** The numbers and types of samples can be narrowed to save time, money and provide a more accurate diagnosis. Give your veterinarian the flock health and history information and they can help you narrow the sample list. The following sections will provide guidance on identifying, labeling, packaging, and shipping samples to optimize avian health testing.

2.2 Sample Collection Guidance

Primary reasons to collect samples during a post-mortem are to:

- verify the absence or presence of an infectious disease agent within the flock
- verify the application of vaccine(s) and confirm flock immunity after vaccination
- confirm organ development or irregular post-mortem findings

Primary samples that may be collected from birds for diagnostic testing include:

- Blood
- Cleft palate, tracheal or choanal swabs
- Feces
- Organ or tissue

Quality and quantity

- Good quality and correct quantity are required to complete diagnostic testing efficiently and accurately. Bad quality samples will cause questionable test results.
- Inadequate sample quantity may impact the accuracy of the results.
- Inadequate number of samples or samples that do not represent the flock can lead to incorrect assumptions about the immunity or health status of the flock.

Identification

- Correct label and sample identification are required to conduct testing and report results to the correct location, production manager, and veterinarian.
- Poorly labelled samples causes poor traceability and may delay the result report.
- If no label is provided, the sample may be discarded.

Packaging and timing of sample shipment

- Correct packaging and good timing for shipment reduces the risk of sample spoilage and possibility of testing delays.
- Poor packaging increases the risk of sample contamination, damage, and spoilage.
- If samples are submitted late, results may be received too late to reduce the biosecurity risk for the flock or farm.
- Samples degrade over time. If held too long, samples have poor quality and cannot be used for testing.

Storing a portion of the sample

- For blood samples, it is recommended to store a portion of the serum from the blood sample for the life of the flock. This can be very helpful as a reference sample.

2.2 Sample Collection Guidance

Fecal samples may be requested as additional testing (environmental swab) or used for routine monitoring during post-mortem evaluations to assess the gastro-intestinal health of the flock. Specific sampling methodology and amount needed should be specified by the veterinarian, laboratory or company QA department.

- To test for disease freedom, litter or fecal samples may be used to test for Salmonella.
- To test for intestinal parasites, fecal samples may be collected to verify if there is a coccidial or worm infestation.

Blood samples are routinely collected from flocks to test for diseases and verify the immune response (titers) following vaccination. Specific testing methodology, amount of blood needed, equipment required, etc. should be specified by the veterinarian, laboratory or company QA department. During a post-mortem session, blood may also be collected:

- to test for disease freedom. Blood may be used to test for Mycoplasma, Avian Influenza (AI), Salmonella or other diseases that are not included in the vaccination program.
- to test for specific concerns (i.e., toxins, blood chemistry profile, etc.). Blood may be collected to verify the health status of the flock.
- to verify immune response (titers). Blood may be collected before and several weeks after vaccinating the flock. To verify the immune response and uniformity of antibody response to the vaccine(s), ELISA tests are traditionally used to measure the titer level or sero-conversion.
    - ***For live vaccines, collect blood approximately 3 weeks after vaccination.***
    - ***For inactivated (killed) vaccines, collect blood approximately 4 to 5 weeks after vaccination.***

Cleft palate, tracheal or choanal swabs are routinely collected from flocks to test for respiratory diseases. These swabs can be part of the post-mortem evaluation and diagnostic process and collected pre or post-euthanasia. Precise testing methodology, sample size per airspace or barn, tools and supplies required should be specified by the veterinarian, laboratory or company QA department.

- Cleft palate or tracheal swabs may be used to test for Infectious Laryngotracheitis (ILT), avian influenza (AI), Mycoplasma synoviae (MS), or Mycoplasma gallisepticum (MG). Cloacal swabs can be used to test for Avian Influenza (AI) and Infectious Bronchitis Virus (IBV).
- Choanal swabs may be collected to test for Infectious Bronchitis (IB) or Newcastle Disease Virus (NDV) .
- Swabs may be required after suspect blood results from routine screening tests for respiratory disease, if abnormal respiratory signs are seen in a flock, and during situations when there is an increased risk of an infectious avian respiratory disease in the immediate area near the flock or farm.

Organ or tissue samples may be collected to test for diseases or examine any pathological or histological changes in the tissue.

- Specific sampling methodology (which tissues, how much tissue, quantity of birds to sample, etc.), the method of tissue submission and storage (fixed, fresh, or frozen tissue) and any additional requirements should be specified by the veterinarian, laboratory or company QA department.
- Samples may be taken from recent mortality or birds that have been euthanized recently. Samples should not be collected from deteriorating carcasses or decomposing birds.
- For fresh samples, the tissue or organ should be placed in a sample bag and kept cool (refrigerator or cooler) immediately after collection and until samples arrive at the lab.

Euthanasia

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3.1 Euthanasia Definition and Goals

Euthanasia is defined* as a "method of killing that minimizes pain, distress, and anxiety experienced by the animal prior to loss of consciousness and causes rapid loss of consciousness followed by cardiac or respiratory arrest and death." For a post-mortem process, if live poultry are used, birds must be euthanized to evaluate the internal organs.

These key factors should be achieved for euthanasia:

- a process that minimizes pain, anxiety, and distress of the bird prior to loss of consciousness
- a rapid loss of consciousness and an irreversible, efficient death of the bird
- a procedure that is humane and completed with respect to the bird being euthanized, and
- a method that can be completed by competent and trained staff.

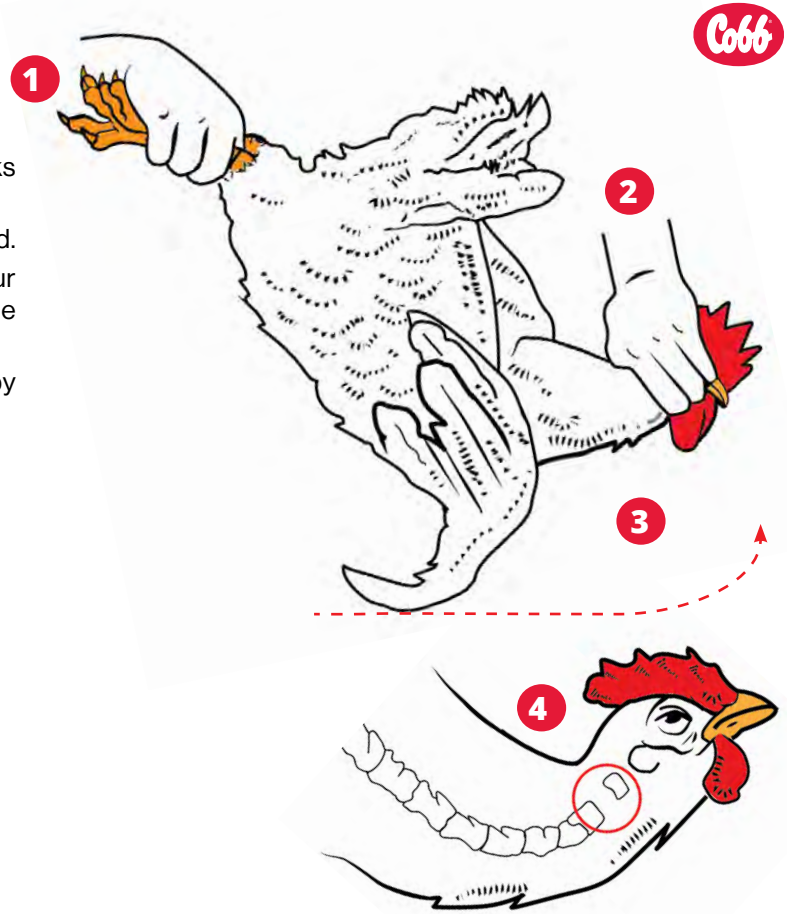
The method of euthanasia used for an individual chicken should be selected with regards to:

- the location where the evaluation will occur (i.e., farm or laboratory)
- the focus of the post-mortem and if any specific organs or samples are required
- the age and size of bird and number of birds to be euthanized
- personnel involved (training, compliance, skill) and safety considerations
- the availability of euthanasia equipment
- national poultry or regulatory guidelines for euthanasia that may restrict the method(s) used.

**The current definition is from the AVMA Guidelines for the Euthanasia of Animals, 2020 Edition available at: (https://www.avma.org/sites/default/files/2020-02/Guidelines-on-Euthanasia-2020.pdf)*

3.2 Manual Euthanasia

1. Hold the bird securely by both legs (between the hocks and feet).
2. Place your other hand at the base of the chicken's head.
3. Gently pull the head toward your knee and rotate your wrist/hand so that you will dislocate the neck at the point where the head and neck meet.
4. Check to verify that the technique was effective by feeling for the gap in the neck.



External Visual Examination

4

Inspect the external physical characteristics of the bird:

1. Feathers
   - coverage
   - cleanliness
   - condition
2. Skin condition and integrity
3. Feet, legs, and skeletal health
   - toe and footpad
   - joint
   - overall
   - keel
4. Head condition
   - eyes
   - ears
   - nostrils
   - beak
   - comb
   - wattle
5. Development and body composition
   - body weight
   - fleshing
   - fat deposition
   - uniformity
6. Cloaca and tail

4.1 Feathers

1. Feathers can be inspected on live or recently culled birds. Inspect the feathers on the body. Check feathers for:
   - Coverage
   - Cleanliness
   - Condition
2. Extend the wings and check the primary feathers for shape and abnormalities.
3. Inspect the feathers for stress marks.
4. Inspect feathers for growth gaps.

Stress marks in feathers

Growth gaps in feathers

Normal feather development

Irregular feather development

4.2 Skin Condition and Integrity

Check the skin for

- Signs of external parasites (mites, lice, etc.)
- Scratches or other injuries
- Dehydration (dehydrated birds will have dry skin and elevated scales on the legs; older dehydrated birds will have a dry, scaly comb).

Foot of hydrated bird

Foot of dehydrated bird

Vent Region

Poultry Lice - tiny, yellow colored. Egg clusters are attached at the base of feather shafts.

Fowl Mite - Black, dirty, feathers caused by accumulation of mite droppings and dried blood.

Feathered Areas

Depluming Mite - burrows into feather shaft causes birds to pull out feathers.

Under Wing

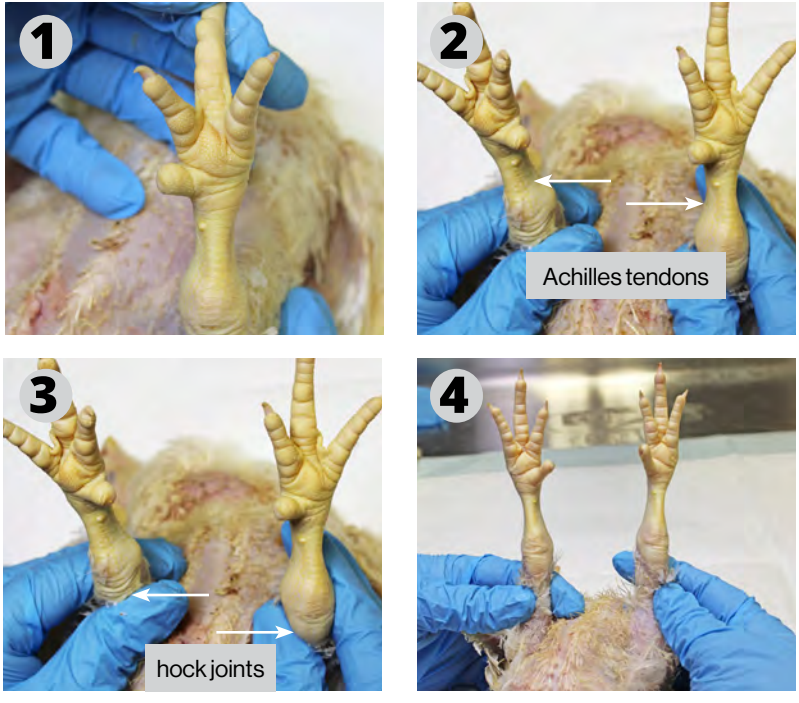
Fowl Tick - tiny tick that sticks to skin and causes red spots.

