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VMTH ANATOMIC PATHOLOGY
NECROPSY SERVICE

Necropsy Service Hours are 1:00 p.m. to 5:00 p.m., Monday through Friday and 9:00 a.m. to 12:00 noon on Saturdays. Sunday is an on-call day for emergency necropsies only. Emergency necropsies consist of herd health problems and/or any case the diagnosis of which will be impeded by waiting. The final decision to necropsy an animal is made by the faculty pathologist on duty.

Necropsy Rotation
Necropsies are performed on clinic cases as part of the educational program. A team comprised of the faculty pathologist, one pathology resident and six to eight senior veterinary students is responsible for performing routine necropsies Monday through Saturdays and emergency cases on Sundays.

Learning Objectives
- Learn necropsy techniques including appropriate tissue sampling
- Learn to describe lesions and formulate morphologic diagnoses for pathology reports
- Learn to recognize and interpret lesions in light of the clinical history
- Understand mechanisms of disease and the pathogenesis of lesions

Grading
Student grades will be based on the above learning objectives, as well as on work ethic and professionalism.

Learning Materials Available
- Daily necropsy cases
- Biopsy cases from weekly Biopsy Conferences
- Web-based cases at http://w3.vet.cornell.edu/nst/nst.asp
  Necropsy Show and Tell John M. King Cornell University.
- Study sets available from pathology conferences (AFIP, CL Davis, Zoo/Wildlife/Primate Conferences).
- Gross Pathology – Noah’s Archive CD’s

Required Attire
- Bring rubber boots and coveralls/scrubs
- Wear nametags, it helps us get to know you!
- Bring clean clothes and shoes to change into because boots and dirty scrubs cannot be worn outside of necropsy area.
- Leave back packs and clothes in the student locker room lockers in VM3A.
# VMTH ANATOMIC PATHOLOGY
## SENIOR STUDENT ROTATION SCHEDULE

**SCHEDULE:**

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MONDAY</strong></td>
<td>8:00 A.M.</td>
<td>Check in at VMTH Anatomic Pathology office (VM3A: 1346)</td>
</tr>
<tr>
<td>FIRST WEEK</td>
<td></td>
<td>Review &quot;Necropsy of a Dog&quot; DVD (VM3A: 1338)</td>
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<tr>
<td>STUDENTS</td>
<td></td>
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<tr>
<td><strong>MONDAY</strong></td>
<td>9:30 A.M.</td>
<td>Orientation, necropsy demonstration &amp; explanation of tissue processing (VM3A: 1325 &amp; 1350)</td>
</tr>
<tr>
<td>ALL STUDENTS</td>
<td>A.M.</td>
<td>Daily case discussion time scheduled by ‘Faculty on duty’</td>
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<tr>
<td></td>
<td></td>
<td>‘Resident on duty’ will inform students when to arrive (VM3A: 1325)</td>
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<tr>
<td></td>
<td></td>
<td>Necropsy to follow (VM3A: 1350)</td>
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<tr>
<td><strong>TUESDAY</strong></td>
<td>A.M.</td>
<td>Daily case discussion time scheduled by ‘Faculty on duty’</td>
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<tr>
<td></td>
<td></td>
<td>‘Resident on duty’ will inform students when to arrive (VM3A: 1325)</td>
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<tr>
<td></td>
<td></td>
<td>Necropsy to follow (VM3A: 1350)</td>
</tr>
<tr>
<td><strong>WEDNESDAY</strong></td>
<td>8:00 A.M.</td>
<td>Small Animal Grand Rounds (VMTH: 2240)</td>
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<td></td>
<td>A.M.</td>
<td>Daily case discussion time scheduled by ‘Faculty on duty’</td>
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<td></td>
<td>‘Resident on duty’ will inform students when to arrive (VM3A: 1325)</td>
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<td></td>
<td>Necropsy to follow (VM3A: 1350)</td>
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<tr>
<td><strong>THURSDAY</strong></td>
<td>8:00 A.M.</td>
<td>Large Animal Grand Rounds (VMTH: 1071)</td>
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<td></td>
<td>A.M.</td>
<td>Daily case discussion time scheduled by ‘Faculty on duty’</td>
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<td></td>
<td>‘Resident on duty’ will inform students when to arrive (VM3A: 1325)</td>
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<td></td>
<td></td>
<td>Necropsy to follow (VM3A: 1350)</td>
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<tr>
<td><strong>FRIDAY</strong></td>
<td>8:00 A.M.</td>
<td>Biopsy Conference (CAHFS)</td>
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<td></td>
<td>Preparation for Gross Rounds (VM3A: 1354)</td>
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<tr>
<td></td>
<td>9:00 A.M.</td>
<td>Gross Pathology Rounds (VM3A: 1354)</td>
</tr>
<tr>
<td></td>
<td>A.M.</td>
<td>Daily case discussion time scheduled by ‘Faculty on duty’</td>
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<tr>
<td></td>
<td></td>
<td>‘Resident on duty’ will inform students when to arrive (VM3A: 1325)</td>
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<tr>
<td></td>
<td></td>
<td>Necropsy to follow (VM3A: 1350)</td>
</tr>
<tr>
<td><strong>SATURDAY</strong></td>
<td>9:00 A.M.</td>
<td>Daily case discussion and Necropsy (VM3A: 1325 &amp; 1350)</td>
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</tbody>
</table>

**SUNDAYS AND HOLIDAYS: ON-CALL**

Students are required to be **on-call one Sunday** of each Rotation. Each group of students is responsible for organizing the roster to provide equal coverage on each Sunday. Use the sign-up sheets provided at orientation. In the event of a university holiday at least two students should plan to be on call for the holiday.

**POLICY ON ABSENCES:**

According to VMTH policy, students are expected to be present during scheduled necropsy times for the entire rotation. Absences (up to 2 days per rotation) due to sickness, family emergency, or job interviews need to be authorized by the Faculty Pathologist, on duty that week. Any additional missed days must be made up. Schedule make-up days with office personnel, VM3A: 1346.
HEALTH AND SAFETY ISSUES

**Health Hazards:** Every case is potentially infectious. Coveralls, boots, and gloves are required in the necropsy room and adjoining areas. Necropsy boots and dirty scrubs must **not be** worn outside of the necropsy room.

| IF RABIES IS CONSIDERED IN THE DIFFERENTIAL DIAGNOSIS, IT IS THE RESPONSIBILITY OF THE PATHOLOGIST IN CHARGE TO DECIDE HOW THE CASE WILL BE HANDLED. |

It is essential that sharp items such as scalpel blades, needles, and razor blades be discarded only in the designated red SHARPS containers located throughout the facility.

Also, all paper, plastic and/or any non-biologic waste must be discarded only in the designated red biohazardous waste toters located on the necropsy floor.

Psittacine birds and primates are necropsied in the biosafety cabinets or in the isolation necropsy room due to the potential hazard of psittacosis and other zoonotic diseases. If the carcass is too large to necropsy in the biosafety hood, then masks, goggles, and other protective clothing are to be worn.

Students who are pregnant, immunocompromised, or are taking prescribed antibiotics are to report to the supervising pathologist following orientation.

**Clean Environment:** Students are responsible for helping to maintain a clean working environment on a daily basis. The day’s activities are to be cleaned up prior to leaving the necropsy room.

**Physical hazards** are greater than biologic dangers, i.e. *knives*, hoists, slippery floors, etc. Blood, intestines, mineral oil, and fat on the floors make them very slippery.

Learn how to wrap the leg chain before hoisting up a carcass from a necropsy assistant. Even when chains are used properly, do not stand under animals on hoists. Handle the dumpster with care. It can crush fingers.

Special care must be taken with the use of the stryker saws. Protective face shields and ear protectors are available at the power sawing stations. Students are **not** permitted to use the band saw for liability reasons.
ROUNDS

Daily Gross Rounds are held by some faculty pathologists in the Necropsy Room at the end of the day for the benefit of students and clinicians. Students are responsible for saving interesting lesions of the day for presentation.

Weekly Pathology Gross Rounds are conducted by the students and are held on Fridays at 9:00 a.m. in the Specimen Review Room, VM3A:1354.

- Interesting lesions throughout the week are saved on a cart in the cooler.
- Students present case material to the group in attendance.
- At the end of gross rounds the resident on duty will select any tissues to be saved for sophomore teaching and those tissues shall be placed on the appropriate shelf in the walk-in, “In-Coming Cooler”.
- All other tissues that were displayed at rounds are to be discarded by the students. The klotz is dumped down the drain and the tissue is thrown in the incineration dumpster in the “Outgoing Cooler”.

SA and LA Grand Rounds
Attendance at Small Animal Grand Rounds on Wednesdays and Large Animal Grand Rounds on Thursdays, both at 8:00 a.m. at the VMTH is strongly encouraged.

Biopsy Conference
Biopsy cases from the VMTH are presented by residents and discussed by the residents and faculty pathologists. The conference is held at CAHFS Maddy Conference Room from 8-9 am on Fridays. Students are encouraged to attend, but will need to have their Gross Rounds cases prepared before attending.
CASE MANAGEMENT AND RESPONSIBILITIES

The Gross Necropsy is the first of several stages in the completion of a final pathology report. After the necropsy, a Gross Report is generated within 48 hrs that provides a description of what was seen at necropsy and an interpretation of those findings (Preliminary Diagnoses). The formalin-fixed tissue samples collected at the time of necropsy are subsequently trimmed by residents and processed into H & E slides by laboratory personnel (within several days of necropsy). Then the slides and laboratory results are reviewed by resident and faculty pathologist, and histolopathologic findings are added to the report. A final report including all gross and histopathologic findings as well as results of ancillary tests is usually available within 4 weeks of the necropsy. The final report is posted on VMACS.

Students perform necropsies with guidance from a resident and faculty pathologist.

Before case discussion at 11AM, students should review the clinical history, radiographs/CT's/MRI's and clinical pathology data for the day’s cases and read about the pathologies of the suspected diseases. Students should come prepared to discuss the case at 11AM.

1. Deceased animals are tagged and placed in the pathology walk in cooler. Necropsy request forms are submitted to the pathology service office by the clinician on the case.

2. Pathology request form must be signed by the clinician before proceeding with a necropsy.

3. Verify that the carcass I.D. tag and the request form clinic numbers and animal breed all match. If there is a discrepancy of any kind, contact the clinician on the case for verification of correct animal I.D. before proceeding with the necropsy. Do not assume someone else has confirmed I.D. It is very very hard to explain why Mrs. Wiggins' Muffy was accidentally necropsied!

4. Be sure to check if necropsy is "cosmetic" or "owner pick up" before beginning necropsy. The negative ramifications are obvious! If animals are designated to be saved for owner pick up reattach necropsy I.D. tag to outside of bag or box along with the “Remains Ready For Release” tag that will be attached to the necropsy request form.

5. Cases are assigned a Pathology accession number e.g.: 09N1234. Use this number on all paperwork and samples associated with the case. If a Pathology accession number has an “EX” at the end of the number, please be sure to include this “EX” at the end of the accession number on all wet tissue containers.

