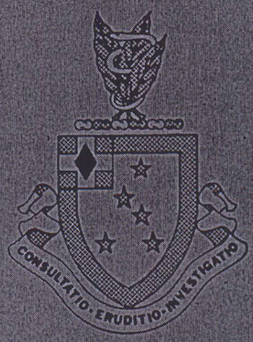
SYLLABUS

Veterinary Pathology Department Wednesday Slide Conference 1986-1987



Armed Forces Institute of Pathology
Washington, D.C. 20306-6000
1992

M00587

Syllabus

VETERINARY PATHOLOGY DEPARTMENT, AFIP, WEDNESDAY SLIDE CONFERENCE 1986-1987

90 microslides

Prepared by

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PREFACE

The Registry of Veterinary Pathology, Armed Forces Institute of Pathology, has conducted the Annual Wednesday Slide Conference Program for more than two decades. The cases presented each Wednesday throughout the academic year are distributed to more than 100 active participants, including military and civilian veterinary pathologists throughout the United States and Canada, as well as other British Commonwealths, and Far Eastern and European nations. The diagnoses, comments, a synopsis of the discussion, and references for each case are forwarded to participants weekly. Our list of active contributors continues to grow.

This study set has been assembled in an effort to make the material presented at our weekly conferences available to a wider circle of interested pathologists and other scientists. Discussion and comments are abbreviated in this syllabus for succinctness.

This set, composed of 84 cases and 90 microslides, was assembled from the 120 cases studied during the 1986-1987 conferences.

We wish to thank each contributor for his or her participation and for the permission to use cases in this study set. We also wish to give special thanks to the American Veterinary Medical Association, the major sponsor of the Registry of Veterinary Pathology.

LIST OF SLIDES

Slide number	Animal	Tissue	Diagnosis
1	Skunk	Brain	Rabies
2	Dog	Liver	Chronic active hepatitis
3	Horse	Lung	*Histoplasma capsulatum*
		Placenta	
4	Baboon	Skin	*Histoplasma duboisii*
5	Hamster	Intra-abdominal nodule	*Histoplasma duboisii*
6	Dog	Uterus	*Coccidioides immitis*
7	Rabbit	Skin	Shope fibroma
8	Cow	Small intestine	Bovine viral diarrhea
9	Raccoon	Brain	Toxoplasmosis, distemper
10	Hamster	Liver	Schistosomiasis
11	Dog	Skin	Canine cutaneous histiocytoma
12,13	Dog	Liver	*Bacillus piliformis*
		Heart	
14	Pig	Muscle	*Trichinella spiralis*
15	Rat	Thoracic mass	Malignant hibernoma
		Spinal cord	
16	Rat	Mammary gland	Adenocarcinoma
17	Rat	Testicle	Interstitial cell tumor and lymphosarcoma
18	Rat	Kidney	Nephrocalcinosis
19	Goat	Placenta	*Brucella abortus* placentitis
20	Cow	Ileum	*Cooperia* sp
21	Horse	Pancreas	Pancreatic necrosis, equine adenovirus, and lymphoid hypoplasia
		Lymph node	
22	Horse	Brain	*Micronema deletrix*
23	Horse	Liver	Necrosis/pneumonia, rhino-pneumonitis
		Lung	
24	Cow	Small intestine	Enteritis, *Yersinia pseudo-tuberculosis*
25	Muskrat	Cerebrum	*Frenkelia* sp
26	Cow	Cerebellum	Dysmyelination
27	Horse	Cerebrum	*Fusarium* mycotoxicosis
28	Dog	Spinal cord	Leukomalacia
29	Dog	Lung	*Paragonimus kellicotti*
30	Sheep	Brain	Neuronal pigmentation, *Trachyandra divaricata*
31	Dog	Heart	Atherosclerosis

LIST OF SLIDES (Cont'd)

Slide number	Animal	Tissue	Diagnosis
32	Cow	Brain	*Babesia bovis*
33	Horse	Ovary	Dysgerminoma
34,35	Mouse	Liver Brain	Murine hepatitis virus
36	Rat	Stomach	Rhabdomyosarcoma
37	Dog	Kidney	Renal cell carcinoma
38	Horse	Mammary gland	Adenocarcinoma
39	Horse	Skeletal muscle Kidney	Compartment syndrome with muscle necrosis and nephrosis
40	Monkey	Multiple organs	*Nocardia asteroides*
41	Bird	Proventriculus and ventriculus	"Macaw wasting disease"
42	Bird	Skeletal muscle	Hypovitaminosis E
43	Bird	Spleen Liver	Eastern equine encephalitis
44	Horse	Gutteral pouch	Aspergillosis
45	Monkey	Intestine	Fibromatosis/amyloidosis
46,47	Monkey	Lung Lymph node	*Mycobacterium avium*
48	Opossum	Lung	*Besnoitia darlingi*
49	Dog	Kidney	Familial glomerulosclerosis
50	Dog	Lung	*Blastomyces dermatitidis*
51	Bird	Multiple	*Salmonella pullorum*
52	Horse	Lung	Granular Cell Tumor
53	Bird	Proventriculus	*Tetrameres* sp
54	Dog	Oral mucosa	Amelanotic melanoma
55	Pig	Heart	Mulberry heart disease
56	Dog	Small intestine	Canine parvovirus
57	Cat	Lung	Feline herpesvirus
58	Mouse	Preputial gland	*Escherichia coli*

