STANDARDIZED NECROPSY REPORT FORM FOR GORILLAS

Please send completed path report to the SSP Veterinary and Pathology Advisors

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Please see attached pages for description of specific methods for examination of organs of special interest

WORK SHEET

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<th>Pathology # gross exam</th>
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<td>Animal #/Name</td>
<td>Stud Book Number</td>
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<tr>
<td>Date of Death/Euthanasia</td>
<td>Time (am/pm)</td>
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<td>Method of euthanasia</td>
<td>Time and date of necropsy</td>
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<td>Post mortem state</td>
<td>Nutritional state subjective or body score</td>
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<td>Pathologist or prosector/ institution:</td>
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Gross diagnoses:

____________________________________________________________________________________________

Abstract of clinical history:

____________________________________________________________________________________________

Please check tissues submitted for histopathology.

External Examination (note evidence of trauma, exudates, diarrhea):

- Hair coat:

- Skin:

- Scent glands (axillary organ in gorillas):

- Mammary glands and nipples:

- Umbilicus (see neonatal/fetal protocol):

- Subcutis (note: fat, edema, hemorrhage, parasites):

- Mucous membranes (note: color, exudates):
Ocular or nasal exudate:
Eyes and ears:
External genitalia:
Oral cavity and pharynx
Pharyngeal and lingual tonsils:
Dentition
Tongue:

**Musculoskeletal System:**

Are there any fractures, degenerative lesions or malformations?:

Muscles:
Bone marrow (femur):
Joints (note effusions, synovial proliferation, arthritis):
Growth plate in young animals (distal femur, costochondral junction or sternabra):
Spinal column (examine ventral aspect for spondylosis when viscera removed)

**Examination of the neck region:**

Larynx:
Laryngeal air sac (see attached protocol):
Mandibular and parotid salivary glands:
Thyroids and parathyroids:
Cervical/cranial lymph nodes:
Esophagus (please take sections from proximal, mid and distal esophagus to map striated and smooth muscle distribution):

**Thoracic Cavity:**

Are there any effusions, adhesions, or hemorrhage?:

Mediastinal and coronary fat (color and relative abundance):
Thymus (are there cervical portions as well as anterior mediastinal?):
Heart (see attached protocol):
Great vessels (see attached protocol):

Trachea and bronchi:

Lungs:

Esophagus:

Lymph nodes:

**Abdominal Cavity:**

Effusions, adhesions, or hemorrhage?:

Omental, mesenteric and perirenal fat:

Liver and gall bladder:

Stomach:

Pancreas:

Duodenum:

Jejunum:

Ileum:

Cecum and (in apes) appendix:

Colon and rectum:

Lymph nodes:

Kidneys and ureters:

Adrenals:

Gonads:

Uterus:

Bladder and urethra:

Male accessory sex glands (prostate and seminal vesicles):

Umbilical vessels, round ligaments of bladder in neonates:

Abdominal aorta (note evidence of atherosclerosis) and caudal vena cava:
Nervous System:

_____ Meninges:

_____ Brain:

_____ Pituitary:

_____ Gasserian (trigeminal) ganglia:

Is there an identifiable pineal gland?

_____ Spinal cord (not necessary in every case, but if removed, please note to what level the spinal cord extends):

_____ Brachial plexus and sciatic nerves:

Note: Great Ape Aging Project is accepting brains from gorillas.

To submit an ape brain, contact

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212-659-5904
e-mail: patrick.hof@mssm.edu or mraghant@kent.edu
WEIGHTS AND MEASUREMENTS (in grams, kilograms, and cm, please):

Body weight:______________________________________________

Lymphoid tissue:
R. axillary LN _________  L. axillary LN _________
R. inguinal LN _________  L. inguinal LN _________
Jejunal LN _____________
Spleen _________________  Thymus _________________

Abdominal Organs:
Liver _________________
R. kidney ______________  L. kidney ______________
R. adrenal _____________  L. adrenal _____________
R. ovary _______________  L. ovary _______________
uterus ___________________________________________

placenta (weigh in toto and measure disc(s):

Thoracic Organs:
Heart _________________  Thymus (above)

Height ____________ Circumference at coronary groove _____________
Left Vent.__________  Rt. vent.__________  Septum______________
Lt. AV valve_______  Rt. AV valve_______
Aortic valve_______  Pulmonary valve.________

R. lung ________________  L. lung ________________

Other:
Brain _________________  Pituitary _________________

Thyroids (wt)  Left ____________  Right ______________
Thyroids (3 dimensions) Left ____________  Right ______________