6. Students perform the gross necropsy and take tissue samples for histopathology and ancillary procedures.
   - Be sure to show the resident and faculty pathologist on duty all lesions
   - No tissues should be discarded until reviewed by the resident and pathologist

7. If clinicians request to be paged for the necropsy the student is responsible to page the clinician at the appropriate time. Usually it is best to wait until all lesions have been exposed and reviewed with pathologist before paging clinicians.
8. After the necropsy, re-attach the necropsy I.D. tag to outside of bag on all cases, whether they are Save Remains or not. In the event that we need to “dumpster dive” for a carcass, this makes it easier to identify every case.

9. Place all canine, feline (that are not designated “save remains”), sheep, goats, and biological materials from all potential zoonotic disease suspects in a bag, properly labeled, in the blue incineration dumpster, in the cooler.

10. Students record findings in a gross necropsy report the day the necropsy is performed. The student report is graded by the resident and returned to the student with comments.

Thoroughness and accuracy in recording necropsy findings and complete and careful collection of tissues for histopathology are crucial for completing an accurate final necropsy report. YOU play a critical role in this process.

Collection of Tissues for Histopathology and Microbiology etc.

Histopathology:
- In general, samples of all major organs are collected in formalin from every case. At the discretion of the resident and faculty pathologist on duty, the pink “Histopathology Form” may be used as a guide for collecting a sample of all tissues or specified tissues during necropsy.
- Label containers (on the sides, not the top) with necropsy #, clinic #, date, species, and resident.
- Be gentle with tissues. eg. hold tissues at the edges, don't scrape or wash tissues to be examined histologically, collect tissues before they have been handled excessively.
- Samples must be between 0.5 - 1cm thick to fix properly. Big chunks autolyze before they fix! Samples from tiny animals (birds, rodents) can be fixed intact. Formalin penetrates to approximately 1cm.
- Formalin to tissue ratio must be at least 10:1.
- Organs with regional variation e.g.: lung & G.I. require multiple samples e.g.: cranioventral and caudodorsal areas, various levels of the intestines.
- Organs with focal or multifocal lesions should have multiple areas sampled, including both affected and unaffected areas.
- Samples that can't be easily identified outside the body need to be labelled (placed in a tissue cassette or with a laundry tag) eg. specific lymph nodes, lesions not attached to recognizable tissues.

NOTHING SHOULD BE THROWN AWAY UNTIL THE STUDENT REVIEWS THE CASE WITH THE RESIDENT AND FACULTY PATHOLOGIST.
Microbiology, Toxicology and Other Services:

- The procedure and what specimens to be taken should be discussed with the resident and/or pathologist on duty.
- Micro samples are taken by sterile technique at necropsy whenever possible. Use the sterile instruments and sterile petri dishes available on the necropsy floor. Label each container with the animal ID, resident's name, tissue identification and "Sterile" or "not-sterile" (which ever is appropriate).
- For intestine specimens: tie off a segment of the gut and place it in a petri dish or whirl pack, labeled as to which section of GI is submitted.
- The outside of all containers must remain clean from feces, blood, etc.

The lab submittal form must be completed with:
- Clinic number
- Pathology accession number
- Clinician name
- Pathology resident name

The student is to review the completed form with the resident before placing the form with the sample in the double sided outgoing refrigerator.

NOTE: Laboratory tests which are performed by CAHFS for the VMTH require the completion of a CAHFS submission form only.

For a complete list of all tests available from CAHFS visit their website at: http://cahfs.ucdavis.edu
NECROPSY TECHNIQUE

Develop a systematic approach to the necropsy so you remember to examine all tissues and take all samples. Do not omit steps unless instructed to do so by the faculty Pathologist. Either take samples as you remove an organ or remove all organs and then systematically sample them. Show all lesions to the resident and faculty pathologist.

There are several copies of Gross Necropsy Technique for Animals, King, Dodd, Newsome available in the Conference room. Techniques for performing necropsy on wild mammals, birds and reptiles are also available on the Web www.vetmed.ucdavis.edu/whc/pdfs/necropsy.pdf

PRIOR TO NECROPSY

1) Review clinical data.
2) Make a problem list.
3) Read request carefully and note any special requests on form.

BIOHAZARDS

1) Protective clothing.
2) Wear gloves.
3) Safety glasses are available if desired.
4) N95 masks

EQUIPMENT

Knife, steel, scissors, forceps, scalpel, cutting board, rib cutters.

SAMPLING

Plan ahead for Microbiology, Virology, Immunology, Parasitology and Histopathology.

For Microbiology:

Take samples before touching tissues. Swab or aspirate abscesses or joints. Take culture samples as steriley as possible. For non-sterile samples, take a large enough section to allow searing and sampling of deep tissue. For bacteremia; take a sterile heart blood sample or unopen spleen or bone marrow.

For Histopathology:

Tissue samples should be 0.5-1.0 cm thick and placed in 10% buffered formalin, with a ratio of 10 parts formalin to 1 part tissue. Hollow organs may be opened and placed serosal surface down on a piece of paper.

EXTERNAL EXAM

1) Place left side down.
2) Do you have right animal? Check age, breed, sex. Is this a cosmetic post? Has permission been granted? Record brands and identifying data.
3) Give an external exam and palpation, including mammary glands and orifices.
4) Abortions - Record the crown to rump length (cm), sex, placenta present, placenta complete.
5) Evaluate and record nutritional status by pericardial/perirenal fat depots.
6) Intact or neutered - regardless of the signalment, check for gonads.
7) Surgical prep/catheters/incisions/cutaneous or subcutaneous masses, contusions should be noted under "integument".
8) Record post-mortem state - degree of autolysis.
INITIAL INCISION
Incise the skin along the ventral midline from the mandible to the pelvis cutting to the right of the mammary gland or penis. Reflect the skin and both right legs (open right coxofemoral joint to reflect the hind leg). Remove udder or penis.
Open abdominal cavity by carefully cutting through the abdominal wall from xyphoid along last rib, lumbar transverse processes and pelvis to inguinal area. Lay flap toward you. Examine abdominal organs in situ. Note especially the relationships and any abnormal peritoneal cavity contents.
Stab diaphragm - observe for rush of air; cut diaphragm from right costal arch.
Remove right rib cage with rib cutter (may need pruning shears).
Free rib and break in your hand - test strength - examine costochondral area for abnormal growth.
Open pericardial sac - examine contents.

THORACIC VISCERA
To remove the pluck (heart and respiratory system), make cuts on lateral sides of floor of mouth. Separate and spread mandibles for greater access to mouth. Reflect tongue, cut hyoid apparatus. Reflect esophagus and trachea to thoracic cavity. Cut above aorta throughout thorax. Sever esophagus and large vessels at the diaphragm and remove the pluck.
Examine tongue.
Dissect thyroid and parathyroids free.
Examine and open esophagus. Examine thymus and mediastinal structures.
Palpate lungs - note color and texture.
Open trachea - observe contents, extend cut into pulmonary parenchyma and through bronchi.
Incise pulmonary vessels and thoracic aorta.
Leave heart attached to the lungs to examine the great vessels.
Open right atrium.
Cut through anterior surface of AV valves where right ventricle joins the septum. Continue a "U-shaped" cut around right ventricle to connect with the pulmonary artery. Follow the arteries into the pulmonary parenchyma.
Open left atrium.
Incise left ventricle in the middle portion as seen when lying with the septum down.
Make separate incision around papillary muscle extending into the aortic valve.

ABDOMINAL VISCERA
Record any abnormal position of all abdominal organs.
Check patency of bile duct by making a small cut into the duodenum then squeezing the gall bladder. Remove stomach and intestine. In the dog, cat and pig, the small intestine should be linearized by cutting the gut along its mesenteric attachment. For horses, the small intestines can be linearized and then the large bowel removed en masse. Horse intestines are most easily removed dorsally (over the back, away from the prosector). For ruminants, remove all intestines en masse over the dorsal side of the animal and then remove the forestomach ventral (toward the prosector). Open the intestines away from the body to avoid contamination of other organs. (Note: May want to take samples for histology now because autolysis occurs rapidly.
Dissect spleen and pancreas free. Examine visually and make multiple parallel cuts through the parenchyma of each organ.
Remove liver - examine both surfaces - open the vena cava to check for thrombi or abscesses and then make multiple cuts through parenchyma.
Incise gallbladder.
Identify adrenal glands, remove them and make a transverse cut to observe corticomedullary ratio.
Remove each kidney. Make a sagittal cut along the midline to examine the corticomedually ratio and pelvis. Remove capsule.
Open pelvis. Cut through pubis into obturator foramen and then through ischium. Reflect bladder, urethra and colon through open pelvis. Separate urogenital tract from rectum. Open bladder and urethra. Examine ovaries. Open vagina and uterus OR examine testicles and reflect prepuce. Examine penis, prostate and testicles.

**J O I N T**

Open stifle and shoulder joints at least. Select several other joints as well. Examine cartilage and synovial fluid. Flex and extend all joints where possible.

**B O N E M A R R O W**

Remove the muscle from a femur and cut along the midline or split with a bone cutter.

**B R A I N A N D C O R D**


**D I G E S T I V E T R A C T**

For ruminants: Open the abomasum along the greater curvature, open the reticulum and check contents for hardware, open the rumen and omasum. It is usually adequate to limit the opening of the small and large intestines to representative and suspicious portions but the entire tract must be palpated and examined externally.

For small animals: The entire digestive tract is opened.

**M I S C E L L A N E O U S**

Examine umbilicus, inguinal rings, ears, tympanic bulla, nasal cavity and sinuses and muscles.


Dispose of carcass (on hoist or in dumpster, leave identification attached to outside of bag), and wash instruments, work area, and tissue containers.


If the case calls for “Save Remains” be sure to place carcass in a locked cage and/or designated pick-up row, in the case of a large animal, in the “In-Coming” cooler. All “Save Remains” cases **stay in the “In-Coming” cooler.**
Students record findings on the Pathology report form (see below and next page example). Paperwork from the necropsy room must be free of blood and other contaminants or placed in a vinyl sheet protector before removing from the necropsy room. Students are to submit completed gross reports before leaving each day and to retrieve the graded reports from the designated trays in VM3A: Room 1325.

In general a necropsy report consists of two parts.

a. **Objective description**

b. **Interpretation**

A veterinarian must be able to accurately describe lesions even if he/she lacks the expertise to interpret them. As medical knowledge evolves, interpretations may change, yet an objective description remains valid. It is imperative to keep description and interpretation separate: objective descriptions are recorded in the Gross Findings section while interpretations are made in the Pathologic Diagnoses and Case Summary. Your accurate objective description allows others to interpret your findings.

**Necropsy Report Outline**

- **Signalment and Header information:** in addition to the obvious signalment, date, your name, resident name, etc., please also indicate whether the animal died or was euthanized, post mortem interval ("# of hrs. dead"), post mortem state (good, fair, autolyzed, etc.) and nutritional state (obese, good, thin, emaciated, etc.). This information is important when evaluating histologic findings.