LIST OF SLIDES (Cont'd)

Slide number	Animal	Tissue	Diagnosis
59	Penguin	Liver Lung Kidney	Plasmodium sp
60,61	Mouse	Skin	Mast cell tumor
62	Bird	Colon	Teratoma
63	Dog	Lung	Hypervitaminosis D
64	Dog	Lung	Pulmonary hyalinosis
65	Cow	Kidney	Lead poisoning
66	Dog	Lung Kidney	Paraquat poisoning
67	Guinea pig	Lung	Bordetella bronchiseptica
68	Cow	Colon	Solid carcinoma (carcinoid)
69	Cow	Lung	Candida glabrata
70,71	Sheep	Spinal	Hypomyelination, border disease
72,73	Bird	Liver Cecum	Histomonas meleagridis
74	Goat	Thyroid	Follicular cell hyperplasia and hypertrophy (hyperplastic goiter)
75	Monkey	Mandible	Ameloblastic odontoma
76	Bird	Skin, crop	Budgerigar fledgling disease
77	Bird	Small intestine	Jejunitis, Isospora serine
78	Monkey	Liver	Infectious hepatitis
79	Monkey	Bone	Hyperostosis/hypertrophic osteopathy
80	Rat	Ear	Auricular chondritis
81	Horse	Nasal mucosa & submucosa	Amyloidosis
82	Dog	Tooth	Dysplasia
83	Cow	Heart	Myocarditis, hairy vetch toxocity
84	Mastomys natalensis	Skin	Multiple epithelial tumors with follicular differentiation
85	Dog	Skin	Lipoma with chondroid differentiation
86	Cat	Skin	Sporothrix schenckii
87	Horse	Cerebellum	Abiotrophy
88	Sheep	Lung	Adenocarcinoma - Jaagsiekte
89	Horse	Placenta	Villous aplasia/twin placentae
90	Cow	Eye	Retinal dysplasia due to BVD infection

COMMENTARY ON SLIDES

Slide 1

History. This adult male striped skunk (Mephitis mephitis) was cornered by dogs within a farmyard and was shot by the farmer.

Diagnosis. Brain, cerebrum, or hippocampus: Meningoencephalitis, nonsuppurative, multifocal, mild with numerous eosinophilic, cytoplasmic neuronal inclusion bodies; etiology--findings consistent with rabies virus infection.

Comment. The numerous inclusion bodies noted in this case were of particular interest. This is apparently a pattern in wild carnivores as opposed to domestic carnivores, which usually display markedly fewer inclusions. Recent evidence suggests that acetylcholine receptors at the neuromuscular junction may be the "productive receptors" for rabies virus and that viral amplification occurs within myocytes.

Contributor. Department of Veterinary Pathology, University of Saskatchewan, Saskatoon, S7W OWO, Canada.

Suggested reading. Spriggs, D. R.: Rabies pathogenesis: Fast times at the neuromuscular junction. J. Inf. Dis. 52(6): 1362-1363, 1985.

Slide 2

History. This 7-year-old spayed female Doberman pinscher had a 2- to 3-month history of polyuria and polydypsia, and it developed abdominal distention the week before presentation. Abdominocentesis produced straw-colored fluid. The dog had a ravenous appetite, tarry stools, and icteric mucous membranes.

Diagnosis. Liver: Hepatitis, chronic-active, diffuse, moderate to severe, with bridging fibrosis and piecemeal necrosis.

Comment. The lesions observed are compatible with the so-called chronic-active hepatitis. Doberman pinschers, particularly females, seem to be predisposed to CAH. The etiology is not known.

Contributor. Department of Veterinary Pathobiology, College of Veterinary Medicine, University of Minnesota, St. Paul, MN 55108.

Suggested reading. Rakich, P. M., Prasse, K. W., Luckert, P. D., and Cornelius, L. M.: Immunohistochemical detection of canine adenovirus in paraffin sections of liver. Vet. Pathol. 23: 478-484, 1986.