Legs and Feet

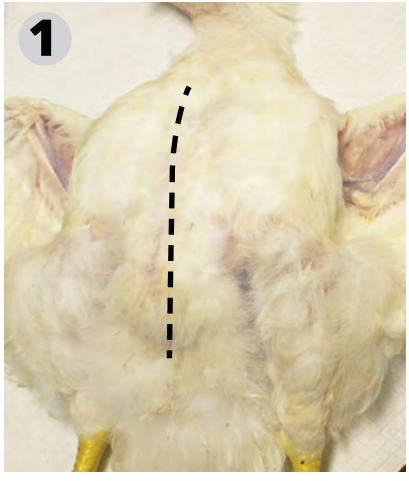
Scaly Leg Mite - raised, uneven, crusty and/or thickening scales.

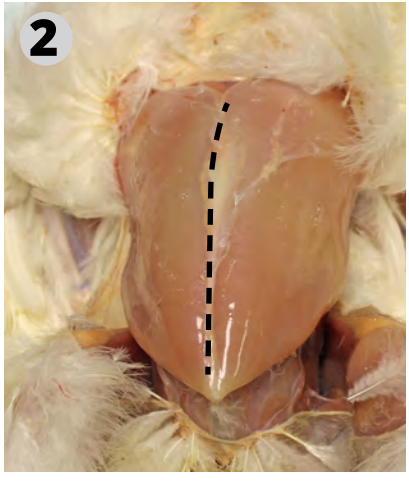
4.3 Feet, Legs, and Skeletal Health

1. Evaluate the condition of the feet (foot pads, toes and toenails). Inspect for any litter or manure accumulation, ulcers, and foot or toe damage. Inspect the legs for overall health condition.
2. Take the weight of the legs with your index finger. With your thumb feel for hard nodules or inflammations in the Achilles tendon.
3. Check for swelling of the hock joint.
4. Evaluate leg straightness. Hold the legs at the natural width for the frame size of each individual bird. Holding the legs either too far apart or too close together will make them appear crooked.



1. The keel bone is the pronounced bone that extends from the sternum and runs axially over the midline. It is located ventral to the heart and anchors the muscles used for wing motion (pectoralis major and pectoralis minor). Palpate the keel bone and inspect it for curvatures or bends.
2. The keel bone also can be visually inspected after euthanasia and breast skin removal.





4.4 Head Condition

Head

1. Check the head for any swelling

Eyes and Ears

2. Check eyes and ears for redness, swelling and discharge.

Nostrils and Beak

3. Check the beak shape. Check the beak, internally and externally including the corners for abnormalities such as lesions from mycotoxins or beak conditioning errors.
4. Check the nostrils for blockages and buildup of materials. Apply pressure to the top of the nostril to check for mucus.

Comb and Wattle

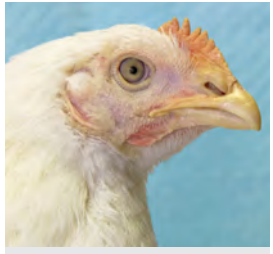
5. Observe the size and color of the wattle and comb relative to age. (See following page for examples of comb and wattle appearance at different ages.)

4.4 Head Condition

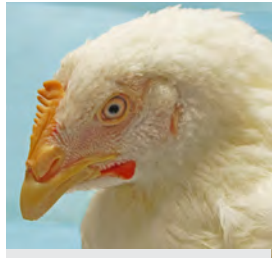
These photos illustrate normal appearance, size and coloration of the comb and wattle relative to age of broiler breeder chickens:

2-week old chick

11-week old female

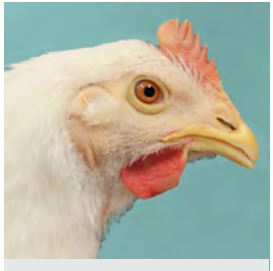


11-week old male

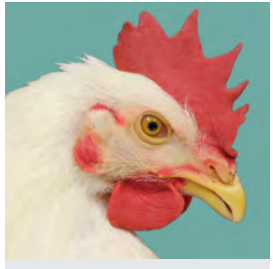


14-week old female

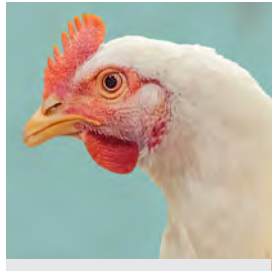
14-week old male



21-week old female



21-week old male



32-week old female

32-week old male

4.5 Development and Body Condition

Body weight

1. Weigh the bird. Record and compare the weight to what is expected for the age, sex, and line.
2. Verification of the body weight and documentation of body condition (fleshing and fat deposition) of birds are recommended as part of the flock evaluation process and post-mortem session. For example, post-mortem sessions can allow farm managers and veterinarians to verify possible biological reasons for underweight birds or those that have inadequate fleshing and/or fat deposition. Conversely, if broiler breeders are overweight and over-conditioned (excessive fleshing and fat scores) during a post-mortem session, this may help explain mortality during the onset of egg production and fertility concerns in a broiler breeder flock.

You can find the expected body weight for each of our products in our supplements, available at Cobbgenetics.com

Fleshing, Fat Deposition and Uniformity - Females

1. Evaluate the fleshing and fat deposition for each individual bird.
2. Use the chart to determine if flesh score is correct for the bird's age.
3. Palpate the pelvic bone to assess fat accumulation. Hens (in production) may have visible fat deposits underneath the skin on the bottom (ventral) portion of each wing. Parallel to this fat deposit is a large blood vessel. This combination is often referred to as the fat vein. The fat vein can be used to determine subcutaneous fat deposition. Fat accumulation can also be visually inspected during the internal examination.

Explanation of female fleshing scores		
Fleshing 1	Substantially under the desired level of fleshing.	
Fleshing 2	Ideal breast shape for a 12 week-old female.	
Fleshing 3	Breast fleshing shape at 16 to 25 weeks during preparation for lay.	
Fleshing 4	Breast fleshing shape at 19 to 25 weeks during preparation for lay.	
Fleshing 5	Oversized breast muscle.	

Optimum Fleshing Score and Pelvic Fat for Females Given as Age and Percentage of Flock within Each Score				
Age (weeks)	Fleshing score			Pelvic Fat
	2	3	4	
12	70%	30%		
16	40%	60%		
19	<10%	60%	30%	>65%
20	<5%	60%	35%	>75%
21		60%	40%	>85%
22		60%	40%	>90%

4.5 Development and Body Condition

Fleshing and Uniformity - Males

1. Evaluate the fleshing.
2. Use the tables to determine if flesh score is correct for the bird's age. See Cobb supplements for more information on male fleshing.

Optimum Fleshing Score and Pelvic Fat for Males Given as Age and Percentage of Flock within Each Score					
Age (weeks)	Fleshing score				Fleshing Score (Weighted Average)
	2	2.5	3	4	
20	25%	50%	25%		2.50
25	15%	55%	30%		2.60
30	5%	60%	35%		2.65
35	3%	60%	35%	2%	2.70
40	1%	53%	40%	6%	2.80
45	1%	50%	40%	9%	2.85
50		45%	43%	12%	2.90
55		40%	45%	15%	2.95
60		30%	55%	15%	3.00

Explanation of male fleshing scores

Fleshing 1	Severely under conditioned breast and very thin. No wing resistance. Unacceptable male.	 *Not Acceptable*
Fleshing 2	Thin breast from top (wing area) down. More keel bone exposed. Flaccid wing resistance.	 *Lean*
Fleshing 2.5	V shaped breast with more fleshing in upper breast part near the wings. Stronger wing resistance and minimum condition for most males for good fertility.	 *OK*
Fleshing 3	More rounded breast with more breast deposition on the side of the keel. Similar to fleshing 2.5, fleshing 3 is good and preferred for males during the production period.	 *OK*
Fleshing 4	Wide breast on top (wing area) and down to end of the keel. This condition will become more noticeable after 50 weeks.	 *Too Heavy*
Fleshing 5	Very wide breast (dimple in keel area). Severely over fleshed male for all the male lines. Fertility would be negatively affected.	 *Excessive*

4.6 Cloaca and Tail

Cloaca and Tail

1. Inspect the cloaca. Check for a pasty vent (cloaca) and accumulation of urate deposits. For males, check the color (redness) for active breeding roosters (see section 5.7 for more photos and information).
2. Inspect the tail. The tail should be well-feathered. Any signs of tail pecking can be an indication of stress, high density, or nutritional deficiencies.

A normal cloaca, clean and free of abnormalities.

This female has a well-developed and well-feathered tail.

Post-Mortem Internal Visual Examination

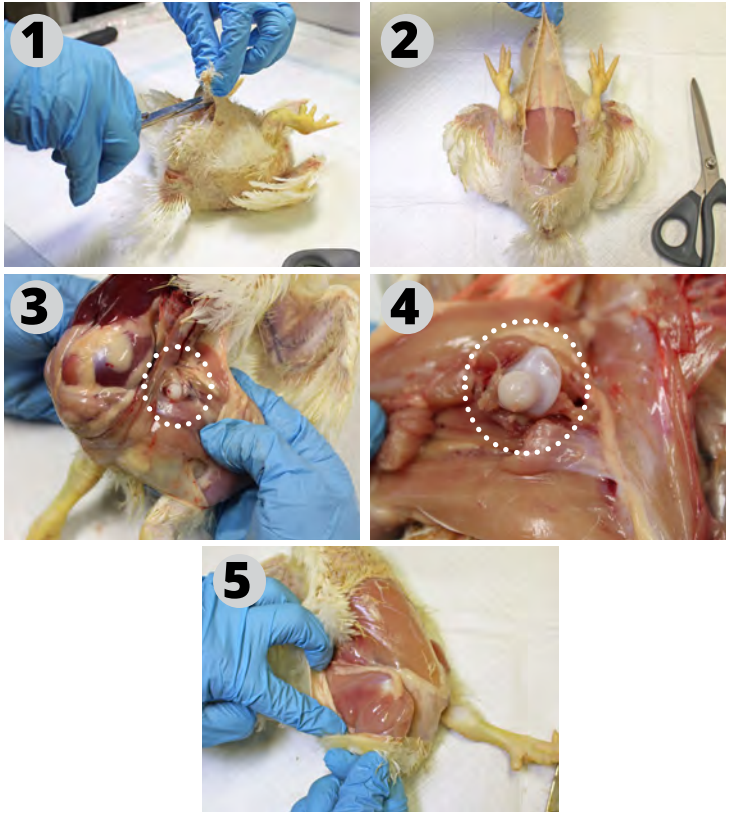
5

5.1 Examination Sequence

1. It is recommended to wet the carcass using water containing a disinfectant after euthanasia to keep feathers and down from interfering with the post-mortem examination.
2. Remove the breast skin
3. Subdermal and femoral head exam
4. Examine the legs
5. Examine the head and neck region
6. Examine the thoracic cavity and coelomic cavity (space where internal organs are suspended).
7. Examine the reproductive organs

5.2 Subdermal and Femoral Head Examination

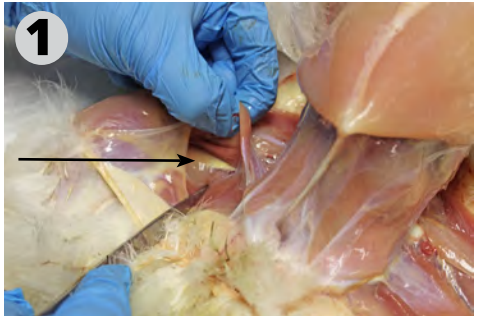
1. Remove the skin from the breast.
2. Examine the keel and breast to check the condition of the bird and check for any abnormalities (i.e. crooked keel; irregular color of the breast). Note fleshing and breast shape.
3. Support the carcass and elevate the leg to 90 degrees. Pull the leg from the joint (for older birds) or pop the femoral head out (for younger birds) by pressing the thigh down and towards the back of the carcass.
4. Inspect the femoral head. A normal, healthy femoral head is shown in the photo.
5. Remove the skin from the legs and sides of the breast. Inspect the muscle revealed after the skin was removed. Look for any hemorrhages in the thigh muscles (i.e., lesion due to a mycotoxin issue, injury or disease like infectious bursal disease (IBD)).