- **Gross Findings**
 Describe all lesions by organ system (see page 11 for details). Be as objective as possible. Describe size, shape, color, texture, number, distribution, nature and volume of contents, odor, and weight if appropriate. Use numbers (#’s), for size give three dimensions (use a ruler for accuracy and use the metric system). Do not use vague terms like many, large, etc. Organize findings in logical order, e.g.: oral cavity - stomach - small intestine - colon. Normal findings do not need to be recorded unless especially relevant. If no significant findings are present, indicate "NSF" If an organ system is not examined, indicate "NE".

- **Pathologic Diagnoses**
 Subjective interpretation of findings in the appropriate format for a morphologic diagnosis. This is the section where you interpret your findings as best you can. Provide morphologic diagnoses for all significant lesions, being as specific as possible based on gross findings. A morphologic diagnosis for inflammatory and degenerative conditions should include the duration, severity, distribution and character of the lesion. For neoplastic lesions, morphologic diagnosis only names the tumor.

**examples:**
- Lung: **Severe cranoventral, necrotizing bronchopneumonia**
- Lungs and lymph nodes: **Disseminated neoplasia (presumptive metastatic hemangiosarcoma)**
- Spleen: **Nodular hyperplasia**
- Ribs right 3, 4 and 5: **Multiple acute fractures**
• **Case Summary**

This section should include the clinical-pathologic correlations, significance of lesions and association among lesions.

Explain how all lesions fit together. What findings are significant or incidental? How do your lesions match the clinical findings? Clinical pathology findings? Questions posed by the submitting clinician or student on the necropsy request should be addressed here. What additional procedures are pending? micro, cultures, histo, etc.

Together, the Pathologic diagnoses and Case summary should provide a basic understanding of the case.
DESCRIPTION OF NECROPSY FINDINGS

The following material is intended as a guide for the acceptable format of writing necropsy reports. It includes suggested terms for accurately describing lesions.

The most important principle to keep in mind when writing is to be objective; that is, record only your observations. Although the prosector also interprets as s/he proceeds, those interpretations go into the pathologic diagnoses and case summary. The following salient features should be covered as fully as is applicable when describing each lesion:

- location
- size or volume
- shape
- number
- distribution
- color
- consistency
- cut surface appearance
- odor (occasionally)

**Location** - Use anatomical terms, e.g., medial, lateral, cranial, caudal, etc. Localize the lesion as closely as possible while still being practical. If a skin lesion is being described, you should be sure to indicate which body region is affected. Relate internal lesions to body cavities, lobes of viscera, surfaces, etc.

**Examples:**
1) A 3cm laceration is on the right lateral thorax just behind the elbow.
2) A 3cm laceration is on the medial aspect of the right hind leg, halfway between the stifle and groin.
3) A 5cm diameter mass is on the diaphragmatic surface of the right lateral liver lobe.
4) A 1cm nodule is on the serosal surface of the terminal ileum, 5 cm from the cecum.

**Size or volume** - Use metric measurements. Estimates are accepted. Do not use cookbook terms like "the size of a hen's egg or pea or orange or softball". Remember to give three dimensions when appropriate. To say "the tumor is 3 x 5 centimeters" tells nothing about its third dimension. Estimate the volume of fluids in body cavities. To say "the abdomen was filled with fluid" does not tell how much fluid it was filled with. Was it 50 ml, 500 ml, or 5 liters? Words like large or small are too vague in pathological descriptions. The percent of parenchymal involvement is often useful when referring to the lung, liver, or kidney. You may refer to normal size to indicate enlargement or shrinkage. For example, a spleen may be 2X normal size or a testicle 1/2 normal size.

**Shape** - Use terms like spherical, cylindrical, oval, pedunculated, sessile, rugose, corrugated, smooth, rough, lobulated, broad-based, wedge-shaped, stellate, tapered, streaked, pitted, granular, elevated, depressed, etc.

**Number** - If more than one similar lesion is found in a given location, indicate how many. If the number was less than 10, you should count them and give the actual number. If the number of similar lesions is above 10, give an estimate of the number using phrases like: about 25, between 50-100, hundreds, thousands. Words like "multiple" are too vague for gross pathological descriptions. Do not use the phrase "too numerous to count".

**Distribution** - This part of the description may be hard to separate from number or location. Words like diffuse, disseminated, focal, patchy, irregular, or scattered may be used.

**Color** - Keep them simple!

**Consistency** - Most solid lesions can be described (with modifying adjectives) as soft, firm, or hard. Sometimes words like gritty, greasy, friable, rubbery, turgid, indurated, stringy, gelatinous, rigid, or pliable may be appropriate. Fluids may be watery, viscous, mucoid, caseous, clear, cloudy, or opaque, etc.

**Cut surface appearance** - In examining larger organs or tumors, you should slice into them at regular intervals to determine if they are solid, cystic, uniform, or varied on the interior.
Odor - Only occasionally do alterations acquire odors distinctive enough to be significant. Words like sweet, sour, fetid, acidic, or putrid may be appropriate.

Pathologic diagnoses:

The pathologic (morphologic) diagnosis of inflammatory or degenerative processes should consider all of the following, but do not necessarily include them if they are not necessary.

- Organ
- Duration
- Severity
- Distribution
- Character
- Lesion

Examples:
- Liver: Subacute severe multifocal necrotizing hepatitis
- Liver: Multiple granulomas (chronicity, severity, and character are implied)
- Liver: Severe diffuse fatty degeneration
- Stomach: Locally extensive chronic ulcer
- Small intestines: Severe acute diffuse hemorrhagic enteritis

### Table 4.2 Slauson and Cooper Classification of Inflammatory Lesions

| Extent | Duration | Distribution | Exudate          | Modifier         | Anatomic e
|--------|----------|--------------|------------------|------------------|-------------
| Minimal| Peracute | Focal        | Suppurative      | Interstitial     | Nephritis   |
| Mild   | Acute    | Multifocal   | Nonsuppurative   | Broncho-         | Hepatitis   |
| Moderate| Subacute | Diffuse      | Serofibrinous    | Glomerulo-       | Enteritis   |
| Severe | Chronic  | Locally ext. | Fibrinopurulent  | Submandibular    | etc.        |
| Extensive| Chronic active | Locally ext. | Necrotizing      | Granulomatous,   | etc.        |

The pathologic diagnosis of tumors should only include the organ and name of the tumor with "metastatic" if appropriate.

Examples:
- Liver: Hepatocellular carcinoma
- Lung: Metastatic hepatocellular carcinoma
- Kidney: Lymphosarcoma
VMTH ANATOMIC PATHOLOGY
GROSS REPORT

Pathology #: 09N1234 Patient #: 12-34-56

Date of Necropsy: 5/1/07 Species: K9 Sex: F Age: 8 yrs.
Resident: Resident’s Name Identification: _______________________
Pathologist: Place your name here Owner: ___________________________
Student: Your Name Clinician: ___________________________

Died ___ or Euthanized ___ X ___ on (Date): 5/1/07 Time: 6 a.m. PM Interval __ 6
Method of Euthanasia: Beuthanasia PM State: Good ___ X ___; Fair ___; Autolyzed ___
Nutritional State: Obese ___; Good ___; Fair ___; Thin ___; Emaciated ___

PATHOLOGIC DIAGNOSES:

(1) Spleen, lymph nodes, bone marrow, jejunum: Lymphosarcoma
(2) Skin: Petechia (Disseminated intravascular coagulation (DIC), presumptive)
(3) Stomach: Leiomyoma
(4) Heart (Left AV valve): Endocardiosis
(5) Uterus: Cystic endometrial hyperplasia

Integument: (Body weight: ___ 36 kg. ___)
The skin over the right cephalic vein is shaved and the vein contains an IV catheter. The ventral abdomen is shaved from the xiphoid to the pubis. Petechial hemorrhages are present on the skin and subcutis of the ventral abdomen and inner thighs.

Peritoneum:
The abdominal cavity contains 40-60 ml of serosanguineous fluid.

Digestive Tract:
A 1 x 1 x 2 cm smooth firm raised dome-shaped mass is present within the muscular wall of the pylorus. On section, the mass is white and firm and is covered by an intact mucosa. A 3 x 3 x 4 cm soft creamy-white multilobular mass is present surrounding the mid-jejunum. The mass arises from within the thickened intestine and the lumen at this site is markedly narrowed to 5 mm. The mucosa in this area is ulcerated leaving an underlying roughened red to brown friable (necrotic) surface.

Liver: (Liver weight: ___ 1.44 kg. ___)
NGL (No gross lesions)

Pancreas:
NGL.

Spleen:
The spleen is enlarged 2-3 times greater than normal and weighed 900g. It is swollen with rounded edges and has a firm meaty texture. It is a homogeneous red/brown and bulges on cut surface.
Urinary System:
NGL.

Genital System:
This is an intact female. The endometrium contains thousands of transparent fluid-filled cysts, varying from 1-5 mm in diameter and distributed evenly throughout both horns and body.

Mammary Gland:
NGL.

Pleura:
NGL.

Respiratory System:
The distal 1/3 of the trachea and major bronchi are filled with pink foam. The (entire) lungs are dark purple-red and oozes a large amount of serosanguineous fluid when cut (pulmonary edema).

Cardiovascular System:
(Heart Weight: __270 g.__)
There was slight smooth nodular thickening along the fringes of the left AV valve leaflets.

Lymph Nodes:
All peripheral lymph nodes are markedly enlarged. Submandibular and prescapular nodes are most affected and range from 3-4 cm in diameter. All other peripheral nodes (axial, prefemoral, popliteal) are enlarged to 1.5-2 cm in diameter. Mesenteric nodes (jejunum) are also prominent (1 x 1 x 3 cm). Enlarged nodes are uniform cream to white and soft and lacked any normally evident cortex or medulla.

Musculoskeletal System:
NGL.

Nervous System:
NE (not examined).

Other Endocrine Organs:
The adrenals and thyroids are unremarkable.

Bone Marrow:
The femoral bone marrow has a red/brown color similar to the spleen and fills the entire diaphyseal cavity. Diaphyseal fat is not evident.

Special Senses: (e.g., ocular, ears/typanic bullae, nasal cavity) NE.

Case Summary (Clinical pathological correlation, lesion pathogenesis, and association between lesions):
The gross findings of enlarged peripheral and mesenteric lymph nodes with loss of normal architecture and infiltrated and discolored spleen and bone marrow are consistent with the clinical diagnosis of lymphosarcoma. Additionally, there was presumptive involvement of the jejunum, likely the mass noted on abdominal palpation. The petechial hemorrhages noted in the skin and subcutis were suggestive of DIC. Incidental findings include mild endocardiosis, presumptive gastric leiomyoma, and cystic endometrial hyperplasia. The pulmonary edema was likely associated with euthanasia. Histopathology is pending. (Also indicate if any micro, virology, etc. was submitted).
NECROPSY PROCEDURE FOR EXOTIC AND DOMESTIC BIRDS

This procedure is excerpted and modified from the article, A Necropsy Procedure for Exotic Birds by P.K. Ensley, R.J. Montali and E.E. Smith. Complete copies are available to those interested in zoologic medicine, record keeping and necropsy room protocol, etc. pertaining to pathologic service at zoologic parks. There also is an abbreviated procedure on the web www.vetmed.ucdavis.edu/whc/pdfs/necropsy.pdf

1. Wear mask and necropsy psittacine birds in the biosafety hood.

2. Identify bird
   • Tag on bag, type of bird, leg bands (record and save), zoonotic potential.

3. External examination
   • Weight, condition of carcass, plumage, orifices, wounds, tumors, parasites, nutritional state (keel prominence, crop fullness).