Slide 3

History. This thoroughbred female equine fetus was found in the field. The mare aborted without showing signs of illness. She had produced healthy foals the past 4 years.

Diagnosis. (1) Lung: Pneumonia, interstitial/alveolar, granulomatous, diffuse, severe, with numerous intracytoplasmic yeast forms within macrophages. (2) Placenta: Placentitis, granulomatous, diffuse, moderate, with multifocal, subacute, vasculitis; etiology--Histoplasma capsulatum.

Comment. The diagnosis was based on the species and the organ affected, number of organisms, host response, and morphology using Gomori methenamine silver stain. Several cases of equine abortion associated with Histoplasma capsulatum have been reported. The pathogenesis in these cases is still in question: Histoplasma capsulatum has been isolated from placentas as well as from fetal tissues from apparently clinically normal mares.

Contributor. Livestock Disease Diagnostic Center, University of Kentucky, 1429 New Town Pike, Lexington, KY 40511.

Slide 4

History. This is tissue from an adult male red baboon (Papio cynocephalus papio) imported from Senegal 2-1/2 years previously. It was one of eight baboons with multiple pustules and ulcers on the head, tail, ears, hands, feet, and buttocks. The lesions failed to respond to a wide variety of antibiotics.

Diagnosis. Skin: Dermatitis, pyogranulomatous, focal, severe, with intracytoplasmic yeast organisms in multinucleated giant cells.

Comment. This presentation of Histoplasma capsulatum var duboisii in the skin is typical. This characteristic finding of multinucleated giant cells is a useful aid in differentiating H capsulatum var duboisii from other budding yeasts (Cryptococcus neoformans and Blastomyces dermatitidis, for example). The incubation period for H capsulatum var duboisii is long, with a documented 3-year period having been noted in a captive baboon.

Contributor. USAF School of Aerospace Medicine, Veterinary Sciences Division, Comparative Pathology Branch, Brooks AFB, TX 78235-5301.

Slide 5

History. The specimen consists of one of several intra-abdominal nodules from a Syrian hamster (Mesocricetus auratus) that was injected intraperitoneally with exudate obtained from a draining skin lesion on a recently imported African baboon. The injection was given 3 months prior to euthanasia and necropsy. The slide was stained with Gomori's methenamine silver and counterstained with H&E.

Diagnosis. Intra-abdominal nodules (per contributor): Inflammation, pyogranulomatous, multifocal, severe.

Comment. The serologic test used to identify cultures of Histoplasma capsulatum is only genus specific and so does not separate the two varieties of Histoplasma species. The size of the tissue forms, as determined by infecting a laboratory animal, is the only way to identify the varieties.

Contributor. Division of Host Factors, Center for Infectious Diseases, Centers for Disease Control, Atlanta, GA 30333.

Slide 6

History. An ovariohysterectomy was performed on this 3-year-old golden retriever because of a history of a vaginal discharge associated with an earlier dystocia and delivery of a stillborn pup 2 months earlier. Neck pain, present for 3 months, responded to steroid treatment over the previous month.

Diagnosis. Uterus: Metritis, granulomatous, diffuse, severe, with yeast organisms compatible with Coccidioides immitis. Uterus: delayed involution.

Comment. The architecture of the uterus is partially effaced by the combined effects of delayed uterine involution and a diffuse mycotic infection with attending pyogranulomatous inflammation. The differential diagnosis included Blastomyces dermatitidis and Coccidiodes immitis. In select sections, organisms with morphologic characteristics of C immitis (spherules of approximately 75-um diameter containing endospores and the absence of unequivocal broadbase budding) were observed. This case demonstrates the difficulty of differentiating between these two mycotic agents. Definitive diagnosis of
C immitis was established by immunofluorescence on tissue sections.

Contributor. Ohio State University, Veterinary Pathology, Columbus, OH 43210.

Slide 7

History. This is tissue from a 1-year-old New Zealand white rabbit (Oryctolagus cuniculus) from a small commercial rabbit breeder who was holding his breeding stock in outside wire cages. Several rabbits were noted to have solitary raised nodules on the face.

Diagnosis. Haired skin: Mesenchymal cell proliferation, with mild acanthosis, intraepidermal vesicles and pustules, intracytoplasmic inclusion bodies in epidermal and follicular epithelial cells as well as proliferating mesenchymal cells, and subacute diffuse inflammation.