Testes (wt.)  Left ____________  Right ______________
Testes Length x dia.  Left ____________  Right ______________

Penis (length x diameter) ______________________________________

Tumors(?) Measurements (3 dimensions) ________________  Weight ___________
STANDARDIZED BODY MEASUREMENTS FOR NONHUMAN PRIMATES INCLUDING APES:

crown rump length (linear)______________________________
crown rump length (curvalinear)__________________________
cranial circumference (above brow ridge)__________________
Length of head (tip of jaw to top of crest)__________________
width of brow ridge_____________________________________
chest circumference (at nipples)____________________________
adventitious circumference (at umbilicus)___________________
Left arm: Shoulder-elbow:______________________________
    elbow-wrist:_______________________________________
    wrist-tip of middle finger:___________________________
    pollex:____________________________________________
Right arm: Shoulder elbow:_______________________________
    elbow- wrist:______________________________________
    wrist-tip of middle finger:___________________________
    pollex:____________________________________________
Left leg: hip-knee:______________________________________
    knee-ankle:________________________________________
    ankle-tip of big toe:_______________________________
    heel-tip of big toe:_______________________________
    hallux:____________________________________________
Right leg: hip-knee:_____________________________________
    knee-ankle:________________________________________
    ankle-tip of big toe:_______________________________
    heel-tip of big toe:_______________________________
    hallux:____________________________________________
ANCILLARY DIAGNOSTICS (CHECK IF PERFORMED, GIVE RESULTS IF AVAILABLE, NOTE LOCATION IF STORED, OR TO WHOM SENT):

Cultures:
  bacterial:
  fungal:
  viral:

Heart blood:
  serum:
  filter paper blot:

Parasitology:
  feces:
    direct smears:
    parasites:

Tissues fixed in 10% formalin (list tissues or specific lesions other than those checked above):

  Tissue fixed for EM:__________  Tissue frozen:_____

  Impression smears:_____________________________________________________

Comments (interpretation of gross findings):
GORILLA POST MORTEM EXAMINATION

Collection of tissues
Tissues to be fixed in 10% neutral buffered formalin should be less than 0.5 cm thick to allow for adequate penetration of formalin for fixation.

Initial fixation should be in a volume of fixative 10 times the volume of the tissues. Agitation of the tissues during the first 24 hrs is helpful to prevent pieces from sticking together and inhibiting fixation.

Labeling of specimens
If pieces are small or not readily recognizable (eg. individual lymph nodes) they can be fixed in cassettes or embedding bags or wrapped in tissue paper labeled with pencil or indelible ink. Another alternative is to submit lymph nodes with attached identifiable tissue, eg. axillary with brachial plexus, inguinal with skin, bronchial with bronchus, etc.

Sections from hollow viscera or skin can be stretched flat on paper (serosal side down) and allowed to adhere momentarily before being placed in formalin with the piece of paper. The paper can be labeled with the location from which the tissue came.

The formalin container should be labeled with the animals name or number, the age and sex, the date and location, and the name of the prosector.

Tissues to be preserved
From the skin submit at least one piece without lesions, a nipple and mammary gland tissue, scent gland, and any lesions and subcutaneous or ectoparasites.

Axillary and/or inguinal lymph nodes may be submitted whole from small animals and should be sectioned transversely through the hilus in large primates.

Mandibular and/or parotid salivary glands should be sectioned to include lymph node with the former and ear canal with the latter.

Thyroids, if it is a small primate, may be left attached to the larynx and submitted with the base of tongue, pharynx, esophagus as a block. In larger primates, take sections transversely through the thyroids trying to incorporate the parathyroids in the section.

Trachea and esophagus and laryngeal air sac sections may be submitted as a block.

Cervical lymph nodes may be submitted whole if small or sectioned transversely.

Marrow: A single sternebra can be preserved as a source of bone marrow. A marrow touch imprint may be made from the cut sternebra and air dried for marrow cytology.

Thymus: Section of thymus or anterior pericardium should be taken perpendicular to the front of the heart.

Heart: weigh and measure heart after opening but before sectioning. Longitudinal sections of left and right ventricles with attached valves and atria in large animals and the whole heart opened and cleaned of blood clots in smaller animals. In tiny animals the heart may be fixed whole after cutting the tip off the apex. Please see attached Cardiovascular protocol.

Lungs: if possible inflate at least one lobe by instilling clean buffered formalin into the bronchus under slight pressure. Fix at least one lobe from each side and preferably samples from all lobes. In little animals the entire "pluck" may be fixed after perfusion.