4. Wet plumage with detergent to decrease "floating" feathers and to provide protection for the prosector.
   • Ventral midline incision-intermandibular space to vent.
   • Reflect skin.
   • Disarticulate hips.
   • Examine and section sciatic nerve, leg and breast muscle, joints (knees, hocks).
   • Keel removal:
     'T' incision of abdomen (along edge of keel), elevate tip of keel while transecting the ribs and clavicles. Observe pericardium and air sacs as resecting from sternum to remove keel.
   • Take all bacterial and viral samples or make impression smears (spleen, liver, air sac for Chlamydia FA) before proceeding.
   • Locate spleen (usually spherical) and remove. Left dorsal-lateral edge of proventriculus-ventriculus (gizzard) junction.
   • Identify gonads (along midline anterior to kidneys and adjacent to adrenals) and confirm sex of bird.
     Testes-oval to elliptical, smooth, cranio medial to kidneys.
     Ovaries-left only; immature ovaries are gray, triangular, rough appearance due to immature follicles. Ventral to kidneys.
   • Identify adrenals-oval, yellow-orange, paired dorsal and cranial to gonads.
   • Locate and remove thyroids and parathyroids-paired, round to oval near jugular vein and first rib at carotid artery bifurcation.

5. Viscera removal.
   • Tie off colon at cloaca and small intestine (caudal to duodenal loop). Remove intestinal tract and set aside.
   • Thoracic and abdominal: Transect mandibular rami. Remove with mandible, trachea, esophagus, crop and thymus (in jugular groove), continue dissecting caudally "en masse". Carefully dissect lungs from ribs, and adrenals, gonads and kidneys from vertebral recesses. Extend dissection caudally to include cloaca and vent. Bursa of Fabricius is on dorsal surface of cloaca in young birds.
6. Brain removal
   - Disarticulate the head, remove skull cap as with mammals, remove brain. Examine beak and nasal cavity, remove eyes if indicated and freshly dead.

Guidelines to examine organ systems:

1. Start at head and work caudal, do intestines last.
2. Open all tubular structures.
4. Fix representative tissues of all organs in formalin, 10:1 ratio.
5. Fix suspected gout in absolute alcohol.
6. Weigh organs suspected of being larger or smaller than normal.
7. Freeze (ultra-low) tissues in viral suspected cases.

NOTE:
- Right AV valve is muscular in birds.
- Aorta should be fully opened for atherosclerosis examination.
- Pancreas is located in duodenal loop.
- Formalin fix cranial pole of kidney with adrenals and gonads still attached
- In small birds, formalin fix heart unopened if necessary.
- Check bile duct patency by expressing bile into duodenum.
- Save parasites in saline (.9%).
- Air sacs can be sectioned with the heart or liver or rolled on a wooden stick and fixed.
Normal Organ Weights for Cats and Dogs

**FELINE**

(% Body Weight - mean)

<table>
<thead>
<tr>
<th></th>
<th>MALE (N=52)</th>
<th>FEMALE (N=52)</th>
<th>NEWBORN (N=35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td>0.39</td>
<td>0.40</td>
<td>0.93</td>
</tr>
<tr>
<td>Liver</td>
<td>3.60</td>
<td>3.62</td>
<td>4.07</td>
</tr>
<tr>
<td>Spleen</td>
<td>0.27</td>
<td>0.23</td>
<td>0.17</td>
</tr>
<tr>
<td>Kidneys</td>
<td>0.75</td>
<td>0.69</td>
<td>1.05</td>
</tr>
<tr>
<td>Brain</td>
<td>0.98</td>
<td>1.08</td>
<td>3.60</td>
</tr>
</tbody>
</table>

**CANINE**

<table>
<thead>
<tr>
<th></th>
<th>ADULT</th>
<th>YOUNG</th>
<th>UNDER 6 MONTHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td>-</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Liver</td>
<td>3.98</td>
<td>-</td>
<td>5.4</td>
</tr>
<tr>
<td>Kidneys</td>
<td>0.67</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>Brain</td>
<td>-</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Pancreas</td>
<td>0.23 (for dogs 25-35 lbs.)</td>
<td>Head of pancreas: 15cm long x 1-3cm wide.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tail of pancreas: 10cm long x 4cm wide x 1cm thick.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adrenal cortices are 0.15 to 0.25cm.</td>
<td></td>
</tr>
</tbody>
</table>

**Canine heart weight to body weight ratios**

<table>
<thead>
<tr>
<th>Body Weight (kg)</th>
<th>HW/BW (gm/kg)</th>
<th>Probable Hypertrophy</th>
<th>Definite Hypertrophy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-6</td>
<td>9.5</td>
<td>10.9</td>
<td>12.3</td>
</tr>
<tr>
<td>7-12</td>
<td>9.1</td>
<td>10.5</td>
<td>11.9</td>
</tr>
<tr>
<td>13-18</td>
<td>8.8</td>
<td>10.2</td>
<td>11.6</td>
</tr>
<tr>
<td>19-24</td>
<td>8.4</td>
<td>9.8</td>
<td>11.2</td>
</tr>
<tr>
<td>25+</td>
<td>7.5</td>
<td>8.9</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Add 0.3 to HW/BW of all males and subtract 0.3 for all females. Body weight >20 kg/Add 1.0 to HW/BW if animal is emaciated. Subtract 1.0 from HW/BW if animal is obese.

**Canine left AV/right ratios**

<table>
<thead>
<tr>
<th>Normal</th>
<th>0.54-0.79</th>
<th>0.71-0.79</th>
<th>&gt;0.80</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left AV Incompetance Probable</td>
<td>Definite</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(esp. if nodular)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5/14/91
SF/Sr/Org. Wt.
CRITERIA FOR CARDIAC HYPERTROPHY:

A. Left ventricular hypertrophy

\[
\begin{align*}
\text{LV + S / BW} \geq 0.57\% & \quad (*) \\
\text{LV + S / TC} \geq 66.25\% & \quad (*) \\
\text{LV + S / RV} \geq 3.88\%
\end{align*}
\]

B. Right ventricular hypertrophy

\[
\begin{align*}
\text{RV / BW} \geq 0.18\% & \quad (**) \\
\text{RV / TC} \geq 20.94\% & \quad (**) \\
\text{LV + S / RV} \leq 2.76\%
\end{align*}
\]

C. Biventricular hypertrophy

\[
\begin{align*}
\text{LV + S / BW} \geq 0.57\% \\
\text{RV / BW} \geq 0.18\% \\
\text{TC / BW} \geq 0.94\%
\end{align*}
\]

CRITERIA FOR VALVULAR ALTERATIONS:

A. Aortic Valve Alterations:

Stenosis
\[
\begin{align*}
\text{A/P} \leq 0.81 \\
\text{A/LAV} \leq 0.52 \\
\text{A/RAV} \leq 0.41
\end{align*}
\]

Dilatation
\[
\begin{align*}
\text{A/P} \geq 1.17 \\
\text{A/LAV} \geq 0.84 \\
\text{A/RAV} \geq 0.65
\end{align*}
\]

B. Pulmonic Valve Alterations:

Stenosis
\[
\begin{align*}
\text{A/P} \geq 1.17 \\
\text{P/LAV} \leq 0.49 \\
\text{P/RAV} \leq 0.38
\end{align*}
\]

Dilatation
\[
\begin{align*}
\text{A/P} \geq 0.81 \\
\text{P/LAV} \geq 0.89 \\
\text{P/RAV} \geq 0.70
\end{align*}
\]

C. Left Atriovalvular Alterations:

Stenosis
\[
\begin{align*}
\text{LAV/RAV} \leq 0.60 \\
\text{A/LAV} \geq 0.84 \\
\text{P/LAV} \geq 0.89
\end{align*}
\]

Dilatation
\[
\begin{align*}
\text{LAV/RAV} \geq 0.96 \\
\text{A/LAV} \leq 0.52 \\
\text{P/LAV} \leq 0.49
\end{align*}
\]
Measurements for Assessing diseases of the heart:

1. Body weight (Kg) _______
2. Heart weight (g) _______ TC
3. Right AV circumference (cm) _________________
4. Pulmonic valve circumference (cm) __________
5. Left AV circumference (cm) _____________
6. Aortic valve circumference (cm) ___________
7. Right ventricular weight (g) _______ RV
8. Right ventricular thickness (cm) _______ RVT
9. Left ventricular+ septum weight (g) _______ LV+S
10. Left ventricular thickness (cm) _______ LVT
11. Septal thickness (cm) _______ ST

Calculations: Normal

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Heart weight/Body weight</td>
<td>0.76 ± 0.09%</td>
</tr>
<tr>
<td>B. LV + S/body weight</td>
<td>0.45 ± 0.05%</td>
</tr>
<tr>
<td>C. LV + S/Heart weight</td>
<td>59.53 ± 3.51%</td>
</tr>
<tr>
<td>D. RV/Body weight</td>
<td>0.14 ± 0.02%</td>
</tr>
<tr>
<td>E. RV/Heart weight</td>
<td>18.08 ± 1.43</td>
</tr>
<tr>
<td>F. LV +S / RV</td>
<td>3.32 ± 0.28</td>
</tr>
<tr>
<td>G. A/P</td>
<td>0.99 ± 0.09</td>
</tr>
<tr>
<td>H. A/LAV</td>
<td>0.68 ± 0.08</td>
</tr>
<tr>
<td>I. A/RAV</td>
<td>0.53 ± 0.06</td>
</tr>
<tr>
<td>J. P/LAV</td>
<td>0.69 ± 0.10</td>
</tr>
<tr>
<td>K. P/RAV</td>
<td>0.54 ± 0.08</td>
</tr>
<tr>
<td>L. LAV/RAV</td>
<td>0.78 ± 0.09</td>
</tr>
<tr>
<td>M. LVT/RVT</td>
<td>2.13 ± 0.33</td>
</tr>
<tr>
<td>N. LVT/ST</td>
<td>1.01 ± 0.09</td>
</tr>
<tr>
<td>O. RVT/ST</td>
<td>0.48 ± 0.07</td>
</tr>
</tbody>
</table>

LAB SUBMITTAL GUIDELINES

SUBMISSION OF TISSUES FOR PATHOLOGIC EXAMINATION

A. General Considerations
   1. A complete history and gross description should accompany each case including size, shape, color, consistency, and distribution or pattern of the lesions.
   2. Include a list of the tissues submitted and designate the type of examination to be done (histopathology, microbiology, FA, etc.).
   3. List the pathology resident's name and clinician's names, pathology and clinical accession numbers, species and date of submission.