Comment. Some sections display prominent freeze artifact. The intercellular and intracellular spaces distorting much of the section, as well as the clefts at the dermal-epidermal junction, are products of ice crystal formation. However, the following pox lesions are discernible: eosinophilic intracytoplasmic inclusion bodies in the stratified epithelium of the epidermis, vesicles, and pustules within the epidermis, and a thick crust covering parts of the epidermis. As stated by the contributor, the diffuse subacute inflammatory infiltrate suggests an early stage of regression. The rabbit (Shope) fibroma virus is transmitted via arthropod vectors, specifically mosquitos and fleas, and infects wild and domestic rabbits. The term "fibroma" is misleading in that the tumor consists of spindle-shaped and polygonal cells that have abundant cytoplasm and do not resemble fibroblasts. Furthermore, a trichrome stain demonstrated little or no collagen in this particular mass.

Contributor. Centers for Disease Control, Building 1-6416, 1600 Clifton Road, N.E., Atlanta, GA 30345.

Slide 8

History. This is tissue from a 1-year-old Holstein bull that had a 3-week history of diarrheal stools that initially contained blood-flecked mucus. Anorexia and weight loss occurred despite treatment with antibiotics and intravenous and oral fluids.

Diagnosis. Small intestine: Enteritis, subacute, transmural, diffuse, moderate, with focal ulceration and multifocal subacute vasculitis.

Comment. Noting the ulceration, the transmural enteritis, and the subacute vasculitis, conference participants included bovine viral diarrhea, malignant catarrhal fever (MCF), rinderpest and salmonellosis in the differential diagnosis. Vasculitis in the bovine, while it is characteristic of MCF, is not pathognomonic. Vasculitis due to bovine viral diarrhea is not limited to the intestine but may be present in other organs (the heart, brain, and adrenal cortices, for example).

Contributor. New Bolton Center Laboratory, Large Animal Pathology, 382 West Street Road, Kennett Square, PA 19348.

Slide 9

History. A 12-month-old female wild racoon (Procyon lotor) had a 10-day history of severe bilateral purulent ocular discharge and progressive hindlimb paralysis.

Diagnosis. (1) Brain: Polioencephalitis, necrosuppurative, multifocal, severe, with associated eosinophilic vasculitis and meningitis, (2) Brain: Gliosis, multifocal, mild, with intracytoplasmic and intranuclear inclusion bodies in astrocytes and neurons, and spongiform change in the white matter.

Comment. Concurrent distemper and toxoplasmosis infections are not uncommon among carnivora of the Canidae, Mustelidae, Procyonidae and Viveridae families. In regard to concurrent cases in wild animals, it is speculated that latent Toxoplasma infections are exacerbated as a result of immune suppression produced by distemper virus infection. This immune suppression is evidenced in vitro by the reduced mitogenic activity of lymphocytes.

Contributor. Department of Pathobiology, College of Veterinary Medicine, University of Illinois, Urbana, IL 61801.

Slide 10

History. This is one of three age-unspecified male Syrian golden hamsters (Mesocricetus auratus) found dead. They had been experimentally infected with 500 cercariae of Schistosoma hematobium.

Diagnosis. (1) Liver: Inflammation, granulomatous, portal, mild, with associated parasite eggs and hematin pigment. (2) Liver: Schistosomes, intravenous. (3) Liver: Amyloid, portal and centrolobular.

Comment. The absence of a body cavity and calcareous corpuscles along with the presence of an intestinal tract and its location (liver vasculature) aided in the identification of this schistosome parasite. Also of value were the oval to round moderately thick-walled eggs, some of which had an identifiable terminal spine. Gross and light-microscopic changes in the liver included marked fibrosis (pipe stem of Symmer's fibrosis), amyloidosis, and variable degrees of granulomatous inflammation.

Contributor. Division of Comparative Medicine, Johns Hopkins University Medical School, Baltimore, MD 21205.

Slide 11

History. This is tissue from a 1-1/2-year-old male miniature dachshund. The owner noticed a small protruding pigmented (brownish) nodule on the skin covering the inside of the pinna of the right ear. Original measurements were approximately 4 x 4 x 3 mm. The mass enlarged rapidly and was removed surgically about 4 months after it was first seen. The lesion was tender, and the dog resisted palpation of the involved area.

Diagnosis. Haired skin: Cutaneous histiocytoma.

Comment. The diagnosis of histiocytoma was based on history; subgross appearance of the mass (abutting dermis, well-defined, non-encapsulated); cellular morphology (large nucleus, abundant cytoplasm, absence of PAS-, Giemsa- or toluidine blue-positive granules or melanin pigment); and a high mitotic rate. Although not necessary for a definitive diagnosis, these cells are cytochemically alpha-naphthyl acetate esterase positive.

Contributor. Batelle Columbus Division Pathology Section, Room 6144/B, 505 King Avenue, Columbus, OH 43201-2693.

Slides 12 and 13

History. This is tissue from a 9-week-old female cocker/poodle cross. The puppy was listless for a couple of days. Its eyes were watery and its breathing raspy. The puppy was found dead in its bed. It had been vaccinated 1 week earlier with DHL and parvo-virus vaccines.