GI tract: Take sections of all levels of the GI tract including: upper, mid and distal esophagus; gastric cardia, fundus and...
pylorus; duodenum at the level of the bile duct with pancreas attached; anterior, middle and distal jejunum; ileum; ileoceccolic junction with attached nodes; cecum and (in apes) appendix; ascending, transverse and descending colon. Open loops of bowel to allow exposure of the mucosa and allow serosa to adhere momentarily to a piece of paper before placing both bowel section and paper in formalin; or gently inject formalin into closed loops.

Liver: One section should include bile ducts and gall bladder and take sections from at least one other lobe.

Spleen: Make sure sections of spleen are very thin if the spleen is congested; formalin does not penetrate as far in very bloody tissues.

Mesenteric (jejunal) nodes should be sectioned transversely; colonic nodes may be left with colon sections.

Kidneys: cut the left one longitudinally and the right one transversely so they will be identifiable, submit sections from both.

Adrenals: Fix small adrenals whole and section larger ones (left - longitudinal and right transversely) making sure to use a very sharp knife or new scalpel blade so as not to squash these very soft glands.

Bladder: sections should include fundus and trigone. Make sure to include round ligaments (umbilical arteries) in neonates.

Accessory sex glands: Section the prostate with the urethra and seminal vesicles transversely. Section testes transversely.

Female reproductive tract: In small females fix the vulva, vagina, cervix, uterus and ovaries as a block after making a longitudinal slit to allow penetration of formalin. Rectum and bladder (opened) can also be included in this block. In somewhat larger animals make a longitudinal section through the entire tract. In large primates make transverse sections of each part of the tract and the ovaries.

Gravid uterus: Measure placenta and fetus. Perform a post mortem examination of the fetus. Take sections of disc from periphery and center and from extraplacental fetal membranes. Take sections of major organs and tissues of fetus (see protocol)

Nervous system: The brain should be fixed whole, or, if too large for containers, may be cut in half longitudinally (preferred) or transversely through the midbrain. It should be allowed to fix for at least a week before sectioning transversely (coronally) into 0.5-1.0 cm slabs to look for lesions. Submit the entire brain if possible and let the pathologist do the sectioning, otherwise submit slabs from medulla, pons and cerebellum, midbrain, thalamus and hypothalamus, prefrontal, Note: Institutions may elect to send brains to the Great Ape Aging Project.

Pituitary: Fix whole. Put pituitary in an embedding bag or cassette if it is small. Also remove and fix the Gasserian (trigeminal) ganglia. If the pineal gland is evident, please submit for histology.

Spinal cord - if clinical signs warrant, remove the cord intact and preserve it whole or in anatomic segments (eg. cervical, anterior thoracic etc.) Please note to which spinal column segment the cord extends.

Bone marrow: Split or saw across the femur, to get a cylinder and then make parallel longitudinal cuts to the marrow. Fix complete cross sections or hemi-sections of the marrow. Alternatively make a transverse cut and scoop out marrow

Take sections of any and all lesions, putting them in embedding bags or cassettes if they need special labeling.

Remember, it's better to save "too many" tissues than to risk missing essential lesions or details.

This represents a lot of work on the part of the prosector, often under less than comfortable conditions. But the effort expended at the time of the gross post mortem is much appreciated by the histopathologist, and is crucial to our investigations of the causes of morbidity and mortality of gorillas

THANK YOU !!!!!
CARDIAC EXAMINATION FOR APES AND OTHER PRIMATES

Examine heart in situ. Check for position, pericardial effusions or adhesions. Collect for culture or fluid analysis if present.

Remove heart and entire thoracic aorta with "pluck".

Examine heart again. Check the ligamentum (ductus) arteriosus for patency. Check position of great vessels.

Open pulmonary arteries to check for thrombi.

Remove heart and thoracic aorta from the rest of the "pluck".

Examine for presence of coronary fat. Examine external surfaces especially coronary vessels and palpate for evidence of plaque or mineralization. Note relative filling of atria and state of contraction (diastole or systole at death) and general morphology. (The apex should be fairly sharp.)

Measure length from apex to top of atria. Measure circumference at base of atria (around coronary groove).

Open the heart:

Begin at the tip of the right auricle and open the atrium parallel to the coronary groove continuing into the vena cava. Remove blood clot and examine the AV valves and foramen ovale. Cut into the right ventricle following the caudal aspect of the septum and continuing around the apex to the anterior side and out the pulmonary artery. Remove postmortem clots and examine inner surface.