B. Histopathology
   1. For routine microscopic examination use 10% buffered neutral formalin with a formalin:tissue ratio of 10:1.
   2. Necropsy specimens should be no more than 1/2 cm thick and approximately 2 x 2 cm square.
   3. Biopsy material should be as large as possible up to the size for necropsy specimens, and include normal and abnormal tissue.
      a. Needle biopsies are acceptable but may not always be diagnostic or representative.
      b. Lymph node needle biopsies are often unacceptable and the entire node should be submitted cut in cross section.
   4. Intestinal sections should be laid out flat on a piece of saline-soaked lens paper and submitted mucosa side up.
   5. Do not freeze tissue, and tightly seal containers.

C. Microbiology and Virology
   1. Tissues should be approximately 2 x 2 x 1 cm and sent refrigerated. Freezing is acceptable and necessary if transport is over 24 hours.
   2. Swabs of exudates should be sent in suitable transport media.
   3. Submit serum with suspect viral samples as it can be used to neutralize the virus.

D. Fluorescent Antibody
   1. Tissue should be 1/4 cm cubes and submitted in Michel's media.

E. Cytology
   1. Impressions of organs such as spleen, liver, and bone marrow are particularly useful in diagnosis of diseases and neoplasms of the hematopoietic system, and Chlamydia infections.

F. Serology
   1. Serum is useful from aborted fetuses to determine if an immune response has occurred and if the serum will neutralize any of the common viruses that cause abortion.

G. Rabies Examination
   The entire brain is removed from the animal, and specific sections are sent in a double sealed container, to the local Health Department, which includes the pathology reference number. The remainder of the brain is placed in formalin.
BACTERIOLOGY-PARASITOLOGY
Veterinary Medical Teaching Hospital

Microbiology: VMTH 1025  Parasitology: VMTH 1013
Supervisor: Spencer Jang  Tech: Robin Houston

Weekday laboratory hours:
Monday through Friday: 7:30 a.m. - 6:00 p.m.
(tissue accepted until 5:00 p.m.)

Weekend laboratory hours:
Saturday: 9:00 a.m.-1:00 p.m. (tissues accepted until 12 noon)
Sunday: 10:00 a.m.-12:00 p.m. (tissues accepted until 11:00 a.m.)

SUBMITTAL FORMS
- Bacteriology and Parasitology forms are provided in an ancillary room, 1350C on the necropsy floor.
- Completed request forms (1 form/animal) and specimens are to be placed on the designated trays in the necropsy room. Transport of specimens from the necropsy room will be handled by the laboratory. Call 2-9446 for pick up or questions. Request for routine culturing will be at the discretion of the laboratory.
- Include clinician and pathologist names on submittal form. Provide any history, age and condition of the animal (fresh, autolyzed, etc.).
- On avian specimens, indicate species of bird.
- Specimens submitted for special laboratory testing at CAHFS (Botulism, Enterotoxemia, Clostridial FA (C. chauvoeii, C. septicum and C. sordellii), Leptospirosis IFA, E. coli, K99 latex test) must be routed through the VMTH Micro lab. Call lab 2-9446 for any questions. Direct submittals to CAHFS are not accepted.
- When an infectious agent is suspected it may be hazardous to personnel handling specimens. Indicate in heavy print "suspect" (rabies, Chlamydia, anthrax, Coccidioides, etc.) on the request form.
- To avoid contamination, submittal forms and the outside surface of specimen containers must be kept clean (no blood or feces, etc.).
SPECIMEN SUBMITTALS
- Specimens will be taken steriley at necropsy. If not sterile then label container “Not Sterile”. Submit tissue of sufficient size to allow searing (1 cm x 1 cm).
- Place each sterile tissue in a separate sterile petri dish. Label each dish.
- Sterile swabs (Amies with charcoal) of lesions or aspirates of CSF, joint fluid, blood, cavity fluid are submitted and labelled on tube or syringe.
- Gut specimens: tie off a segment of the gut and place in petri dish. Large pieces of gut submit on plastic pie plate. Label gut section.
- Anaerobic cultures require immediate attention. Please call lab 2-9446.
- To adequately store specimens for aerobic culture the following morning, place in the refrigerator located in the Necropsy room. Place request form on the front bench in the Microbiology lab or slip under the door if closed, indicating that the specimen in the refrigerator on the necropsy floor.
- Specimens requiring anaerobic culturing the following morning should be placed in anaerobic transport media held at room temperature.
- Swabs are not appropriate for anaerobic culture, when submitted, place in anaerobic transport media.
- When more than one sample is submitted, label each tissue and include the pathology accession number on the container.

GENERAL INFORMATION
- There is usually no need to select more than four tissues (especially for anaerobes) for routine cultures. **Combining specimens is not recommended.**
- Lab animal inoculations are routinely done for botulism. Due to prohibitive cost, authorization must be obtained from the Pathology Service Chief prior to submitting requests of this nature.
- Tissues specifically for F.A. (Clostridial species) are submitted and impression smears are done by the lab.
- Specific requests include fungal culture, *Campylobacter, Mycoplasma, Serpulina, E. coli* typing, antibiotic sensitivity, *Mycobacterium* culture, acid fast stains and PCR identification.

PARASITOLOGY SAMPLES
- For identification of any whole parasite, submit it in saline, not formalin. If submitting a parasite over the weekend, still use saline, place sample in necropsy room refrigerator and leave the Parasitology submission form in room 1013, indicating the location of the sample, e.g. “necropsy room refrigerator” or “student lab refrigerator”.
- When submitting abomasum for total worm count, submit entire intact abomasum and contents in an airtight container. The abomasum will be returned after the contents have been analyzed, if desired. Submit feces for worm egg count as well (at least 5 grams).
- Parasitology prefers gut contents rather than gut loops. Submit samples of sufficient size and quantity. If in doubt, consult a technician (Room 1013).
- When submitting feces for flotation, McMaster sedimentation and/or Bacsman tests, provide at least 5 gm, place in an air tight container and provide refrigeration. Do not freeze or add formalin.
RESULTS

- Microbiology and Parasitology results can be accessed from the hospital computer terminals within 24 hours of submittal. This information is automatically transferred into the text of the corresponding necropsy report under the heading, 'Supplement from Microbiology Laboratory' and is updated according to available results.

FECAL AND INTESTINAL CONTENT CULTURE AND ENTEROTOXIN TESTING

The microbiology laboratory does not perform enteric panels routinely of feces/intestinal contents due to loss of toxin or overgrowth of Clostridium post-mortem. Therefore, specific tests should be requested.

- Specimen: 1 gram of feces or 1 ml of fluid feces. Not recommended, but rectal swabs placed in transport medium are accepted. Feces for culture for Salmonella and other enteropathogens or testing for CL. difficile or CL. perfringens enterotoxin can be kept in the refrigerator overnight without the use of transport medium. For CL. perfringens or CL. difficile culture place some feces in anaerobic transport medium at R.T. overnight if not cultured the same day of submittal.

NOTES:

Latex agglutination test for presence of K99 in isolates of /E. coli in stools of diarrhetic calves within 5 days of birth require fresh stool sample. (VMRD:E. coli antigen test kit)
IMMUNOLOGY-VIROLOGY
Veterinary Medical Teaching Hospital

Immunology: VMTH 1024  Virology: VMTH 1023
Technicians: Eva Tamez-Trevino and Heather Wiese
Supervisor: Barry Puget

SUBMITTAL INFORMATION

- Include clinician and pathologist names on submittal form.
- Complete all areas of submittal form.
- Tie off 1" - 1-1/2" gut sections.
- Tests not listed on the lab request forms or offered by the VMTH lab may still be available through research and other diagnostic labs. Ask for assistance.
- A list of the specific procedures performed either at the VMTH or CAHFS is available on the forms counter of the necropsy floor.

SPECIMEN CONTAINERS

- Separate different tissues and submit in labeled plastic containers with lids (quart and pint sizes available).
- Petri dishes are not effective - specimens will dry out.
- If requesting a pooled sample culture (Chlamydia ELISA) all tissues can be combined in one container.
- Submit heart blood, pleural fluid, peritoneal fluid, and CSF in a clot tube.

SPECIMEN HANDLING

Impression Smears
- Place slides in a slide box or plastic container and submit to appropriate lab. Do not refrigerate.

Skin Biopsies
- Trim as much hair from specimens as possible in order to prevent contamination of Michele's media.

Tissue Samples
- Place in sealed plastic containers or Whirl-packs in the freezer, when in doubt always freeze tissue samples for virology testing.
### IMMUNOLOGY-VIROLOGY LAB

#### VMTH

<table>
<thead>
<tr>
<th>LARGE ANIMAL PCR PREF</th>
<th>PREFERRED SPECIMEN</th>
<th>SMALL ANIMAL PCR PREF</th>
<th>PREFERRED SPECIMEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenovirus</td>
<td>nasal swab, fecal, swab, lung</td>
<td>Canine Adeno (ICH)</td>
<td>liver, spleen, lymph nodes</td>
</tr>
<tr>
<td>Blue tongue</td>
<td>spleen</td>
<td>Canine Corona</td>
<td>colon (1” tied off), feces</td>
</tr>
<tr>
<td>B.R.S.V.</td>
<td>lung</td>
<td>Canine Distemper</td>
<td>lung, bladder, cerebellum</td>
</tr>
<tr>
<td>B.V.D.</td>
<td>spleen</td>
<td>Canine Herpes</td>
<td>lung, liver, kidney, spleen</td>
</tr>
<tr>
<td>Chlamydia</td>
<td>conjunctival smears, placentomes</td>
<td>Canine Parvo*</td>
<td>colon, feces, ELISA on feces</td>
</tr>
<tr>
<td>Coronavirus</td>
<td>Spiral colon (1” section tied off)</td>
<td>Feline Calici</td>
<td>lung</td>
</tr>
<tr>
<td>IBR</td>
<td>fecal sample for ELISA (isolation not routinely done)</td>
<td>Feline Herpes</td>
<td>lung, trachea</td>
</tr>
<tr>
<td>P.I.-3</td>
<td>kidney, lung, trachea, spleen</td>
<td>FIP</td>
<td>liver</td>
</tr>
<tr>
<td>intestine, spleen, thymus</td>
<td>jejunum, proximal ileum, fecal smear, feces-ELISA</td>
<td>Panleukopenia</td>
<td>small</td>
</tr>
<tr>
<td>Rotavirus*</td>
<td>jejunum, ileum</td>
<td>TGE</td>
<td></td>
</tr>
<tr>
<td>TGE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*A BRSV ELISA on lung and a Rotavirus ELISA on feces are routinely done on these specimens as a screen for infection.

*Parvo fecal ELISA done as a screen for infection.

### LARGE ANIMAL VIRAL SEROLOGY PREF

<table>
<thead>
<tr>
<th>Adeno-3</th>
<th>1 ml serum is required on all of these viral serology tests.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue tongue</td>
<td></td>
</tr>
<tr>
<td>B.L.V.</td>
<td></td>
</tr>
<tr>
<td>B.V.D.</td>
<td></td>
</tr>
<tr>
<td>E.I.A. (requires USDA form signed by clinician)</td>
<td></td>
</tr>
<tr>
<td>I.B.R.</td>
<td></td>
</tr>
<tr>
<td>P.I.-3</td>
<td></td>
</tr>
<tr>
<td>Pseudorabies</td>
<td></td>
</tr>
</tbody>
</table>

BG/CON/MANUALS/RES MAN/IMM-VIROLOGY TABLE 7/20
TOXICOLOGY SUBMITTAL PROCEDURES

GENERAL INFORMATION
Helpful submittal information:
  • Complete animal history
  • Feed, water and shelter provisions
  • Clinical signs (e.g. botulism)

CONTACT Dr. Pushner (2-1154) or the Toxicology Lab (2-4589) WHEN:
  • An environmental problem is suspected
  • Unsure of tests to request*
  *It is often beneficial to freeze tissue specimen(s) until completion of histopathological examination and then contact her.