Diagnosis. (1) Liver: Hepatitis, necrotizing, subacute, random, multifocal and coalescing, severe, with cytoplasmic (hepatocytes) Bacillus piliformis. (2) Heart: Myocarditis, necrogranulomatous, multifocal, moderate, with intrasarcoplasmic Bacillus piliformis.

Comment. On H&E-stained sections, the organisms were observed with difficulty within viable hepatocytes and cardiac myofibers immediately bordering the foci of necrosis. The organisms stained selectively with the Giemsa stain. Warthin-Starry technique (pH 4.0) is frequently used to stain

this organism. The inability to culture this Gram-negative, spore-forming bacillus on artificial media makes it difficult to study. Infections with Bacillus piliformis have been reported in foals, hamsters, guinea pigs, gerbils, mice, cats, dogs, and rabbits. The most sensitive host appears to be the rabbit. Compromised immune response seems to be a predisposing factor in Tyzzer's disease.

Contributor. Montana Veterinary Diagnostic Laboratory, P.O. Box 997, Bozeman, MT 59771.

Slide 14
History. This is tissue from a 5-week-old mixed-breed male pig that was one of a group used in a parasitology experiment.

Diagnosis. Striated muscle: Myositis, granulomatous, multifocal, mild, with intrasarcoplasmic nematode parasite; etiology--Trichinella spiralis.

Comment. Diagnosis was made using the signalment, history, host tissue response and morphological characteristics of the parasite. The larvae were noted to have stichocytes, lateral cords, and coelomyarian musculature. Infected myocytes undergo transformation to "nurse cells," characterized morphologically by hypertrophy of nuclei and reduction in myofibril content. A recent study supports a blood-borne migration from the host intestine to the musculature.

Contributor. Department of Veterinary Pathology, College of Veterinary Medicine, Iowa State University, Ames, IA 50011.

Suggested reading. Wang, C. H., and Bell, R. G.: Trichinella spiralis: new born larval migration route in rats re-examined. Exp. Parasit. 61: 76-85, 1986.

Slide 15
History. This is tissue from a 69-week-old Fisher 344 female rat that was sacrificed in a moribund condition. The animal was an untreated control in a 2-year carcinogenicity/toxicity study. Clinical signs prior to sacrifice included bilateral posterior paresis.

Diagnosis. Thoracic mass: Malignant hibernoma with metastases to lung and extension into spinal canal.

Comment. Although hibernomas have been observed in rats this is the first reported case in a Fisher 344 rat. The differential diagnosis included adrenocortical carcinoma, liposarcoma, hibernoma, hepatocellular carcinoma, and chordoma. Tumor cell morphology tended to reduce the likelihood of hepatocellular carcinoma, even though the nature of the pulmonary metastasis favored it. An adrenocortical tumor was considered less likely because of the absence of characteristic endocrine/vascular arrangement of cells. Liposarcoma and hibernoma tumor cells both contain Sudan III-positive vacuoles, whereas

vacuoles in chordoma cells are negative. Further differentiation of liposarcoma and hibernoma is only possible at the ultrastructural level. The contributor noted a finely multivacuolated cytoplasm and abundant mitochondria with elongated transverse cristae and intramatrical granules. These characteristics were also present in cells of the pulmonary metastatic focus. The discontinuities seen in the cortices of the vertebral bone were considered artifacts.

Contributor. NIEHS, TRTP, CPR, P.O. Box 12233, Research Triangle Park, NC 27709.

Slide 16
History. This pregnant rat was necropsied on the 14th day of gestation. A rapidly enlarging mass was noted in the ventral cervical region.

Diagnosis. Mammary gland: Adenocarcinoma, papillary.

Comment. The mass was characterized as adenomatous based on the presence of glandular structures lined by epithelial/secretory cells with prominent apical blebbing. The malignant designation was based on the loss of polarity and piling-up of epithelial cells along the papillary stromal cores and on the numerous and occasionally bizarre mitotic figures seen.

Contributor. B-320 Kodak Park, Health and Environment Laboratories, Eastman-Kodak Company, Rochester, NY 14650.

Slide 17
History. This is tissue from a 22-month-old Fisher 344 male rat. This rat was a control in a 2-year carcinogenicity study. A week before it died, the rat was noted to be icteric and emaciated.

Diagnosis. (1) Testes: Interstitial cell tumor. (2) Testes: lymphosarcoma.

Comment. As indicated in one study, the frequency of large granular lymphocyte leukemia and interstitial cell tumors in 18- and 24-month-old Fisher 344 rats is 17.5% and 80.0%, respectively. These are the most common tumors of the Fisher 344. Not all of the small (5-micron-diameter) cells with scanty cytoplasm and hyperchromatic nuclei are neoplastic lymphocytes; some are a small variant ("reserve" cell) of the neoplastic interstitial cell population.