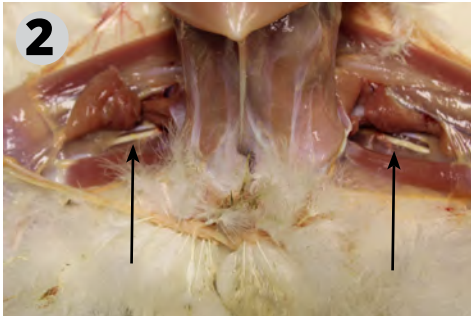


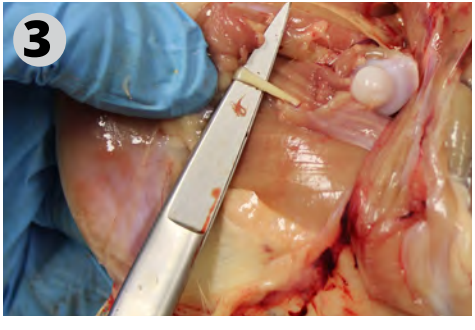
5.3 Leg Examination

Sciatic Nerve

1. On the interior of the upper thigh, raise or cut the muscle to expose the sciatic nerve.
2. Expose the nerves on both legs. There should be no swelling and the nerve on the right and left should be the same size. The normal appearance is shown in the photos.
3. Using scissors, a portion of the nerve can be excised and collected for laboratory analysis.



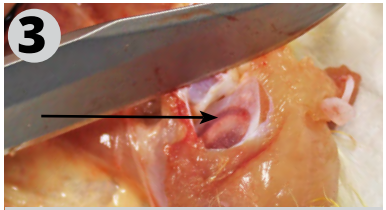




5.3 Leg Examination

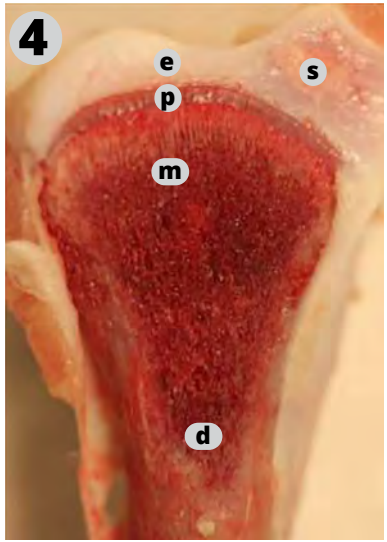
Growth Plates

1. Check the growth plate and bone integrity of young birds by slicing through the proximal end of the tibia (end away from the foot). Always slice the bone away from your hand that is grasping the leg and never towards your hand. Slicing towards your hand can cause a serious injury!
2. It will be necessary to slice through the bone several times to see the internal features.
3. The growth plates should have a uniform thickness. Be sure to check growth plates on both legs as it is possible to have one normal and one abnormal growth plate.
4. A cross-section of a normal tibia is shown in the photo. e (epiphysis); p (physis or growth plate); s (secondary center of ossification); m (metaphysis); d (diaphysis).
5. Note: no growth plate will be visible in mature birds and it will be very difficult to cut through the bone of a mature bird.



Growth plates with normal appearance in a 3-week old male.

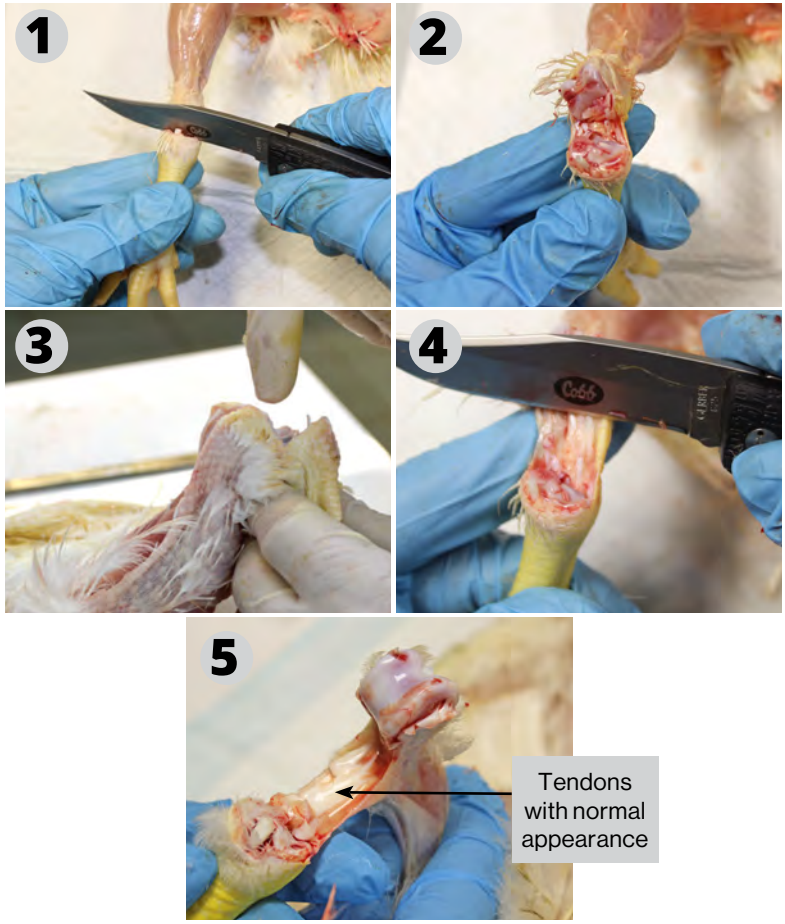
Growth plates with normal appearance in an 11-week old male.



5.3 Leg Examination

Joints, Tendons

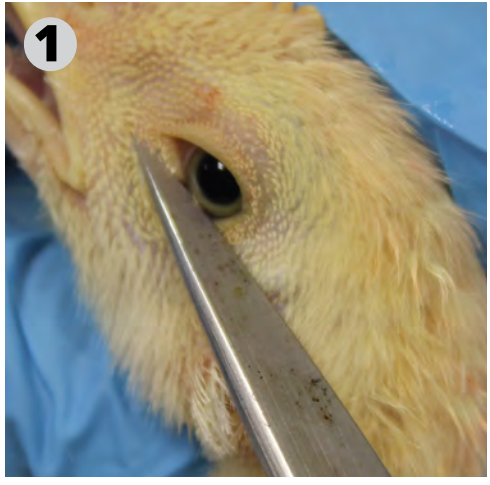
1. Make an incision in the hock joint.
2. Carefully cut through the joint to open it fully.
3. Push a finger into the joint. There should be a sticky fluid attached to the finger when slowly withdrawn.
4. Cut down between the joint and the skin on the leg to reveal the tendon.
5. Inspect the area between the skin and tendon for fluid accumulation. Examine the tendons. They should be white, smooth, and shiny.

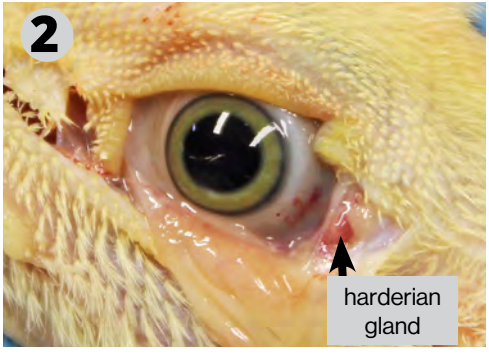


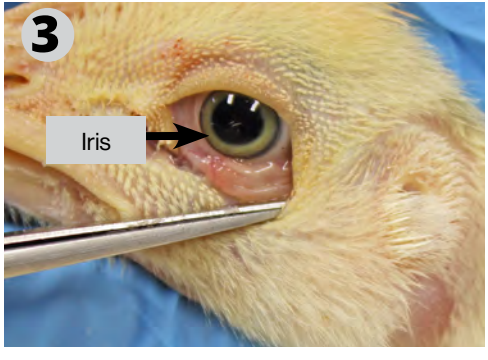
5.4 Head and Neck Region

Eyes

1. Remove the eyelid.
2. Check the color and size of the harderian gland. The harderian gland is important for the immune function and lubrication of the eye.
3. Look for inflammation of the eyelid. Look for irregularities of the cornea (clear dome over the eye), iris (colored part) and pupil of the eye.



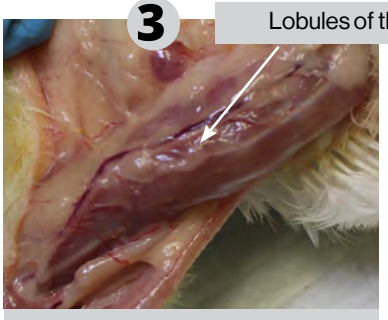




5.4 Head and Neck Region

Thymus

1. Examine the back of the neck especially in young chicks as day of age subcutaneous injections are placed here and may be a source of infection and early mortality issues. Make an incision at the base of the neck.
2. Gently remove the skin to reveal the thymus.
3. The thymus consists of several pairs of pale pink, flattened, irregularly shaped lobes. The thymus lobes can be seen on both sides of the neck near the jugular veins. They should be clearly visible.
4. Note: thymus lobes will not be visbile in mature birds.



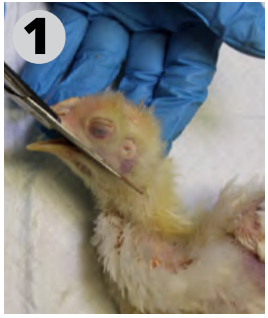
3-week old broiler breeder

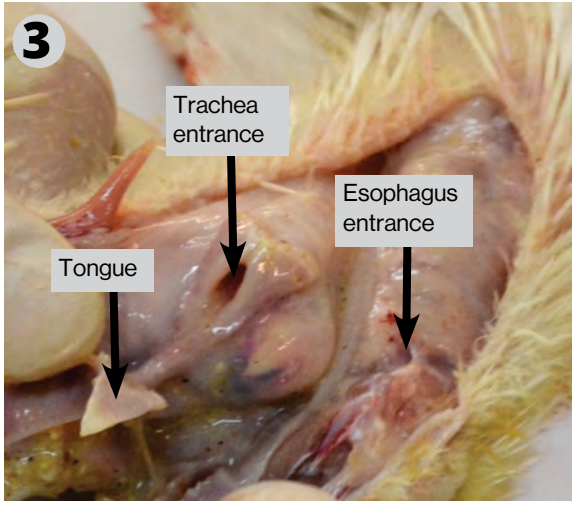
14-week old broiler breeder

5.4 Head and Neck Region

Trachea, Esophagus, Tongue

1. Cut through the corner of the beak to open the mouth and expose the entrance to the trachea and esophagus.
2. Cut down to the crop.
3. Open the cut. The entry to the trachea and esophagus can now be seen. Examine the esophagus, oral cavity, tongue and under the tongue for any abnormalities (such as ulcers due to mycotoxins). Examine the tongue for necrosis and diphtheria by toxins or pox. Take note of any raised or discolored areas. The mucosal surfaces are normally very uniform in color and appearance.