Open left atrium beginning at the auricle and continuing out the pulmonary vein. Remove any clots and examine valves. Open the left ventricle starting on the caudal aspect and following the septum as for the right ventricle. When you reach the anterior aspect, clear the lumen of blood and identify the aortic outflow. Continue the incision around the front of the heart and into the aorta, taking care to cut between the pulmonary artery and the atrium. Open the entire length of the thoracic aorta.

Remove all postmortem clots. You may gently wash the heart in cool water or dilute formalin to better visualize the internal structures and valves. Examine the foramen ovale for patency.

Sever the thoracic aorta from the heart just behind the brachiocephalic arteries. Examine intima and adventitia and section aorta for formalin. Sever the pulmonary vessel and vena cava close to the heart.

Weigh and measure the heart and record (please see work sheet).

Weigh the heart after it has been opened, cleaned of luminal clots and the vessels removed (see above)

Measure height of heart and circumference.

Measure thickness of right and left ventricles and septum.

Measure the circumference of the right and left AV valves and the aortic and pulmonary valves.

Take sections for histopathology:

Sections should include:

Longitudinal sections of left and right ventricles AV valves and atria.

Sections of myocardium from left and right ventricles including coronary vessels.

Sections of papillary muscles.

Sections from the septum at the base of the AV valves (area of conduction system).

Section of the ascending aorta just above the valves (the most common site of dissecting aneurysms in great apes) as well as sections of descending thoracic aorta and abdominal aorta.

Sections from any lesions noted.

Alternatively, fix the entire heart after opening by emersion in 10% buffered formalin for more detailed examination by the SSP pathologist or a cardiac pathologist.

Other vessels:

Make sure to open and examine the entire aorta, iliac arteries and popliteal arteries (frequent sites of aneurysms in humans).

Note the location and severity of fibrous or fatty streaks and overt atherosclerosis. (see diagram)

Please note location of atherosclerosis, aneurysms, dissections or other abnormalities (mark directly on
POSTMORTEM EXAMINATION OF PRIMATE FETUSES, NEONATES and PLACENTAS

Follow the general primate necropsy protocol.

Note presence of hair, freshness of the carcass (if dam is dead, is the decomposition of the fetus consistent with that of the dam) and any evidence of meconium staining.

Make sure to weigh the fetus (without placenta) and make morphologic measurements.

In addition, measure the placental disc(s) and weigh the placenta.

Describe the placental discs and membranes and the vascular pattern.

Measure umbilical length and diameter and note degree of twisting. If possible, please photograph the placenta.

Culture placenta:

Fix sections from margins of discs, extra placental membranes, and from any areas of discoloration.

Internal examination:

Note dentition/erupted teeth and carefully examine the palate.

Identify umbilical vein and arteries and check for inflammation. Make sure to save umbilicus and round ligaments of the bladder (umbilical arteries) for histology.

Make sure to save a growth plate (e.g. costochondral junction or distal femur) in formalin.

Before removing the heart from the pluck, open the pulmonary artery to check for patency of ductus arteriosus. Open the lateral side of the right atrium and examine the foramen ovale for patency.

Cultures:

Culture as many of the following as possible (both aerobic and anaerobic cultures if possible):
- Stomach content or swab of the mucosa;
- lung;
- spleen or liver;
- placental disc and extra-placental membranes.

This is important as there have been several cases of prenatal pneumonia in apes

Tissues for histology (see general necropsy protocol)
POST MORTEM EXAMINATION OF THE AIR SACS OF GORILLAS AND OTHER APES

Examine the skin over the air sac for signs of fistulae or scars. Note thickness of the skin and presence of fat.

Incise the air sac through the skin on the anterior (ventral) aspect.

Note color and texture of air sac lining.

Note presence of absence of exudates, and character of exudate.

Note presence or absence of compartmentalization by connective tissue.

Note extent of air sacs (e.g. under clavical, into axilla, etc.)

Is there a central compartment?

Are the lateral sacs symmetrical (they may vary in size in chimpanzees and bonobos)

Identify and describe the opening(s) from the larynx into the air sac (e.g. single slit-like opening or paired oval openings). Are the openings parallel or perpendicular to the long axis of the larynx and trachea? Note any exudate.

Note the location, size and shape of the opening in the larynx (e.g. from lateral saccules or centrally at the base of the epiglottis).

Cultures: Please culture several different sites within the air sacs (we need data to determine if infections are "homogeneous" or compartmentalized).

Diagrams of air sacs to aid in measurements and descriptions.

Gorilla air sacs (From Dixon)          Chimpanzee air sacs (From Swindler & Wood)

Information on air sac anatomy is especially important for bonobos as there are no published reports on their air sac anatomy.