Contributor. Ethicon Research Foundation, Ethicon, Inc., Sommerville, NJ 08876.

Slide 18
History. These are tissues from eight 10-week-old female Sprague-Dawley rats. The rats were fed a semipurified diet for 28 days prior to sacrifice. Submission is from female controls.

Diagnosis. Kidney: Nephrocalcinosis, corticomedullary junction, multifocal, severe.

Comment. The intratubular structures were identified as mineral calculi. The formation of such deposits is a function of several variables; e.g., (1) strain/species, (2) quality and quantity composition of diet, (3) age, and (4) sex. Depending on experimental conditions, mineral deposits can also develop in the renal interstitium. The concentration of deposits in this case is particularly heavy.

Contributor. The Proctor and Gamble Company, P.O. Box 39175, Cincinnati, OH 45247.

Slide 19

History. This 2-year-old cross-bred female goat was 1 of 20 inoculated with an infectious agent and necropsied 14 days later. No clinical signs were evident until the 14th day, when premonitory signs of abortion (hemorrhagic and suppurative vaginal discharge) were present. The goat was necropsied before abortion occurred.

Diagnosis. Placenta: Placentitis, necrosuppurative, diffuse, moderate, with intratrophoblastic organisms.

Comment. The differential diagnosis was limited to infection by Chlamydia sp, Coxiella burneti, or Brucella sp on the basis of the intracytoplasmic nature of the organism within the chorioallantoic trophoblasts. Coxiella burneti is primarily confined to intercotyledonary areas, causing an acute, diffuse suppurative response with copious exudate covering the affected areas. The lesions of Chlamydia sp and Brucella sp infection are similarly characterized by intracellular coccoid organisms and vasculitis with early lesions limited to the placentomes. Chlamydia sp can be differentiated by staining with Giemsa and Macchiavello techniques.

Contributor. National Animal Disease Center, P.O. Box 70, Ames, IA 50010.

Suggested reading.

Anderson, T. D., Meador, V. P., and Cheville, N. F.: Pathogenesis of placentitis in experimental brucellosis I. Gross and histologic lesions. Vet. Path. 23: 219-226, 1986.

Anderson, T. D., Cheville, N. F., and Meador, V. P.: Pathogenesis of placentitis in experimental brucellosis II. Ultrastructural studies. Vet. Path. 23: 227-239, 1986.

Slide 20

History. This 9-month-old mixed-breed castrated calf was 1 of a group of approximately 100 feeder cattle that were purchased 3 to 4 months previously through a local sales barn. The new owner was told that all calves received appropriate immunizations, implants, and antihelminthics before being moved

into the sales barn. During the time since purchase approximately 40% of the calves had become weak and thin and had developed a poor appetite and watery diarrhea. A few calves also showed "bottle jaw" and had a mild cough. Six calves died.

Diagnosis. Ileum: Enteritis, chronic, diffuse, mild, with well-formed multifocal eosinophilic granulomas in the submucosa, muscularis, and serosa, which contained nematode parasites.

Comment. The abnormal location of these parasite larval and adult forms is interesting. The host response is not surprising, considering the nature and location of the parasites.

Contributor. Tifton Veterinary Diagnostic Laboratory, P.O. Box 1389, Tifton, GA 31793.

Slide 21

History. A depressed tachypneic and dyspneic 4-week-old Arabian foal was presented to the veterinary medical teaching hospital. Thoracic radiographs revealed a pattern consistent with interstitial pneumonia and localized bronchopneumonia.

Diagnosis. (1) Interlobular pancreatic ducts: Necrosis, diffuse, moderate, with epithelial intranuclear inclusion bodies and mild subacute interstitial and periductal inflammation. (2) Lymph node: Hypoplasia, diffuse, severe.

Comment. A variety of immunologic problems in horses have been reported in the literature: (1) combined immune deficiency; (2) agammaglobulinemia (absence of plasma cells, primary follicles, and germinal centers with functional T lymphocytes); (3) hypogammaglobulinemia following inadequate transfer of colostral immunoglobulin from dam to foal (failure to nurse/inadequate immunoglobulin in colostrum/impairment of intestinal absorption of colostral protein); (4) (in an Arabian foal) transient hypogammaglobulinemia of unknown cause (the author suggests that it may be an expression of a heterozygote carrier of CID trait such as has been speculated to occur in children); and (5) IgM deficiency. All these condition involve partial or complete failure of humeral- and/or cell-mediated immunity. Defects are within the lymphocytic progenitor cell line, thymic microenvironment, or the mature lymphocyte's ability to respond to antigenic stimuli. The hypoplastic lymph node present in many sections reflects the immune compromised status of this foal. Pancreatic necrosis in horses is rare; Strongylus vulgaris and adenovirus infections are the most commonly identified causes.