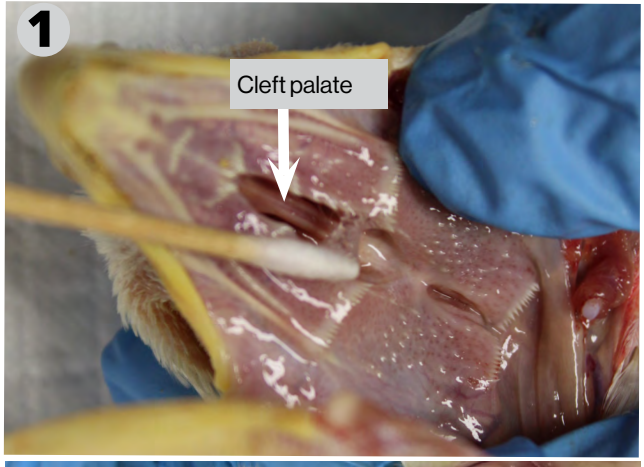


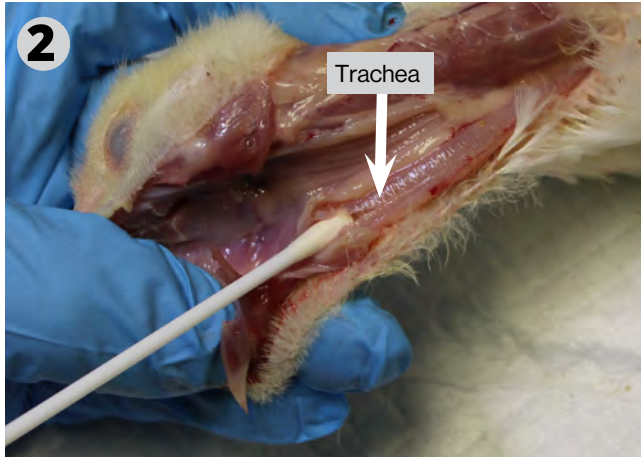


5.4 Head and Neck Region

Cleft Palate, Trachea

1. The cleft palate is often used for taking PCR swab samples. Examine the cleft palate for excessive mucus and red mucus.
2. Swabs of the internal surface of the trachea can also be collected for diagnostics. *(In the photo, the trachea has been cut open to obtain a sample with a swab).*

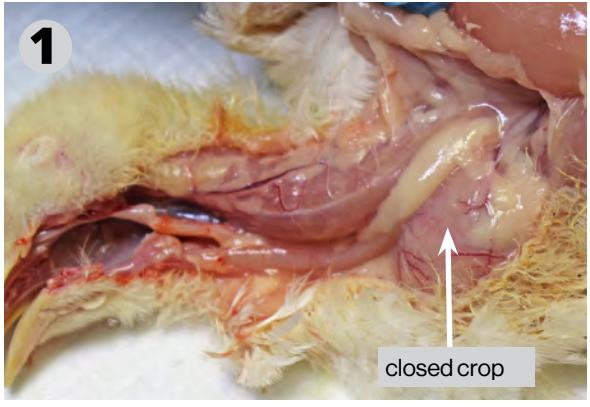




5.4 Head and Neck Region

Crop

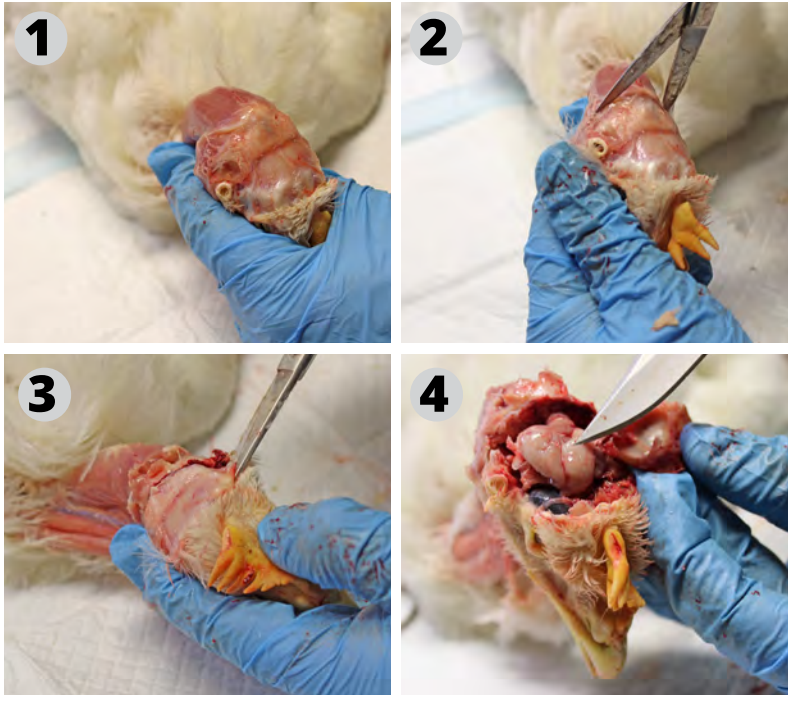
1. Feed enters the mouth and goes straight to the crop. The feed is held here for stabilization and storage. It then passes to the proventriculus where digestive enzymes are added. The crop is where the breakdown of feed starts.
2. Examine the crop for size (correct based on age and weight) and cut the crop to examine the inside. Evaluate the contents of the crop (i.e., feed, litter, etc.) and look for irregularities on the internal surface of the crop (i.e., fungal growth). A fungal infection by Candida can cause whitish, thickened patches inside the crop.



5.4 Head and Neck Region

Brain

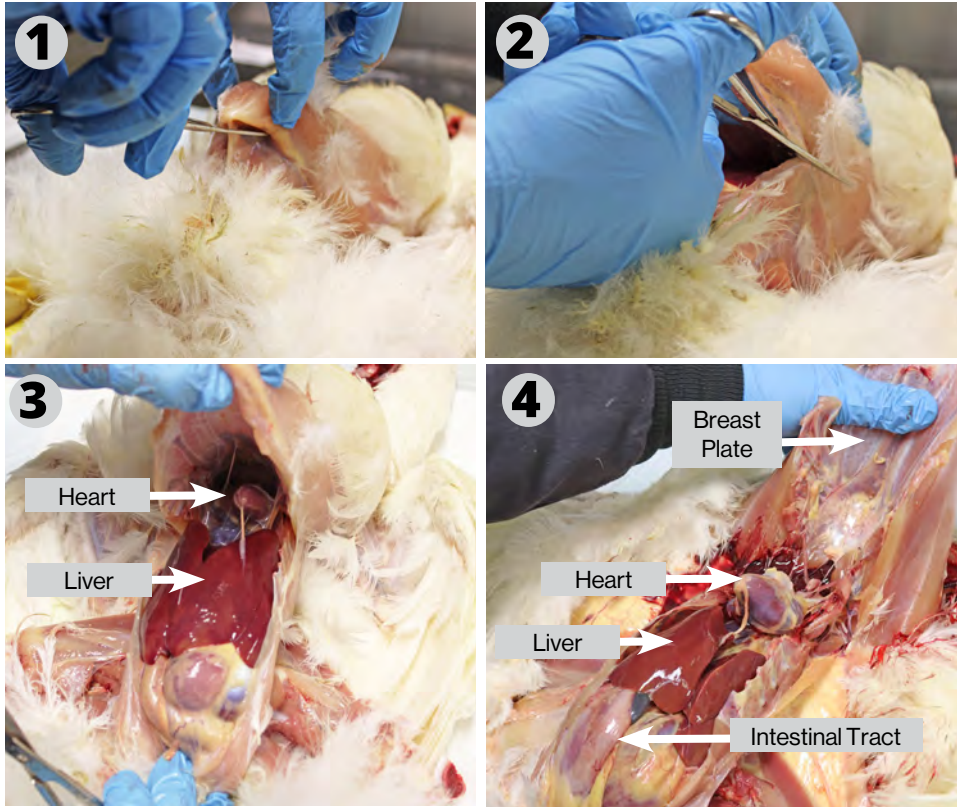
1. Remove the feathers and skin from the head.
2. Using scissors, cut the base of the skull.
3. Carefully cut along both sides of the skull and the front. Do not allow the scissors to go deep into the skull as they may damage brain tissue.
4. Remove the skull cap. Inspect the brain for any discoloration or nodules that can indicate bacterial or fungal infection. The brain should be pale colored as shown in the photo. Brain tissue can be collected and sent for histology, culturing and/or PCR.



5.5 Thoracic Cavity and Coelomic Region

Exposing the Thoracic Cavity and Coelomic Region

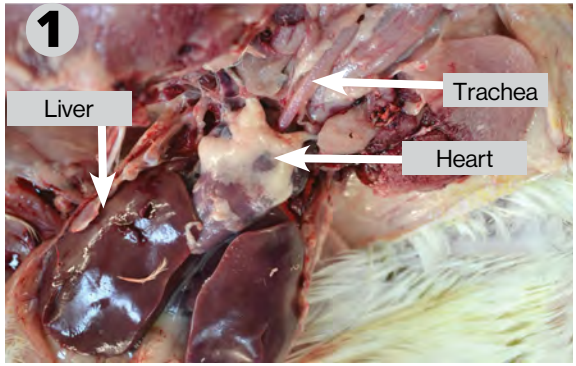
1. Snip the tissue at the tip of the sternum to open the thoracic (chest) cavity and coelomic (abdominal) region.
2. Cut along the edge of the breast, cutting through the muscle and the ribs. Try to avoid damaging the liver, intestines and gall bladder with your knife or scissors.
3. Gently raise the breast plate to reveal the liver and heart.
4. Cut through the shoulder to remove the breast plate. Move the breast plate to the side or remove it completely so that you can inspect the organs. Be careful not to cut the trachea.

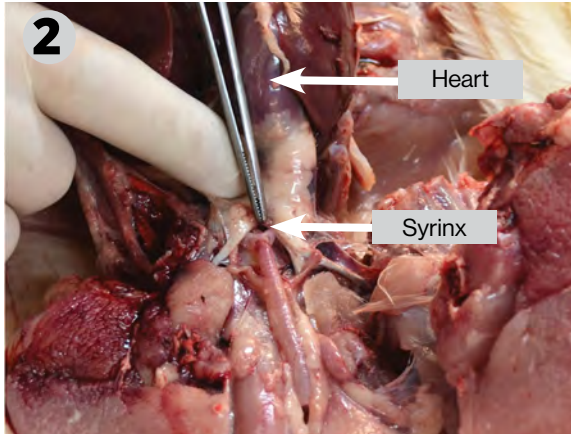


5.5 Thoracic Cavity and Coelomic Region

Heart, Syrinx

1. After the breast plate is lifted or removed, the liver, heart and trachea can be seen clearly. The heart in the photo is healthy. It should be shaped like a blunt arrow. The heart should feel muscular (firm) and not soft (flaccid or floppy).
2. Raise the heart to reveal the syrinx. The syrinx is the point where the trachea splits into two. This is also the place where the bird makes sound. Check the syrinx for mucus/pus, at the point where it splits.

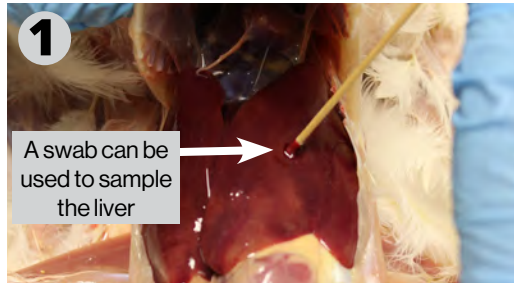


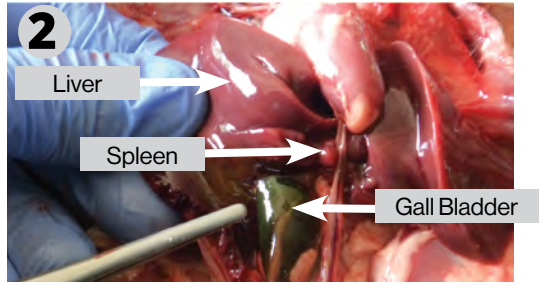


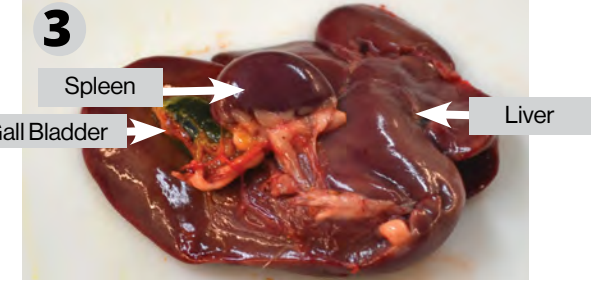
5.5 Thoracic Cavity and Coelomic Region

Liver, Spleen, Gall Bladder

1. Examine the liver. It is the first organ where the absorbed nutrients pass. The liver is a filter (detoxifier). Liver color can vary by diet and age. Chicks typically have a yellow liver (due to yolk absorption) while older birds have a dark red liver as shown here. Observe color, spots or inflammation of the liver capsule (perihepatitis). The edges of the liver should be well-defined. Liver samples using swabs (as seen in the photo) or a small amount of tissue can be placed in a sample jar to submit to the lab.
2. Elevate the corner of the liver to view the gall bladder. The gall bladder releases bile fluid into the digestive tract to support fat digestion. A normal gall bladder should be dark green. A large gall bladder indicates a high level of hemoglobin turnover. Also note, when birds have been off feed, the gall bladder will swell.
3. Remove the liver with gall bladder and spleen attached. The spleen is a small, round, soft organ similar in color to the liver. A normal spleen is about 1 inch (2.5 to 3.0 cm) long and the size of a large olive. Enlargement of the spleen may indicate a high production of lymphocytes in response to an infection.