TISSUE SAMPLES
LIVER*
Best organ for acute toxicosis cases and detecting heavy metals, selenium, insecticides.
Preferred amount: Minimum of 200 grams (large animals) As much as possible (small animals)

KIDNEY
Useful in detecting heavy metals, selenium, ethylene glycol.

BRAIN* (Rule out RABIES before submitting samples.)
Useful in detecting ACHE, chlorinated hydrocarbons, and sodium.
  • If tissue can be spared, cut down middle of organ and freeze one half for submission.

FAT
Useful in detecting chlorinated hydrocarbons (OC 3).

EYE TISSUE AND OCULAR FLUID
Useful in detecting nitrate and magnesium.
Acceptable to store eye in freezer.

RUMEN/STOMACH CONTENTS*
Useful in detecting poisonous plants and metals.
Preferred amount: 1 kg
NOTE: Submit leaves separately

HAIR
Not useful because of contamination.
SKIN
Dermal exposure cases.

HEART CLOT
Submit serum from heart clot for analysis.
  *Most useful tissue for detecting toxicologic disease processes.

URINE
Recommendations for determining presence of drugs: Freeze 60ml of urine for submittal.

PACKAGING
• Seal fluids in vials.
• Save two separate tissue samples (when possible) as follows:
  1) wrap some tissue in foil and submit in plastic cup or freeze
  2) wrap some tissue in plastic and submit in plastic cup or freeze
• Glass containers are acceptable although plastic is more uniform.  8/01
# TABLE 1

**SUGGESTED SPECIMENS FROM MAMMALIAN SPECIES FOR VIRUS ISOLATION AND IDENTIFICATION**

<table>
<thead>
<tr>
<th>Type of Illness or Infection</th>
<th>Common Name or Associated Virus</th>
<th>Other Infections</th>
<th>Clinical Specimens to Collect</th>
<th>Diagnostic Identification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Respiratory</td>
<td>Adenovirus (bovine, porcine, canine)</td>
<td>Infectious canine hepatitis</td>
<td>Nasal and ocular secretions, feces, lung, brain, tonsil</td>
<td>VI (CPE), HA, CF, FA, VN</td>
</tr>
<tr>
<td>Diarrhea (mucosal)</td>
<td>Bovine viral abortions disease</td>
<td>Genital lung, spleen, blood, mesenteric enteric</td>
<td>Nasal secretions, oral lesions, lymph nodes, intestinal mucosa, vaginal secretions, fetal tissues</td>
<td>PCR, FA</td>
</tr>
<tr>
<td></td>
<td>Infectious bovine rhinotracheitis</td>
<td>Central Nervous System (CNS), genital abortions</td>
<td>Nasal and ocular secretions, lung, tracheal swab, tracheal segment, brain, vaginal secretions, serum, aborted fetus, liver, spleen, kidney</td>
<td>PCR</td>
</tr>
<tr>
<td>Rhinotracheitis</td>
<td>Feline</td>
<td>Conjunctival membranes, liver</td>
<td>Nasal and pharyngeal secretions, lung, spleen, kidney, salivary gland, brain</td>
<td>PCR, VI</td>
</tr>
</tbody>
</table>

VI = virus isolation (see section B for type of viral CPE), FA = immunofluorescence, VN = virus neutralization, HI = hemagglutination inhibition, CF = complement fixation, EM = electron microscopy, ECE = embryonating chicken eggs, AGID = agar gel immunodiffusion, HAD = hemadsorption, HA = hemagglutinin, IEOP = immunoelectroosmophoresis

7/20/05
<table>
<thead>
<tr>
<th>Type of Illness or Infection</th>
<th>Common Name or Associated Virus</th>
<th>Other Infections</th>
<th>Clinical Specimens to Collect</th>
<th>Diagnostic Identification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equine rhinopneumonitis</td>
<td>Genital abortions</td>
<td>Placenta-fetus, lung, nasal secretions, lymph nodes</td>
<td>PCR, FA</td>
<td></td>
</tr>
<tr>
<td>(herpesvirus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influenza (equine, porcine)</td>
<td></td>
<td>Nasal and ocular secretions, lung, tracheal swab</td>
<td>ELISA</td>
<td></td>
</tr>
<tr>
<td>Parainfluenza (bovine, equine, porcine, ovine, canine)</td>
<td></td>
<td>Nasal and ocular secretions, lung, tracheal swab</td>
<td>VI (ECE), HA, HI, VN</td>
<td></td>
</tr>
<tr>
<td>Bovine respiratory syncytial virus</td>
<td>Trachea, lung, nasal secretions, clotted blood</td>
<td>VI (CPE), FA, ELISA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reovirus (bovine, equine, canine, feline)</td>
<td>Feces, intestinal mucosa, nasal and pharyngeal secretions</td>
<td>VI, HA, Hi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*African horsesickness</td>
<td>Whole blood in anticoagulant, lesion material, nasal and pharyngeal secretions</td>
<td>VI (CPE and mice), VN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Malignant catarrhal fever</td>
<td>Whole blood in anticoagulant lymph nodes, spleen, lung</td>
<td>VI (CPE), ELISA, FA, VN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(herpesvirus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7/20/05

*Reportable disease or a foreign animal disease.
<table>
<thead>
<tr>
<th>Type of Illness or Infection</th>
<th>Common Name or Associated Virus</th>
<th>Other Infections</th>
<th>Clinical Specimens to Collect</th>
<th>Diagnostic Identification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudorabies (herpesvirus)</td>
<td>(CNS), Genital abortion</td>
<td>Nasal secretions, tonsil, lung, brain (midbrain, pons, medulla), spinal cord (sheep and cattle), spleen (swine), vaginal secretion, serum</td>
<td>VI (CPE and rabbits), VN, ELISA, FA</td>
<td></td>
</tr>
<tr>
<td>Canine herpesvirus</td>
<td></td>
<td>Kidney, liver, lung, spleen, nasal, oropharyngeal and vaginal secretions</td>
<td>PCR, FA</td>
<td></td>
</tr>
<tr>
<td>Porcine inclusion body rhinitis (cytomegalovirus)</td>
<td>Turbinate, nasal mucosa</td>
<td>EM, VI (CPE), FA, VN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equine rhinovirus</td>
<td></td>
<td>Nasal secretions, feces</td>
<td>VI (CPE), VN</td>
<td></td>
</tr>
<tr>
<td>Maedi-Visna (ovine)</td>
<td>(CNS)</td>
<td>CSF, whole blood, salivary glands, lung, mediastinal lymph nodes, choroid plexus, spleen</td>
<td>VI (CPE and sheep), VN, CF</td>
<td></td>
</tr>
<tr>
<td>Bovine rhinovirus</td>
<td></td>
<td>Nasal secretions</td>
<td>VI (CPE), VN</td>
<td></td>
</tr>
<tr>
<td>*Rift valley fever (bovine, ovine)</td>
<td>Whole blood in anticoagulant, fetus, liver, spleen, kidney, brain</td>
<td>VI (CPE and mice), VN, CF, FA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Enteric</td>
<td>Bovine enterovirus</td>
<td>Feces, oropharyngeal swab, feces</td>
<td>VI (CPE), VN</td>
<td></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Type of Illness or Infection</th>
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<th>Clinical Specimens to Collect</th>
<th>Diagnostic Identification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmissible gastroenteritis</td>
<td>Feces, nasal secretions, jejunum, ileum</td>
<td>VI (newborn pigs), FA, EM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonatal diarrheas</td>
<td>Feces, small intestine</td>
<td>ELISA, FA, EM,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Rotaviruses</td>
<td>Feces, intestinal mucosa, regional lymph nodes, brain, heart</td>
<td>ELISA, EM, HA, HI, VN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Parvoviruses</td>
<td>Feces, small intestine</td>
<td>VI (CPE), FA, EM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Coronaviruses</td>
<td>Feces, small intestine</td>
<td>VI (CPE) VN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picornavirus SMEDI (enterovirus)</td>
<td>Feces, intestine, brain, tonsil, liver</td>
<td>VI (CPE) VN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polioencephalitis (Treschen, Talfan)</td>
<td>Brain, intestine, feces</td>
<td>VI (CPE), VN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rinderpest</td>
<td>Blood in anticoagulant, spleen, mesenteric lymph nodes</td>
<td>VI (CPE and cattle), AGID, CF, VN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot and mouth disease</td>
<td>Lesion material, tonsil vesicular fluid, hoof lesions, esophageal-pharyngeal (op) fluids</td>
<td>VI (CPE and neonatal mice), CF, VN, FA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(picornavirus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peste des petits ruminants</td>
<td>Blood in anticoagulant, spleen, mesenteric lymph nodes</td>
<td>VI (CPE and goats), VN, CF, AGID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(morbillivirus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
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<th>Common Name or Associated Virus</th>
<th>Other Infections</th>
<th>Clinical Specimens to Collect</th>
<th>Diagnostic Identification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>3) Central Nervous System (CNS)</td>
<td>Rabies</td>
<td>Brain, salivary gland</td>
<td>VI (mice and inclusions), FA, VN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equine encephalomyelitis (VEE*, EEE, WEE)</td>
<td>Whole blood, brain, cerebrospinal fluid, nasal and pharyngeal secretions, pancreas</td>
<td>VI (ECE and mice), HA, HI, VN, CF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Louping ill encephalomyelitis (flavivirus)</td>
<td>While blood, brain, cerebrospinal fluid</td>
<td>VI (ECE and CPE), FA, VN, HI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hemagglutinating</td>
<td>Brain, spinal cord</td>
<td>VI (CPE), HA, HAD, VN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Caprine arthritis encephalitis (retrovirus)</td>
<td>Blood, spinal cord</td>
<td>VI (CPE), AGID</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Japanese B Encephalitis</td>
<td>Brain, CSF</td>
<td>VI (ECE and mice), IgM, VN, CF, HI, FA, ELISA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Borna disease</td>
<td>Brain, spinal cord</td>
<td>VI (ECE and rabbits), FA, CF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Scrapie</td>
<td>Brain</td>
<td>VI (mice and sheep)</td>
<td></td>
</tr>
<tr>
<td>4) Mucous membranes and Skin</td>
<td>Pos Viruses a. swine pox b. vaccinia c. pseudopox *d. sheep and goat pox</td>
<td>Lesion scrapings, lesions, vesicular fluids, crusts, liver, spleen</td>
<td>VI (ECE, CPE and rabbits), HA, HI, VN, FA, EM</td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
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<th>Diagnostic Identification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bovine mammillitis (herpesvirus)</td>
<td>Lesion scrapings, lesions, teat swab, fluid exudates from lesion</td>
<td>VI (CPE), VN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vesicular stomatitis (rhabovirus)</td>
<td>Vesicular fluid, epithelial covering of lesions, whole blood, regional lymph nodes, tongue swab</td>
<td>VI (CPE), VN, CF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Vesicular exanthema of swine (calicivirus)</td>
<td>Vesicular fluid, epithelial covering of foot lesion, tonsil (op fluid), serum, oral and nasal lesions</td>
<td>VI (CPE), CF, VN, AGID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Swine vesicular disease (picornavirus)</td>
<td>Vesicular fluid, epithelial covering of lesion, oral or nasal lesion</td>
<td>VI (CPE), VN, FA, AGID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Papilloma viruses</td>
<td>Neoplastic</td>
<td>Lesion material, warts, skin scraping</td>
<td>EM, cell transformation, FA</td>
<td></td>
</tr>
<tr>
<td>Contagious ecthyma ORF (parapoxvirus)</td>
<td>Scabs, lesions on lip</td>
<td>VI (ECE and CPE), VN, AGID, FA, EM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Genital and/or abortions</td>
<td>Enteroviruses (CNS)</td>
<td>Vaginal secretions, serum from dam or sow, nasal swab, tonsil, brain, swine, feces (cattle and swine)</td>
<td>VI (CPE), VN</td>
<td></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
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<th>Clinical Specimens to Collect</th>
<th>Diagnostic Identification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parvovirus (swine)</td>
<td></td>
<td>Vaginal secretions, serum from dam or sow, lung (mummified fetus)</td>
<td>VI (CPE), FA, HA, HI</td>
<td></td>
</tr>
<tr>
<td>Bluetongue epizootic hemorrhagic disease, Ibaraki</td>
<td>Hemorrhagic syndrome (Viremia) respiratory</td>
<td>Vaginal secretions serum from dam or sow, fetal heart, heparinized blood, spleen, bone marrow, lymph nodes, lung, semen</td>
<td>VI (CPE and ECE), CF, AGID, FA, VN</td>
<td></td>
</tr>
<tr>
<td>Equine viral arteritis</td>
<td></td>
<td>Whole blood, nasal and pharyngeal secretions, placenta-fetus, spleen, nostril, lymph nodes, conjunctival sac</td>
<td>VI (CPE), CF, AGID, FA</td>
<td></td>
</tr>
<tr>
<td>Border disease (hairy shaker)</td>
<td></td>
<td>Brain, spleen, blood, bone marrow</td>
<td>VI (CPE and interference), FA, VN</td>
<td></td>
</tr>
<tr>
<td>*Akabane</td>
<td></td>
<td>Placenta, fetal muscle, nerve tissues</td>
<td>VI (CPE and suckling mice), FA, VN, HI, HA</td>
<td></td>
</tr>
<tr>
<td>6) Hemorrhage Syndrome (Viremia)</td>
<td>Hog cholera</td>
<td>Tonsil, spleen, liver, brain, lymph nodes</td>
<td>VI (pigs), FA, VN</td>
<td></td>
</tr>
<tr>
<td>Anemia</td>
<td>Equine infectious</td>
<td>Whole blood, spleen, lymph nodes</td>
<td>VI (CPE and horses), FA, VN, CF, ELISA, AGID</td>
<td></td>
</tr>
<tr>
<td>*African swine fever</td>
<td></td>
<td>Blood in anticoagulant, spleen, liver, tonsil, lymph nodes</td>
<td>VI (CPE and pigs), HAD, HA, CF, FA, RIA, ELISA, IEOP</td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
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<th>Diagnostic Identification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Nairobi sheep disease</td>
<td></td>
<td>Spleen, blood (plasma), mesenteric lymph nodes</td>
<td>VI (suckling mice), FA</td>
<td></td>
</tr>
<tr>
<td>*Rift Valley fever</td>
<td></td>
<td>Fetus, blood in anticoagulant, liver, spleen, kidney, brain, serum</td>
<td>VI (CPE and suckling mice), VN, CF, AGID, FA</td>
<td></td>
</tr>
<tr>
<td>7) Neoplastic</td>
<td>Retrovirus</td>
<td>Lymph nodes, metastatic growths, blood in anticoagulant</td>
<td>VI, reverse transcriptase, EM</td>
<td></td>
</tr>
</tbody>
</table>