Contributor. School of Veterinary Medicine, University of Wisconsin, 2015 Linden Drive West, Madison, WI 53706.

Slide 22

History. This is tissue from a 19-year-old male Tennessee walking horse that experienced sudden onset of personality change, lethargy, circling to the left, and head pressing. Six days following onset of symptoms the animal died.

Diagnosis. Brain: Encephalitis, granulomatous, perivascular, multifocal, severe, with multifocal malacia and nematode parasites.

Comment. Micronema deletrix and Strongylus vulgaris are the most common nematode parasites found in the central nervous system of horses. Setaria species has also been reported in horses in Asia. Typical lesions consist of vasculitis and hemorrhagic necrosis. Five differentials for equine central nervous system disorders include: (1) protozoal myelitis, (2) equine degenerative myeloencephalopathy, (3) cervical vertebral stenotic myelopathy, (4) aberrant parasites, and (5) toxins. The organisms in this case were not readily identifiable in all sections; however, in some sections, a body cavity and rhabditiform esophagus could be identified, making a definitive etiologic diagnosis of cerebral micronemiasis possible.

Contributor. Department of Veterinary Pathology, College of Veterinary Medicine, University of Georgia, Athens, GA 30602.

Slide 23

History. This is tissue from a male quarter horse fetus aborted in the 10th month of gestation and submitted for necropsy for determination of cause of death.

Diagnosis. Liver: Necrosis, hepatocellular, coagulative, multifocal. Lung: pneumonia, suppurative, diffuse, mild, with multifocal alveolar and bronchiolar epithelial necrosis with eosinophilic intranuclear inclusion bodies.

Comment. Determining the cause of equine abortion is not easy. In addition to infectious agents, causes such as uterine fibrosis and hypovillation of the chorion due to twin placental contact should be considered. The following gross lesions are found in equine herpes 1-infected fetuses: (1) edema around the heart; (2) clear, yellow fluid in the body cavities, primarily the thorax; (3) fresh appearance of tissues; (4) subpleural edema in lung parenchyma (associated with fluid in the cavity) with distinct impressions of the ribs; (5) prominent lymphoid follicles in spleen (due to necrosis in surrounding red pulp and edema within the follicles, rather than hyperplasia); (6) meningeal edema; and (7) segmental hemorrhage in intestines. In several lung sections there are prominent eosinophilic hyaline crystal-like structures within the airways that resemble the hemoglobin crystals often observed in rat lungs. These are keratinized squames which are aspirated by the fetus during the exaggerated respiratory movements prior to death. This occurs commonly in distressed fetuses. Evidence of Chlamydia was not found in Giemsa-stained sections.

Contributor. Department of Veterinary Science, College of Agriculture, 102B Building 90, University of Arizona, 85721.

Slide 24

History. This is tissue from a 10-month-old Jersey calf. Over a period of 24 to 48 hours the calf had become depressed, developed diarrhea, and became recumbent. The calf was in a semi-comatose state at the time of euthanasia. Several other calves, all of which were in poor condition, had developed similar signs and died during the previous 2 weeks.

Diagnosis. Small intestine: Enteritis, necrotizing, acute, multifocal, moderate, with intralesional clusters of gram-negative coccobacilli, diffuse villous blunting and fusion, and multifocal crypt abscesses.

Comment. The differential diagnosis includes Salmonella sp, Yersinia sp, Nocardia sp, and Fusobacterium sp. Yersinia pseudotuberculosis is widespread in nature and is pathogenic in a variety of animals ranging from reptiles to man. According to a Canadian study, isolates from domestic animals are usually of serotype III whereas those from wild animals and birds are most frequently IB. Both types are isolated with similar frequency from humans. In culture, Y pseudotuberculosis grows best at 25°C rather than 37°C. Multifocal herniation of the mucosa into the submucosa was noted, but the significance of the lesion is not clear.

Contributor. Palmerston North Animal Health Laboratory, P.O. Box 1654, Palmerston North, New Zealand.

Slide 25

History. This is tissue from a muskrat (Ondatra zibethica) of unknown age or gender. The animal was killed by a dog and was submitted for examination for rabies.

Diagnosis. Cerebrum: Protozoal cyst, multiple.