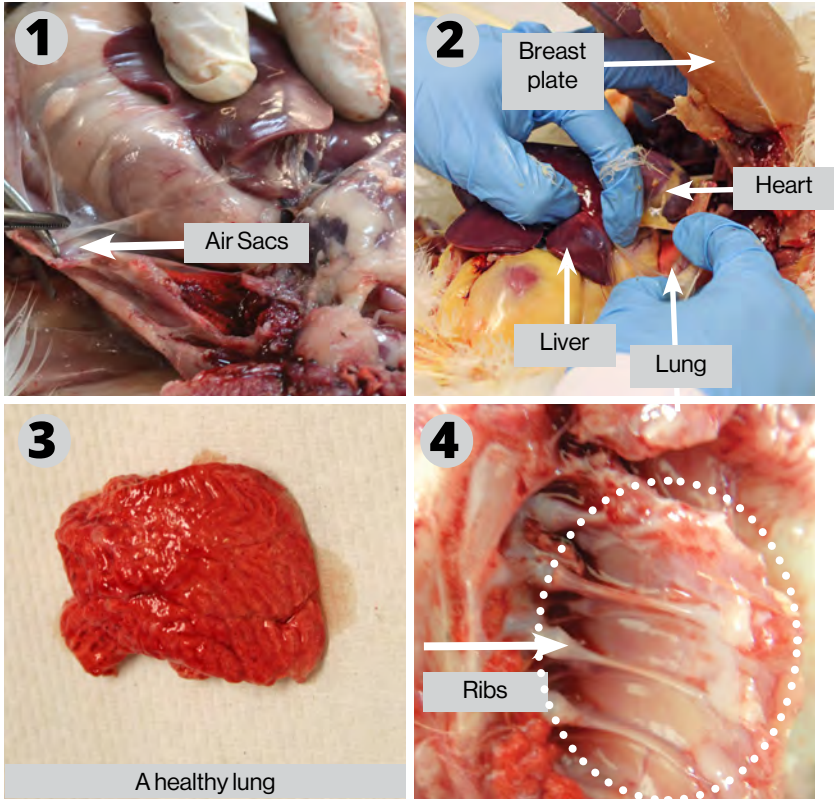




5.5 Thoracic Cavity and Coelomic Region

Air Sacs, Lungs, Ribs

1. After the heart and liver have been evaluated, grasp the gizzard with your left hand and pull it to the left to reveal the intestines, abdominal air sacs and remaining internal organs. Air sacs should be clear and free of exudate.
2. The lungs are firmly attached to the ribs in the upper thoracic cavity under the heart.
3. The lungs should be a bright pink / red color (as shown in the photo), without signs of inflammation. Normal lung tissue is spongy and no nodules or irregular texture should be palpated.
4. Remove the lungs on each side to view the ribs. Check the shape and spacing of the ribs for uniformity. Abnormal findings may include bead like pearls on the ends of the ribs (i.e., rickets). This photo indicates normal rib appearance.

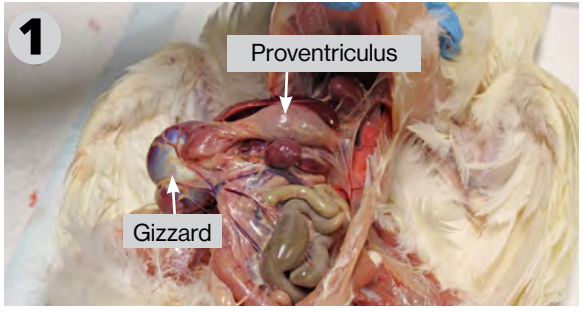


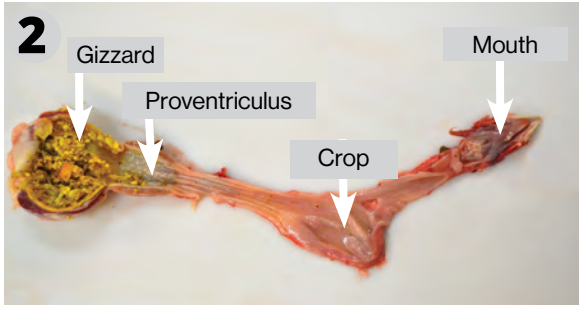
A healthy lung

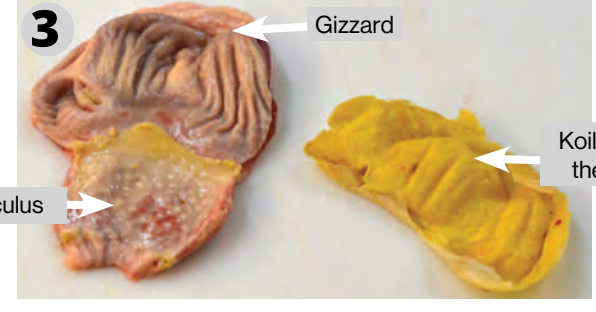
5.5 Thoracic Cavity and Coelomic Region

Gizzard, Proventriculus

1. After the liver is removed, the proventriculus and gizzard are clearly visible. In the proventriculus, enzymes are mixed with feed and digestion continues.
2. Remove the gizzard and proventriculus. Open each organ and inspect them. The photo shows a normal color and texture of the proventriculus and the gizzard.
3. The gizzard grinds food and is a very strong muscle. In the photo the koilin membrane (lining of the gizzard) has been removed. Check the gizzard for erosions and ulcerations. An erosion is a lesion only present in the membrane (koilin layer). An ulceration is a lesion that has eroded through the lining to the muscle layer of the gizzard.



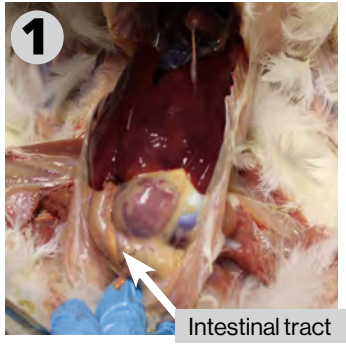


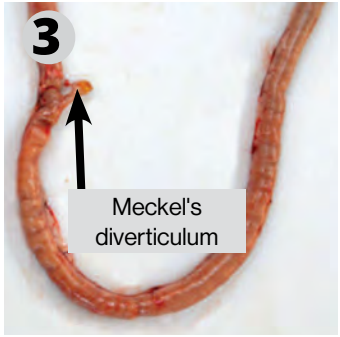


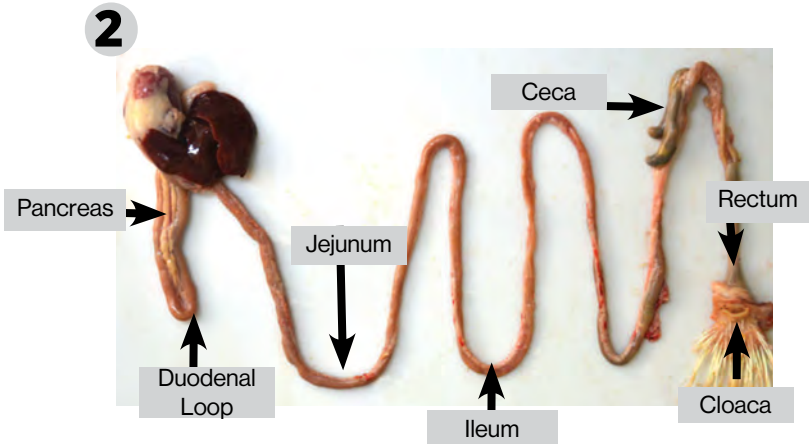
5.5 Thoracic Cavity and Coelomic Region

Intestines

1. The duodenum, jejunum and ileum are classed as the small intestine. The duodenum is the most efficient at breaking down nutrients but more absorption takes place in the jejunum and ileum due to the larger surface area.
2. Remove the intestinal tract and examine. The pancreas is in the center of the duodenal loop and normally a pale color (as shown in this photo). The pancreas secretes enzymes and buffers into the duodenum to further breakdown nutrients.
3. Meckel's diverticulum (yolk sac absorption site) marks the end of the jejunum and the start of the ileum. In young birds, the yolk from the egg is absorbed here. Evaluate meckel's diverticulum for yolk sac retention. This picture indicates a normal sized meckel's diverticulum. A large meckel's diverticulum is indicative of a poorly absorbed yolk sac in young birds.



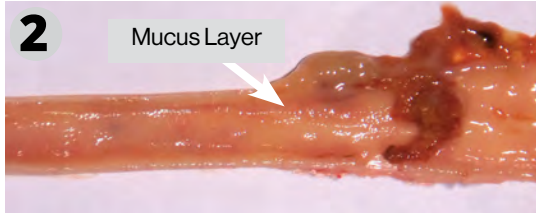


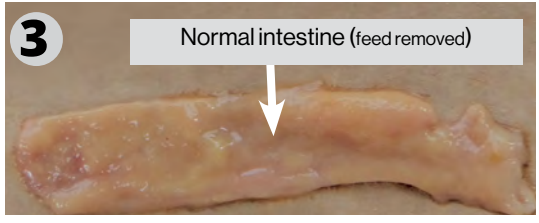


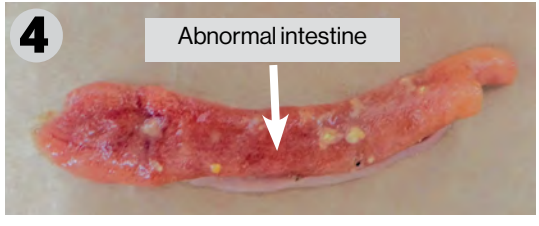
5.5 Thoracic Cavity and Coelomic Region

Intestines

1. Use scissors to open the length of the intestinal tract in order (duodenum to ceca) to examine the intestinal content and texture.
2. Evaluate the opened intestinal tract for color, content and mucus presence. Mucus protects the intestinal wall from being infected with pathogens inside the lumen.
3. In a normal healthy bird, the intestine should be pale in color.
4. An abnormal finding might include the presence of hemorrhages, irregular color or thickness of the ingesting, and irregular texture of the mucosal lining of the intestine.



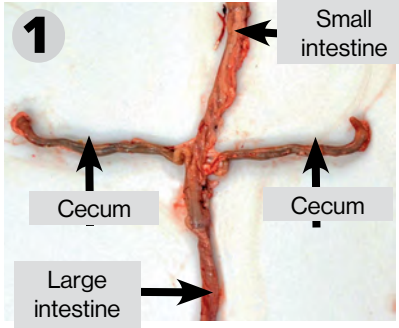




5.5 Thoracic Cavity and Coelomic Region

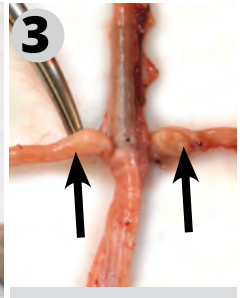
Ceca, Cecal Tonsils

1. The ceca are located where the small and large intestines join. They are emptied on average 1 to 2 times a day. The ceca droppings seen in the litter and are softer, stickier and waterier than a 'normal' dropping. Ceca size may vary among birds. There is one pair of ceca. The ceca are blind pouches (they do not connect to another point).
2. Use scissors to open the ceca and examine the contents.
3. The cecal tonsils are at the joint between the ceca and large intestines. The cecal tonsils are lymph nodules and will respond to an infection. Evaluate cecal tonsils for cleanliness and size. Normal cecal tonsils should be clean and without red inflammation.
4. Abnormal cecal tonsils may be red and/or inflamed (swollen).
5. Cecal tonsils may be submitted for virology testing.