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*Reportable disease or a foreign animal disease.
Nonlesions and Lesions of No Significance

Lois Roth, DVM
John M. King, DVM, PhD
Department of Pathology
New York State College of Veterinary Medicine
Cornell University
Ithaca, New York

Nonlesions or lesions of no significance are among the most common findings during necropsy or exploratory surgery. These findings are frequently difficult to interpret and correlate with other lesions which may be present. Proper interpretation of these observations is important in reaching an accurate diagnosis and prognosis, since these findings are usually incidental and have no bearing on the definitive diagnosis.

The authors' experience is primarily with necropsy material. The importance of an orderly necropsy procedure cannot be overemphasized. The technique they use has been described and is appropriate for all species. "Lesions" and their significance are described in this article in the order they may be discovered during a necropsy. Many of these entities are common to several species; those that are species-specific will be identified as such in the text.

Skin and Body Orifices
Liver Mortis
Liver mortis is a postmortem change related to the settling of blood to the dependent portions of the body. Compression of areas results in regions of pallor, as blood is prevented from pooling in or is expressed from these places. Liver mortis is more easily observed in lightly pigmented or nonpigmented animals.

Nasal and Oral Discharges
These discharges must be carefully evaluated, since the appearance of blood-tinged fluid and/or stomach contents at these orifices may be the result of postmortem change and manipulation of the carcass. If an animal is killed and falls onto a hard surface, the impact may be sufficient to cause bleeding from the mouth or nose. Often a clinical history is helpful in evaluating this finding.

Rectal or Vaginal Prolapse
In an animal that has been dead for several hours, rectal or vaginal prolapse is a common postmortem occurrence. There may even appear to be congestion of the affected area. The presence of an inflammatory reaction, degree of autolytic change, and clinical history are factors that help in proper evaluation.
Spleen
Splenomegaly
There are several major causes of enlarged spleens, and those of diagnostic significance must be differentiated from the artifactual causes. Sequestration of blood following injection of barbiturate anesthesia or euthanasia solutions is probably the most common cause of splenomegaly. The fact that blood oozes freely from the cut surfaces of these engorged spleens can be used to differentiate them from spleens that are enlarged due to chronic infections, especially of the blood protozoa, or severe, acute bacterial infections, extramedullary hematopoiesis, and diffuse neoplastic infiltration. These latter spleens are generally more firm, and blood does not freely ooze from the cut surface.

Normal Surface Fold
Indentations of the splenic parenchyma that are smoothly and regularly covered by the splenic capsule are extremely common in horses. These linear or irregularly shaped depressions are congenital and should be differentiated from healed, traumatic lesions, since these surface folds are not associated with scarring.

Extracapsular Red Pulp
It is quite common for the splenic capsule of young foals to be covered with finely granular red nodules. Histologically, there are nodules of normal red pulp which protrude through the capsule (Figure 1).

Liver
Multifocal Capsular Fibrosis
Plaques and tags of fibrous connective tissue are most common on the diaphragmatic surface of the liver and corresponding surface of the diaphragm in horses. Some consider these connective tissue plaques to be the result of parasite migrations. However, since there is often a matching lesion on the diaphragm, it seems more likely that these fibrous plaques are the result of fluid and fibrin trapped between the liver and diaphragm. Capillary action during the course of resolution of nonseptic peritonitis is the probable cause. Fibrous tags are seen on the capsular surface of the spleen of cattle as well as horses. The cause is not known but these tags of tissue are not considered to be significant lesions.

Tension Lipidosis
Tension lipidosis is a focus of pale, fatty liver, usually with straight borders on the surface of the liver, and extending several millimeters into the parenchyma. A tag of connective tissue, whether a normal mesenteric attachment or the result of previous peritonitis, is usually adherent. This connective tissue attachment exerts tension on this area of liver, compromising (incompletely) its blood supply and causing anoxia and fatty change. These areas have been described as pseudoinfarcts. The lesion is common in cattle and horses but has no significance.

Kidney
Mucus in Renal Pelvis
Copious mucoid material is normally found in the renal pelvis of the horse. Numerous goblet cells that produce mucus are present among the transitional epithelial cells that line the renal crest and ureters of horses. Threads and clumps of whitish mucus may be present in the urinary bladder as well.

Cortical Cysts
Single or multiple cysts of various size, often filled with urine, are seen in cattle (these lesions are much more common in rats, cats, and pigs). When there is no other kidney lesion, these lesions are considered to be congenital and are not a significant finding.

Pulpy Kidneys
Soft, pulpy kidneys are considered to be a diagnostic lesion of enterotoxemia in sheep. Actually, this is due to autolysis that occurs rapidly, frequently in tissues with a high glucose or glycogen content at the time of death.

Respiratory System
Pharyngeal Lymphoid Hyperplasia
A prominent accumulation of lymphoid follicles in the pharynx, surrounding the epiglottis and at the caudal aspect of the tongue, is common in young horses. Clinically, this finding has been associated with poor racing performance, yet marked lymphoid hyperplasia is common in horses that have died for other reasons. The cause of lymphoid hyperplasia in this region is unknown; however, it should be noted that this is the region in which Gasterophilus spp. (stomach bots) emerge following their migration in the oral cavity before they are swallowed. It should also be pointed out that younger animals commonly have prominent lymphoid tissue.

Tracheal Froth
White or blood-tinged froth in the trachea represents
serum that has leaked into the alveoli and airways of the animal at or soon after death. The serum is mixed to a froth by terminal respiratory movements, gasping for air, and the elastic recoil of the lung after death. This "lesion" is often observed in animals killed for necropsy demonstration. It can occur in any species and rarely is significant for diagnostic purposes.

**Multifocal Pleural Fibrosis**

Large, locally extensive areas of slightly thickened, white pleura are commonly observed on the diaphragmatic surface of the caudal lung lobes of cattle and sheep. Tags of connective tissue may be attached to the ventral border as well. Multifocal pleural fibrosis can be seen in aborted fetuses, as well as adult cattle, and should not be considered a significant lesion. The cause is not known (Figure 2).

**Food Material in Trachea and Lungs**

Careful interpretation of this finding in any species is important since it may occur postmortem, as a terminal event, or during life. Generally, food material that is present in the lung prior to death will be associated with some sort of inflammatory response.

*Editor's Note: Rarely, pulmonary edema may be the cause of the animal's death, especially in cases of exercise-induced equine pulmonary hemorrhage.*

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**Figure 2**—The fibrous plaques on the diaphragmatic capsular surface of the liver of this horse have corresponding lesions on the diaphragm.

**Figure 3**—The two pairs of friction rubs near the attachments of the aortic valve cusps in the heart of this horse should not be confused with the normal nodules of Arantius located at the center of the valve.

**Pulmonary Emphysema**

This lesion occurs easily in cattle and often is present terminally if the animal breathes hard before death. Although pulmonary emphysema often may be the actual cause of death of a cow, it is much more important to determine the underlying factors that initially caused hard breathing.