Normal fecal dropping with white urate cap

Normal cecal dropping



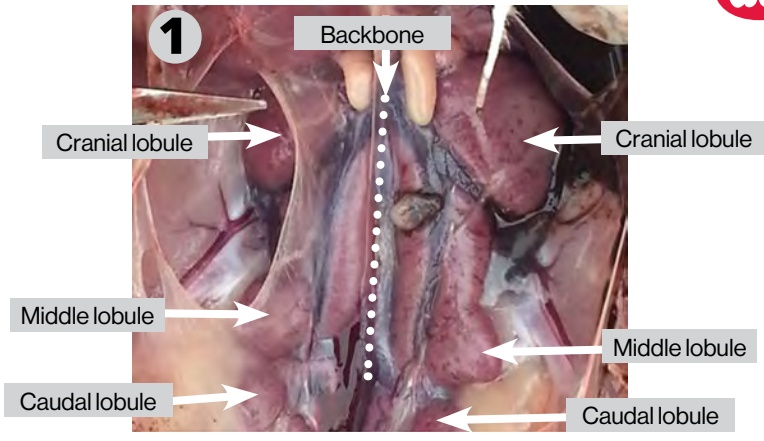
Normal cecal tonsils (no swelling, pale color)

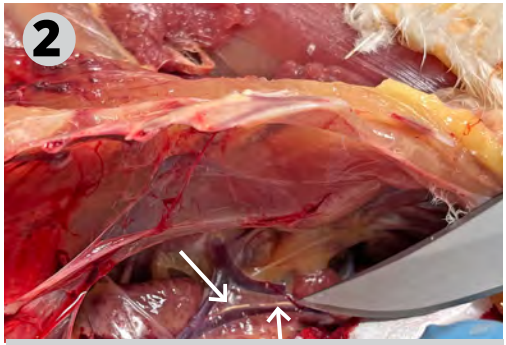
Abnormal cecal tonsils (note inflammation and redness)

5.5 Thoracic Cavity and Coelomic Region

Kidneys, Ureters

1. The kidneys are located under the intestinal tract in a fixed position on either side of the backbone (vertebral column). The kidneys should appear symmetrical and consist of 3 lobules (cranial, middle and caudal) on each side. They should be flat, firm and light purple (similar to the photo). They should not show any signs of blood congestion.
2. The ureters are small, clear tubes and may be difficult to see. However, if urates are present, the ureters may be easier to locate. No urates (white deposits as seen in the photos) should be present in the kidneys or ureters.



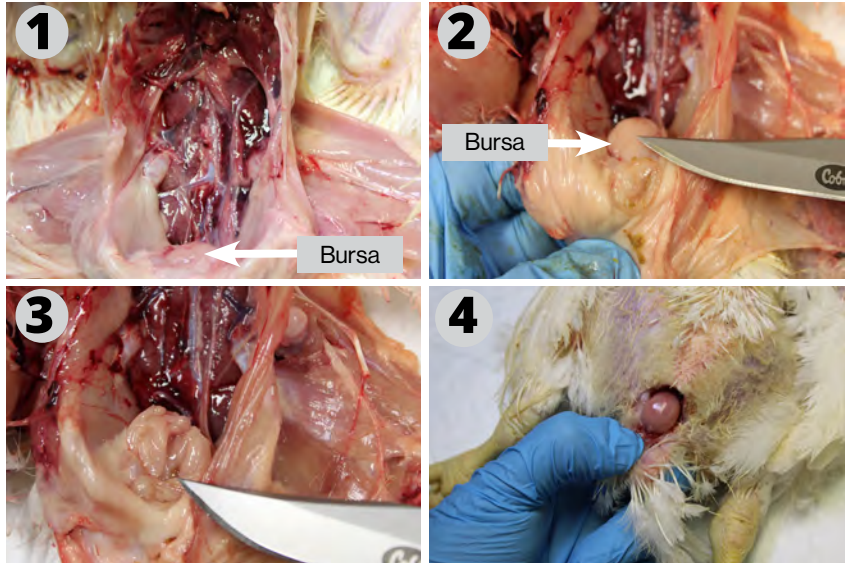


White urate deposits in the ureters may indicate dehydration.

5.5 Thoracic Cavity and Coelomic Region

Bursa of Fabricius

1. After removing the intestinal tract, the bursa of fabricius can be located near the cloaca. This lymphoid organ is important for immunity and antibody production in chickens. The size may vary based on age and vaccination program used for Gumboro (Infectious Bursal Disease). The bursa will normally decrease in size as the bird ages and may be difficult to locate in older birds.
2. On post-mortem inspection, the bursa will appear as a small, round, pale-colored sac.
3. After opening it, you should see several small folds inside the bursa. Evaluate the bursa for irregular size (e.g. much smaller than expected for the age of the bird), swelling (e.g. presence of edema and folds absent if bursa is swollen), and irregular coloring (e.g. small pin-point blood spots or hemorrhages).
4. In young birds, the bursa can also be examined and removed by carefully cutting the skin on the dorsal side just above the tail.



5.6 Female Reproductive Tract

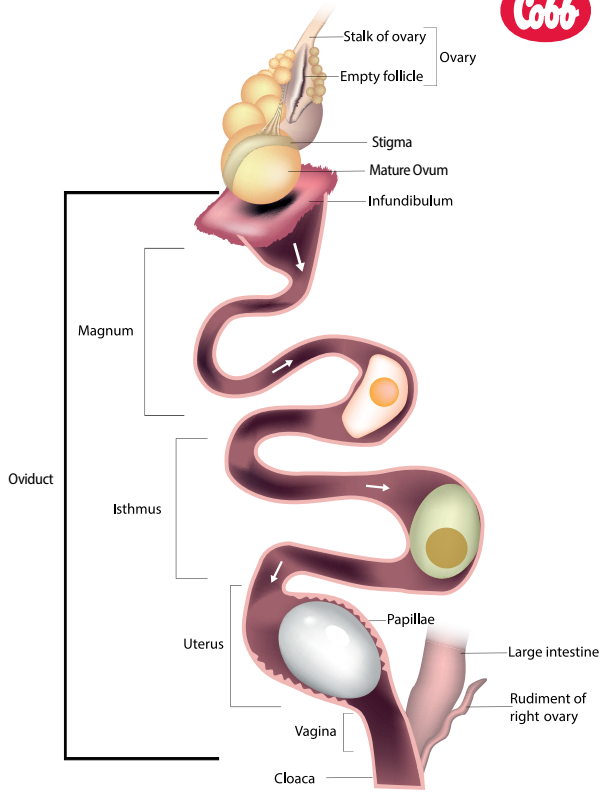
In the female reproductive system, only the left ovary will develop and mature. The ovary is firmly attached to the back of the hen's abdominal wall very near the kidneys.

In mature hens, the ovary is a mass of sacs called follicles and each follicle contains a yellowish ovum (or yolk). The follicle and yolk grow over a 10-day period to the size of a yolk in a normal egg. In a mature follicle, there is an area without blood vessels (the stigma) where the follicle has split apart to release the yolk into the oviduct. If the follicle splits at a point other than the stigma, blood vessels may rupture and blood may appear in the egg.

Approximately every 24 hours, one mature ovum from the ovaries passes into the oviduct which lies along the backbone and connects the ovary to the cloaca. In mature hens, the oviduct is about 63.5 cm (26 inches) long and consists of the infundibulum, magnum, isthmus, uterus and vagina, each with their own function.

Location	Action	Time in location (hours)	Normal length cm (in)
Infundibulum	Ovum fertilized	0.25	5 (2)
Magnum	Albumen is collected	3	33 (13)
Isthmus	Inner and outer shell membranes established	1.25	10 (4)
Uterus	Shell and cuticle pigment added	20.75	10.5 (4.2)
Vagina	Passes through to cloaca	<0.25	10 (4)

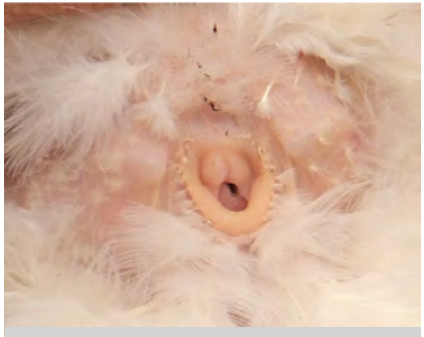
(Table courtesy of Philip Clauer, Penn State University, available at: https://extension.psu.edu/hen-reproduction)



5.6 Female Reproductive Anatomy

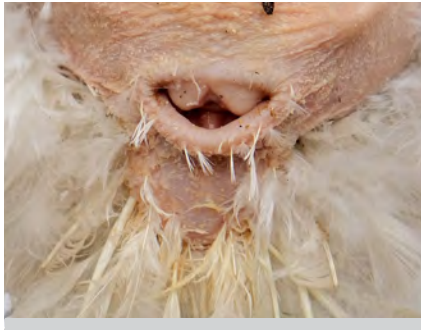
Cloaca

1. Inspect the cloaca for wounds, cleanness, or urate deposits.
2. For hens in production, check for prolapses. Predisposing factors include:
   - repeated pecking at the vent.
   - oviduct fails to retract after egg laying in hens with poor conditioning. (Over-conditioned hens often have insufficient elasticity and tone due to excessive fat; under-conditioned birds may have underdeveloped muscles that are necessary to cope with egg laying).



An 11-week old pullet.

A 21-week old pullet after photo stimulation.

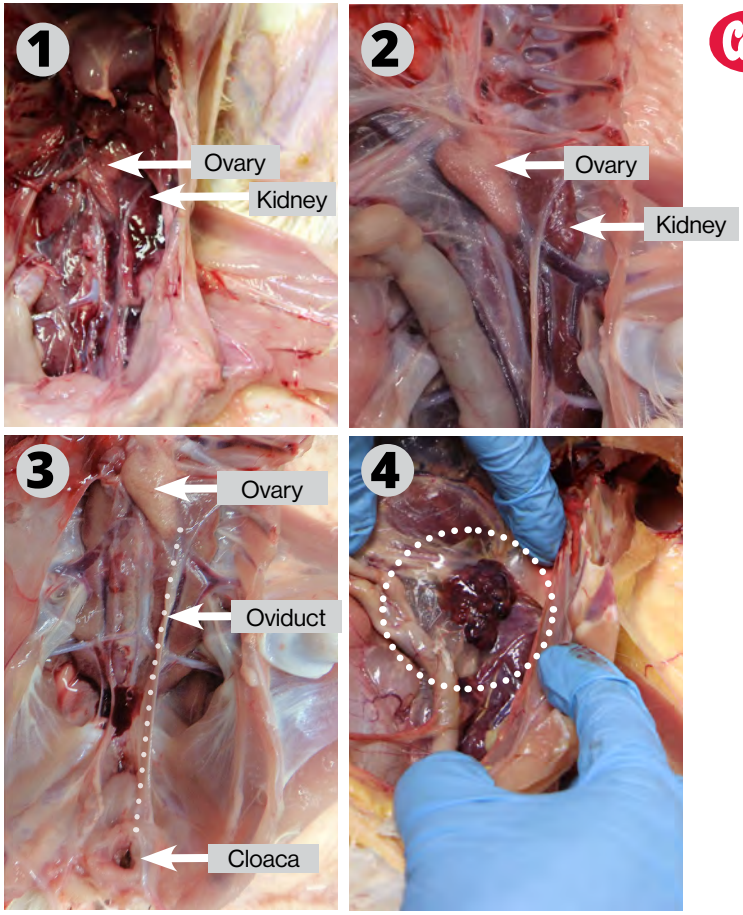


A 32-week old hen.

5.6 Female Reproductive Anatomy

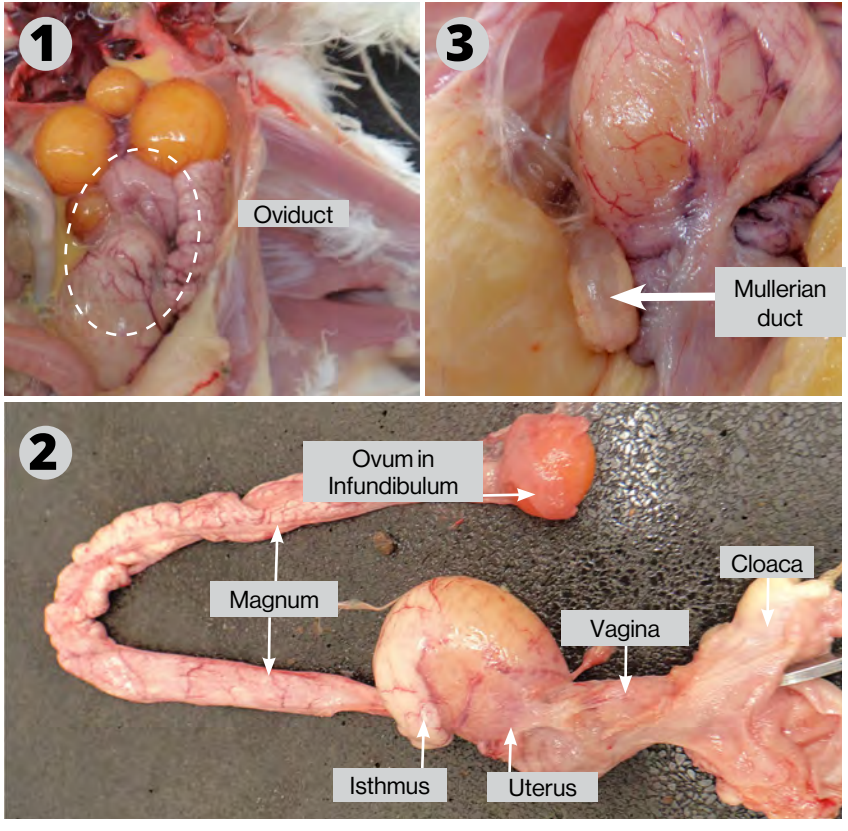
Ovary, Oviduct in **Pullets**

1. The left ovary can be seen after removing the heart, liver and intestinal tract. In young pullets, it is pale colored and situated next to the left kidney.
2. Examine the ovary for size based on age. Make note of any signs of bleeding.
3. The oviduct is a tube-like organ that stretches from the ovary to the cloaca and lies along the backbone (in the picture a white dotted line is overlaying the oviduct). In pullets, the oviduct is a clear, small tube. Inspect the oviduct for developmental defects.
4. After the pullet is photo stimulated, the follicles will begin to develop and appear as a small dark colored cluster.



Ovary, Oviduct in **Hens**

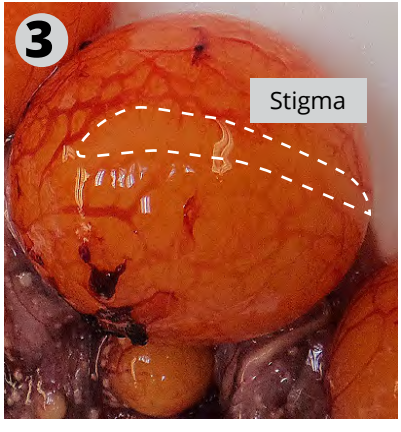
1. After evaluating the heart and intestines, these organs can be removed. This will allow a full view of the reproductive organs (oviduct and left ovary with developed ovum). Inspect the oviduct for developmental abnormalities, double follicles, vascularization and infections.
2. An oviduct that has been removed from a mature female is seen in the photo. One ovum is in the infundibulum (the top of the oviduct). This is where fertilization occurs. A second ovum is in the isthmus (where the eggshell membrane is added) at the end of the oviduct where it joins the uterus.
3. Remnants of the right ovary are shown in the photo. The right ovary is non-functional but can occasionally be seen as a clear, fluid-filled cyst that varies in size called the Mullerian duct. Inspect this remnant for size and clear content.



5.6 Female Reproductive Anatomy

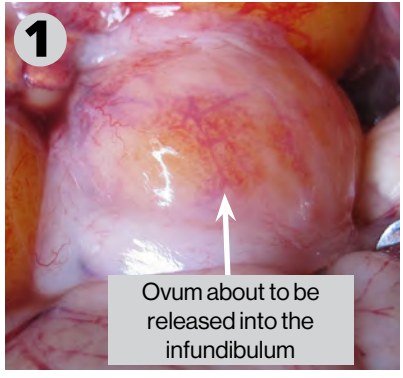
Follicles, Stigma in **Hens**

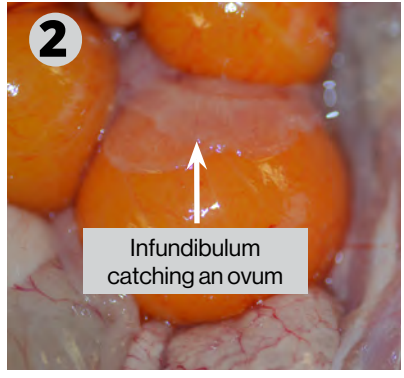
1. Remove the follicles. Inspect for vascularization and degeneration of follicles.
2. Check follicles over 1 cm. The photo shows a hierarchy of ova. A good range is 6 to 8 follicles, > 1 cm each, and increasing in size.
3. The stigma is the point of rupture of the follicle during ovulation. If the follicle splits at a point other than the stigma, blood vessels may rupture.

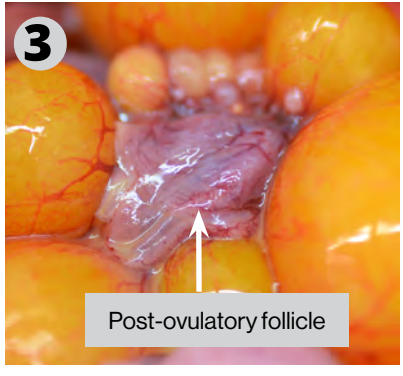


Infundibulum in **Hens**

1. The infundibulum engulfs and pulls mature ova that have been released from a follicle into the oviduct.
2. Fertilization occurs after the ovum is in the infundibulum. Normal appearance is shown in the photos. If the infundibulum does not engulf the ovum, the ovum may be reabsorbed. If not reabsorbed, the ova can accumulate in the coelomic cavity and can lead to a syndrome known as an "internal layer".
3. An ovum has been released and the post-ovulatory follicle is visible. The post ovulatory follicle has a hormonal function. Normal appearance should be whitish red.







5.6 Female Reproductive Anatomy

Magnum, Isthmus in **Hens**

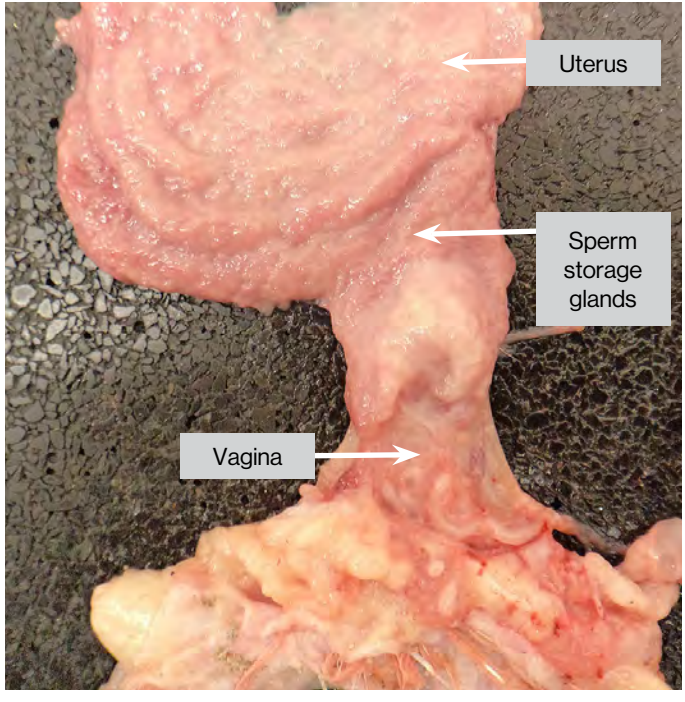
1. The magnum and isthmus shown in the photos have a normal appearance and color.
2. Check for bleeding, ulcers, and remains of albumen or yolk.

Close up of Magnum

Close up of Isthmus

Ovum, Egg in **Hens**

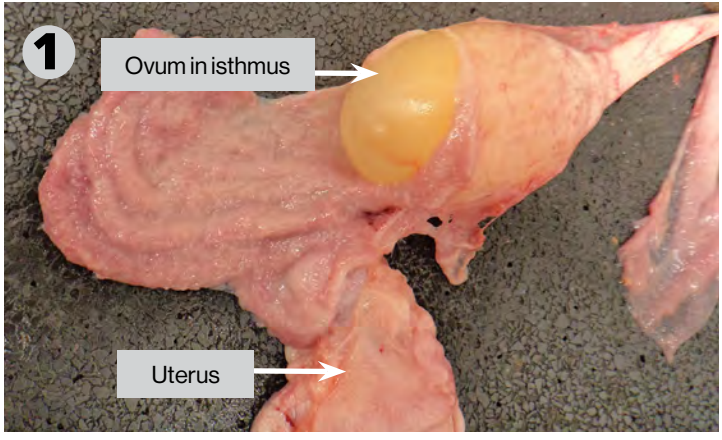
1. The uterus and vagina with the sperm storage glands are shown in the photo. Normal appearance is a light rose color. Inspect for infections and bleeding.

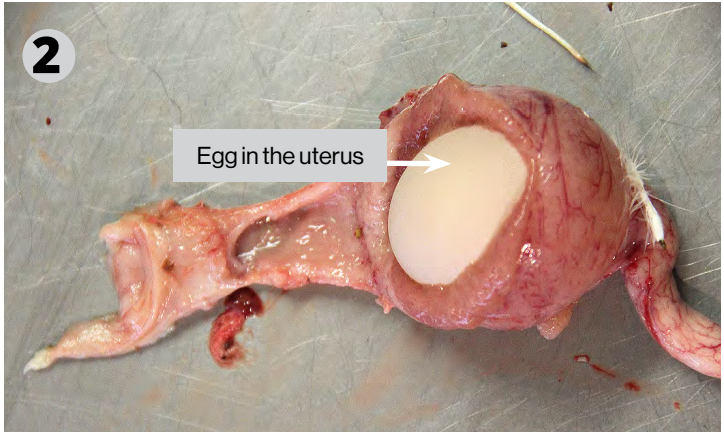


5.6 Female Reproductive Anatomy

Ovum, Egg in **Hens**

1. An ovum located in the isthmus just before entering the uterus where eggshell formation, mainly calcium carbonate, occurs. An ovum at this point should have a semi-transparent membrane. Inspect the ovum for albumen structure.
2. A shelled egg in the uterus. Normal appearance of the uterus is light pink. Inspect for bleeding and the egg for shell deformities.

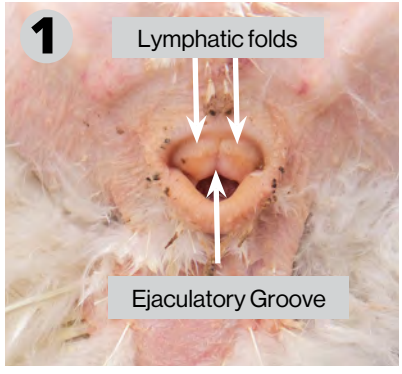




5.7 Male Reproductive Anatomy

Cloaca

1. The male cloaca with ejaculatory groove in between 2 lymphatic folds is shown in the photo.
2. Inspect the cloaca for wounds, cleanness, or urate deposits.
3. In mature males, assess the cloaca for color and signs of mating activity.
4. The cloaca will be pink or red for males that are actively mating hens.