**Heart**

**Nodules of Arantius and Valvular Friction Rubs**

Nodules of Arantius are normal anatomic structures. They are small (1 to 2 mm) nodules of tissue located in the center of the free edge of the aortic and pulmonary valves and are most prominent in horses and pigs. Friction rubs are located near the valve attachment and usually are found in pairs, affecting adjacent valve leaflets. They are 1- to 2-mm nodules of connective tissue. Their exact cause is not known (Figure 3).

**Ventricular Friction Rubs**

These lesions are most commonly observed in horses, near the apex of the left ventricle as small, oval, white patches of endocardial thickening. Ventricular friction rubs are thought to result from endothelial rubbing as the ventricle contracts.

**Os Cordis**

Os cordis consists of two bones embedded in the myocardium at the base of the aortic valve. They are a normal anatomical feature of cattle.

**Endocardial, Myocardial, and Epicardial Hemorrhage**

Large areas of hemorrhage in these locations are common in all species under a wide variety of conditions. They are not indicative of any specific disease and may even be seen in normal animals killed for necropsy demonstration. Large blebs or pockets of hemorrhage, however, are indicative of coagulation disorders, and
diagnoses of vitamin K deficiency or warfarin poisoning should be considered.

**Oral Cavity and Esophagus**

**Dental Pad Erosions**

Interpretation of erosions and ulcers in this location presents a problem. Although oral erosions are lesions of some diseases such as bovine virus diarrhea (BVD) and bluetongue, they may be related to trauma from grinding of the lower incisors. Tooth trauma may cause lesions on the sides of the tongue as well. Erosions on the lower gingiva, the underside of the tongue near its root, and the soft and hard palates are much more reliable as true diagnostic lesions.

**Fimbriae**

These numerous fingerlike, fleshy projections occur along the cranial and lateral borders of the tongue. Fimbriae are seen in many newborn, normal piglets. They wear off soon after birth, leaving no residual evidence of their presence.

**Fat at the Root of the Tongue**

White muscle disease is an important disease in cattle, sheep, and goats. Discrete, opaque white muscle fibers are the lesion of this disease. When searching for this lesion, it is important to look at the muscles at the tip of the tongue, just under the epithelium. Fat, intercalated among muscle bundles farther back in the body and the root of the tongue, may give the impression of pale muscle.

**Esophageal Food Boluses**

Boluses of food are most often found lodged in the esophagus or pharynx as a result of postmortem manipulation. Lesions associated with pressure necrosis and/or clinical signs of choke are helpful in identifying significant boluses.

**Idiopathic Hypertrophy of the Distal Esophagus**

Pathology records from New York State College of Veterinary Medicine show that in approximately 50% of horses necropsied in New York, there is variable thickness of the distal 10 cm of esophageal muscle. The mucosa appears normal. The cause is unknown, and clinical problems result in about 1 to 2% of the affected horses. A similar lesion is found in the distal ileum of 10% of these horses and is also occasionally seen in pigs. Again, the cause is not known, but idiopathic hypertrophy of the muscle in this location is associated with clinical problems, such as ileus, in approximately 50% of the horses affected.

**Stomach**

**Physiologic Hyperemia**

Well-marked reddening of the region of glandular mucosa in the stomachs of pigs and horses is common.

If no free blood appears in the lumen and there is no other evidence of inflammation and ulceration, physiologic hyperemia should be considered normal and not mistaken for hemorrhagic gastroenteritis.

**Residual Mucus**

After death the mucous glands of the stomach and intestine, especially in horses and pigs, continue to secrete mucus. Mucus can be scraped from the surface and will reappear within minutes. This finding is normal and should not be mistaken for necrotic or inflammatory debris, especially when it is seen with physiologic hyperemia.

**Rumen Mucosal Sloughing**

Often as quickly as 20 minutes after death, the lining of the rumen may peel off in large patches. Pale or intensely reddened mucosa remains, depending on whether or not the animal was exsanguinated at the time of death. This finding is often mistakenly described as hemorrhagic or ulcerative rumenitis, but no hemorrhage, exudate, or edema is present to support this interpretation.

**Unguiculate Papillae**

These keratinized papillae are normal structures found at the esophageal groove of ruminants. Unguiculate papillae are usually seen in younger animals, since they most likely wear away or break off with time. Occasionally they may persist and become larger, curved structures. (The word unguiculate means clawlike and should not be confused with ungulate which means hoof.)

**Pigmentation of Ruminal Villi**

Calves and lambs are born with only a gray or almost pure white coloration of the ruminal villi, including the extremely large normal villi associated with the esophageal groove. The mucosa becomes darker with age and intake of nonmilk ingesta so that in adults it is almost always black.

**Postmortem Gastric Rupture**

Postmortem gastric rupture occurs in calves, rabbits, and horses. It often appears along the great curvature, as in pathological antemortem cases, but no hemorrhage is present along the tear and no fibrin or other evidence of antemortem inflammation is present. Even in postmortem cases the mucosa, as it is more plentiful than the muscle coats, will often tuck under giving a false impression of a smooth, healing wound edge.

**Torus Pyloricus**

This is a normal anatomical structure which is most prominent in pigs. It is a tongue-shaped, epithelial-covered bulge of tissue at the gastroduodenal junction. Histologically, it has been shown to consist of fat and
connective tissue. Although quite discrete in pigs, in the bovine it appears as a less well-defined smooth lump in this region. This lesion should not be confused with or considered to be a neoplasm, such as a leiomyoma.

**Small Intestine**

*Bots in the Duodenal Diverticulum*

It may seem unusual to include *Gasterophilus nasalis* with small intestinal lesions, but careful examination will detect these parasites just distal to the gastroduodenal junction in horses. They are not present in the stomach. Often they are associated with local dilatation of the duodenum. Bots rarely cause disease in horses.

*Duodenal Papillae*

Duodenal papillae are two mucosal nodules that are present in the proximal duodenum of most species. These normal structures are the openings of the bile and pancreatic ducts. In many instances, they are erroneously considered to be polyps or neoplasms, especially in the horse in which the major papilla has an umbilicated center and is very prominent.

**Terminal Intussusception**

Terminal or postmortem intussusceptions are common in many species and probably occur as a result of irregular peristalsis which continues after death. Although the affected portion of bowel may be dark, with blood trapped there after death, the lack of fibrin, edema, and inflammation should help to distinguish the real lesion from the artifact.

*Hemamelasma ilei*!

Hemamelasma ilei has only been observed in horses. Usually brown red, these small, generally linear plaques of connective tissue are located on the serosal surface. They are found most often in the ileum, midway between the two mesenteric attachments (Figure 4). This lesion also may be seen in the jejunum or in the duodenum opposite the mesenteric attachment. Histologically, these plaques consist of fibrous connective tissue, intermingled with hemosiderin-laden macrophages. The abundance of macrophages correlates with the degree of pigmentation. Some attribute this lesion to *Streptococcus vulgaris*; however, the authors have never observed parasites in serial sections of this lesion. The exact antimesenteric location of these plaques is also difficult to attribute to parasite migration. These plaques may be related instead to some type of vascular compromise of the intestine as is commonly seen in hemamelasma ilei in association with granulomatous enteritis or intestinal neoplasia. This lesion is often observed as an incidental finding that has no bearing on the definitive diagnosis.

**Physiologic Hyperemia with Diapedesis of Blood**

The intestine is subject to physiologic hyperemia similar to that of the stomach. In addition, there is a tendency for segments of bowel to become dilated with gas. Blood then leaks slowly into the bowel lumen causing fluid and solid ingesta to become stained red brown. This is a postmortem change that should not be mistaken for hemorrhagic enteritis, which should have fibrinous or necrotic cellular exudate adherent to the surface.

**Large Intestine**

*Tiger Stripping*

Linear patches of reddening of the colonic or rectal mucosa are due to trapping of blood in these mucosal folds as the animal terminally strains to defecate. Although many believe this is a lesion of rinderpest and BVD, tiger striping is not a lesion nor is it of diagnostic significance.

**Endocrine**

*Extracortical Nodules*

Tan to yellow nodules of cortical tissue are most common in the adrenal glands of horses and dogs, although they may be seen in any species. They should not be considered to be nodular hyperplasias if the rest of the adrenal cortical tissue is normal and of sufficient quantity, so that the functional need for more tissue is not stimulated. They should not be considered to be neoplasms, because they are present in aborted foals and neonates. They may be *hamartomas*, redundant amounts of tissue that are present in their normal location.

**Adrenal Hemorrhages and Congestion**

This finding is common and is almost always an artifact. In some cases of septicemia, adrenal hemorrhages may be significant if necrosis and thrombosis are found on histological examination. However, adrenal hemorrhages and congestion are rarely significant.

**Thyroid Cysts**

Cysts of the thyroglossal duct are most common in
the thyroid glands of sheep. Grossly, these cysts are usually 2 to 5 mm in diameter and contain white gray to yellow caseous material. Histologically, these cysts are ducts, lined by respiratory, stratified, squamous epithelium and filled with keratin debris.

**Miscellaneous**

**Cholesteatomas**

These lesions of horses may be better named cholesteryl granulomas, because these accumulations of cholesteryl and macrophages on the distal tips of the choroid plexus in the lateral ventricles of the brain are not neoplastic. They are most likely an age-related lesion since they are observed with increased frequency in older horses. Grossly, these lesions are tan, firm-to-hard, sometimes mineralized, nodular masses. If they are carefully dissected away from the brain, cholesteatomas are usually found attached to the left and right sides of the choroid plexus. The normal tan brown pineal gland is found hanging down in the center.

**Pseudomelanosis**

Gray green to black discoloration of the surfaces of the liver, kidney, abdominal wall, or intestine in small patches or large, locally extensive areas is an autolytic change. It is due to postmortem bacterial action on the blood with the formation of hydrogen sulfide. Pseudomelanosis is most often observed in the organs adjacent to the intestines.

**Melanosis**

Melanosis is a normal, gray black pigmentation of the meninges, brain, parenchyma, kidney, adrenal gland, uterus, lung, larynx, esophagus, oral cavity, gastric and intestinal mucosa, and the intima of the great vessels as they leave the heart. Melanosis is not an artifact, nor is it a lesion.

**Injection Sites**

Injection sites are difficult to analyze and may be of any size, shape, color, and consistency, depending on the material that has been injected. The clinical history helps the prosector know what to suspect. Opaque, white material in muscle may be penicillin or terracycline. Brown-stained tissues with brown regional nodes may result from iron injections, most often seen in piglets. Tan, dry, often granular material, with brown fluid material in the pleura or heart chambers or pericardial sac having a medicinal (alcohol) odor, often results from injection of euthanasia solution. A green yellow watery focus surrounded by dry, firm heart muscle may indicate intracardiac injection. Similar foci may be present in the lungs. The odor may also help in the diagnosis.

**Conclusion**

Awareness of the characteristics of nonlesions and lesions of no significance should enable the veterinarian to achieve a more accurate field diagnosis during the performance of postmortem examinations.

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**REFERENCES**