A normal, clean cloaca in an 11-week old male

A normal cloaca in a 21-week old male

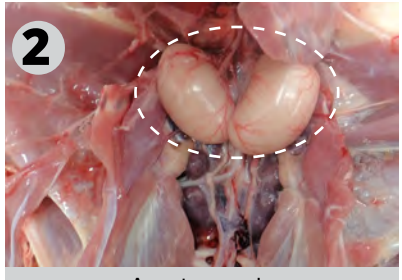
A normal cloaca in a 50-week old male

5.7 Male Reproductive Anatomy

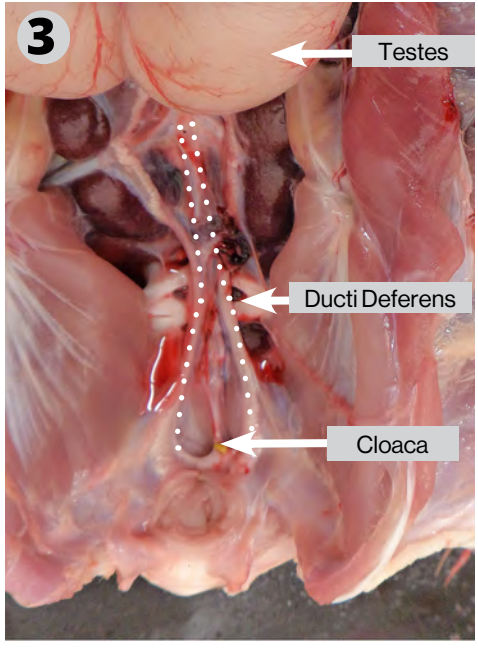
Testes, Ducti Deferens

1. The male chicken has two testis, located on either side of the vertebral column, near the top of the kidneys, in the coelomic cavity. After removing the liver, heart and intestinal tract, the testes will be visible.
2. The testes are bean-shaped and light yellow or tan. They can be visualized in day-old male chicks and increase in size as the male grows and matures. In immature males, each testis is about the size of a grain of rice. In mature males, the size of the testes will be much larger as shown in the photo. Inspect the testes for symmetry, color and size (as it relates to bird age).
3. In the picture a white dotted line is overlaying the ducti deferens. While moving through the ductus, the sperm matures. Inspect the ducti deferens for any abnormalities and obstipation.

An immature male (11-weeks old)



A mature male



5.7 Male Reproductive Anatomy

Testes

1. During post-mortem sessions, male fertility can be assessed if the testes are removed and weighed together. This information should be assessed in combination with the body weight, body conformation and general physical appearance (comb color and size, vent coloration, feather condition, etc.).
2. After 30 weeks of age, the total testicular weight may decrease. However, for active roosters, the pair of testicles should always weigh >25 grams.
3. Inspect the testicles for vascularization on the surface. Normal vascularization is shown in the photo.
4. Cut the testes cross-sectionally and inspect. A normal testis cross-section is shown in the photo.

2

Age (weeks)	21	22	23	24	26	28	30	40	50	60
Weight (grams)	0.5	2	18	24	41	43	45	42	38	32

A pair of normal testes

Cross section of a normal testis

Spinal Examination

6

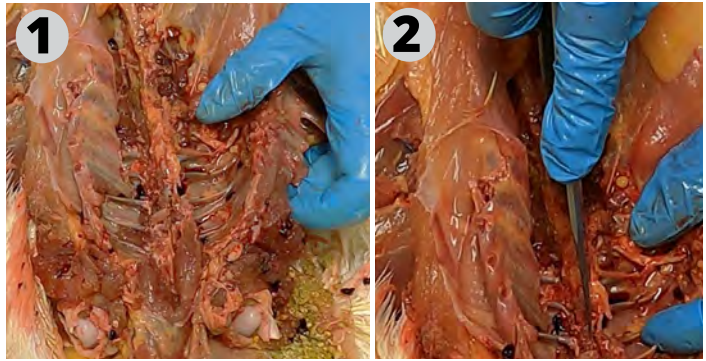
In some cases, examination of the spine may be necessary if mobility issues (lameness, paralysis) or spinal deformities (short stature, spinal curvature, arched back, prominent dorsal keel) are apparent upon external examination. Make note of any mobility issues or spinal deformities on your post-mortem form.

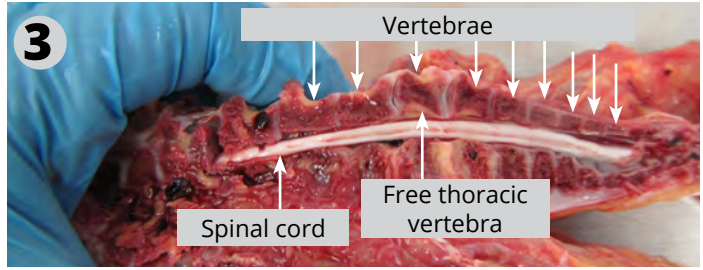
If abnormalities are apparent, it is recommended to collect tissue for both histology and bacteriology.

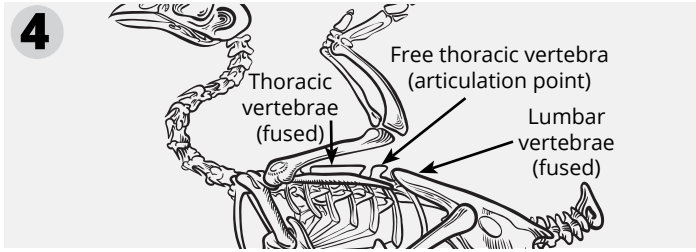
Please note that to view the spinal column, it is best to cut the vertebral column vertically. Making this cut through the vertebrae can be difficult without a large sharp knife or bone saw.

6.0 Spinal Examination

1. To view the spine, the breast plate must be completely removed and all the organs should be removed from the thoracic and coelomic cavities including the lungs and kidneys. After removal, it may be helpful to wash the carcass to remove blood and tissue. Inspect the spine for lesions. The ribs should be evenly spaced. Note any ribs that appear close together.
2. Using a knife or bone saw, cut across the spinal column vertically.
3. Split the spinal column open vertically. The spinal cord will be laying inside the vertebral column (as shown in the photo). It should be white in color and not appear pinched by any vertebrae.
4. There is only one free thoracic vertebra, the articulation point, between the anterior thoracic vertebrae (which are fused) and the posterior vertebrae (lumbar vertebrae are fused; see diagram). As such, the free thoracic vertebra is subject to greater mechanical stress, trauma, dislocation and infection than other vertebrae. Infections and dislocation of the vertebra at this position can impair mobility and cause paralysis.







Concluding the Post-Mortem: Checklist

7

- Review data collected on the post-mortem forms and fill in any missing information.
- Ensure all samples are labelled correctly. Package samples into cooler or other container to prepare for delivery to the lab.
- Dispose of dead birds, including any excised tissues and organs (not including samples) in a biosecure manner. (Some areas may regulate disposal of dead birds. Check with local legislation for regulations regarding disposal.)
- Clean and disinfect all tools. Wash the area where the post-mortem(s) were conducted with detergent and rinse well. Allow the area to dry and subsequently disinfect.

Post-Mortem Resources

8

Glossary

Example of Flock Health and History Form

Example of Post-Mortem Examination Form

Farm Contacts

Glossary of Terms	
Bursa of fabricius	Round organ close to the cloaca, responsible for the development of certain immune cells (B cells)
Ceca	Organ that is responsible for water re-absorption, colonized by bacteria that ferment plant matter and produce vitamins
Cecal tonsils	Lymphatic organs at the cross section of ileum/ceca and rectum
Coelomic cavity	Lower body cavity where internal organs are suspended or located; enclosed by abdominal wall, pelvis and backbone
Cornea	Superficial tissue covering the visual part of the eye
Crop	An organ of the digestive system that stores and mixes feed and water before entering the proventriculus
Duodenum	The first loop of the intestinal tract. The pancreas lies within the loop and secretes pancreatic digestive juices into the duodenum.
Esophagus	Organ carrying feed/ingesta from the oral cavity to the crop
Femur	Long bone of the upper leg/thigh
Gall	Green fluid produced by the liver, stored in the gall bladder and released into the intestinal tract to facilitate the digestion of lipids
Growth plate	The area in a bone where growth occurs
Gizzard	An organ of the digestive system that grinds feed
Harderian gland	An immune system gland located next to the eye
Hemoglobin	Molecules in the blood which bind oxygen and transport the oxygen throughout the body to the tissue
Ileum	Section of the intestinal tract from Meckel's diverticulum to the ceca that is responsible for digestion and absorptions of fat, starch and protein
Iris	Part of the eye that is responsible for the regulating the amount of light entering the eye
Jejunum	The second section of the small intestines. Connects the duodenum to the ileum.
Koilin layer	A layer of tissue inside the gizzard that protects the gizzard tissues from becoming damaged by grinding and digestion
Lobules	Separated parts of an organ with the same function, typically interconnected

Glossary of Terms (Cont.)	
Mucus	Secretion covering the internal surface of an organ e.g. inside the intestines
Proventriculus	An organ located after the crop where digestive enzymes are mixed with the feed
Rectum	A segment of the intestinal tract from Ileum to the cloaca, responsible for storage of feces
Spleen	Organ playing an important role in the production of red blood cells, as also in the immune system
Syrinx	Location where the trachea splits into 2 branches (bronchi) and the organ used to make sound (voice box).
Tendon	Firm tissue which connects a muscle to a bone
Thoracic cavity	Upper body cavity where internal organs (heart, lungs, etc.) are suspended or located; enclosed by ribs, breast/keel and backbone
Thymus	A nodular lymphoid organ running down the neck of the bird
Trachea	An organ of the respiratory tract which brings air from the mouth and nostrils down into the lungs and air sacs
Ulcer	A lesion that causes a break in the skin or mucus membrane
Urates	White waste product of the kidneys, normally present in ureters and making up typical 'white cap' on the fecal mass

Flock History and Health Form

GENERAL INFORMATION

Date	Number of Birds in Flock	Bird Line (Breed)	Flock Age	Farm	House Number

MANAGEMENT CHARACTERISTICS

Hatchery Source	Housing Type	Feed Form / Program		Water Program / Source	Most Recent Vaccination	
		Feed Form	Program		Date	Vaccine

HEALTH HISTORY

Date illness / Mortality began	Severity / Number of birds ill	Number of birds dead	Most Recent Medication / Treatments	Other Health Notes

FLOCK APPEARANCE

DESCRIPTION: *(note general flock appearance including feathering, pigmentation, weight, body condition, fecal consistency, skeletal or respiratory concerns, flock behavior and distribution, etc.)*

Post-Mortem Examination Form (Page 1 of 2)

Date	Flock Age	Farm	House Number	Male to Female Ratio	Number of Dead Birds	Number of Sick Birds	Number of birds necropsied		Dead birds from the 5 previous days					
							M=	F=	D5	D4	D3	D2	D1	D0

PRIMARY CONCERN(S)

FLOCK OBSERVATIONS

Flock notes	yes	no	Flock notes	yes	no
Mortality in one area of the house?			Feed intake issues? extended consumption time / reduced feed intake		
Mortality only at night?			Under fleshed? females / males / both		
Mortality affecting only females?			Over fleshed? females / males / both		
Reduction in egg production?			Water intake issues? higher consumption / reduced intake		
Abnormal egg shape, poor shell quality?			Birds appear dehydrated?		
Flock appears nervous?			Abnormal fecal consistency? wet or liquid / with undigested feed / dry		
Head / face swelling?			Litter quality concerns? damp litter / wet litter / fungal contamination		
Respiratory issues ? (panting/gasping)			Mobility concerns? lameness / deformed legs / foot issues		
Abnormal comb / wattle color or feathering?			Evidence of insect / rodent / biosecurity concerns?		

Post-Mortem Examination Form (Page 2 of 2)

POST-MORTEM FINDINGS

External Exam	Abnormal	Notes
Feathers		
Skin		
Feet		
Legs		
Keel		
Head		
Eyes		
Ears		
Nostrils		
Beak / Mouth		
Comb / Wattle		
Bodyweight / Conditioning		
Cloaca		
Tail		

CONCLUSIONS / NEXT STEPS:

Internal Exam	Abnormal	Notes
Subdermal Muscles		
Femoral Head		
Sciatic Nerve		
Growth Plates		
Leg Joints / Tendons		
Eyes		
Thymus		
Trachea / Esophagus / Syrinx		
Cleft Palate / Tongue		
Crop		
Brain		
Heart		
Liver/Spleen/Gall Bladder		
Air Sacs / Lungs / Ribs		
Gizzard / Proventriculus		
Intestines / Ceca / Cecal Tonsils		
Kidneys / Ureters		
Bursa		
Female Reproductive Tract		
Male Reproductive Tract		

Farm Contacts

Contact	Name	Telephone Number	Email Address
Breeder flock manager			
Feed Mill			
Hatchery manager			
Veterinary service			
Equipment supplier			
Electricity services			
Gas services			
Water services			
Cobb representative			
Laboratory manager			
QA / AW support staff			

NOTES

www.cobbgenetics.com
L-058-05-25 EN