Comment. Included in the differential diagnosis are Frenkelia sp, Encephalitozoon sp, Toxoplasma sp, Besnoitia sp, and Sarcocystis sp. The spores of Encephalitozoon aggregate but produce no cyst membrane. Toxoplasma sp has smaller (30-100-mm) spherical and nonseptate cysts. Cysts of Besnoitia sp are similar in size (grossly visible) but have a thick wall. Cysts of Frenkelia sp and Sarcocystis sp share similar developmental and ultrastructural characteristics and may sometimes be indistinguishable. It is speculated that the two organisms may be closely related. The multilobulated cysts and the lack of inflammatory response are typical characteristics of Frenkelia sp infection as reported in muskrats (Ondatra zibethica) and several species of wild rodents.

Contributor. Department of Veterinary Pathobiology, College of Veterinary Medicine, University of Minnesota, St. Paul, MN 55108.

Slide 26

History. This is tissue from a Charolais heifer of unknown age. This heifer was found in left lateral recumbency in a feedlot pen the day following routine processing. If the heifer was rolled over to the right side, it would struggle to assume the left lateral recumbent position. The body temperature was normal. Treatment with antibiotics, thiamine, corticosteroids, and fluids resulted in no improvement, and the heifer was killed.

Diagnosis. Cerebellum, white matter: Dysmyelination with spongy change, multifocal eosinophilic plaques, and minimal gemistocytic astrocytosis.

Comment. The lesions of progressive ataxia are microscopic, involve the white matter of the brain and spinal cord, and are evident as palely eosinophilic noncellular plaques on H&E. In this case, the round to elliptical plaques within the cerebellar white matter are positive for Luxol-fast blue/periodic acid-Schiff due to the lipid moiety of myelin. Other characteristics noted were the Luxol-fast-blue-positive granules present in many of the plaques, the often vacuolated neuropil around the plaques, and a minimal astrocytic response. Of additional interest was the marked change observed in the granular cell layer; such changes are observed occasionally in the bovine cerebellum and are considered a postmortem autolytic artifact.

Contributor. Texas Veterinary Medical Diagnostic Laboratory Amarillo, P.O. Box 3200, Amarillo, TX 79116-3200.

Suggested reading. Albrechtsen, R.: The pathogenesis of acute selective necrosis of the granular cell layer of the human cerebellar cortex. Acta Neuropath. (Berlin) 37: 31-34, 1977.

Slide 27

History. This is tissue from a 13-year-old quarter horse gelding. The animal was presented for suspected renal disease. This could not be confirmed, but the horse became ill 2 days after admission with progressive lethargy resulting in stupor within 24 hours.

Diagnosis. Cerebrum, white matter: Rarifaction, with multifocal, moderate perivasculitis, endothelial cell hypertrophy and hyperplasia, and vascular necrosis.

Comment. Lesions in organ systems associated with Fusarium mycotoxicosis vary based on (1) species of fungus, (2) the exposure rate and dose, (3) the species of animal exposed, and (4) the stage of toxicosis when the tissues are sampled. Even in fungal monocultures, multiple toxic compounds may be present. In the equine species, lower dosage and longer exposure produce central nervous system lesions while higher dosage over a shorter period result in hepatic lesions. Lesions vary according to the species exposed, with pigs developing pulmonary edema; sheep, acute nephrosis and hepatosis; rats, cirrhosis, intraventricular cardiac thrombosis, and nephrosis and with baboons

displaying acute congestive heart failure and cirrhosis.

Contributor. Department of Veterinary Pathology, College of Veterinary Medicine, Texas A&M University, College Station, TX 77843.

Slide 28

History. This is tissue from a 3-month-old female Afghan hound. This dog was first seen 7 days prior to necropsy. She presented with a 2-day history of progressive hindlimb weakness, hyperreflexia, and rigid paraplegia. The panniculus reflex was absent. No lesions were seen on radiographs. Over the following week these clinical signs advanced to involve the front limbs. A presumptive diagnosis of Afghan hound myelopathy was made, and the animal was subjected to euthanasia.

Diagnosis. Spinal cord, dorsal and ventral funiculi (C-6): Leukomalacia, severe.

Comment. Afghan myelopathy is a primary, degenerative, progressive disease of unknown etiology seen in young Afghan hounds of both genders. Histologically, lesions are confined to the spinal cord and to the neuropil of the dorsal trapezoid nuclei of the brain. The lesions in the spinal cord extended from C-6 to T-13. Both cranial to the lesions at C-2 and caudal at L-3, the white matter showed normal myelin staining with Luxol-fast blue/cresyl echt violet (LFB/CEV). In the cervical segments the lesion is seen principally in the dorsal funiculi and ventral sulcomarginal tracts. In the mid-thoracic cord all dorsal, lateral, and ventral white matter tracts are involved. The degeneration is characterized as a spongiform change that progresses from vacuolization to marked cavitation of the white matter. Ultrastructural studies have confirmed persistence of axons in the cavitated sites and demonstrate a primacy of myelinoclasis. The myelin degeneration progresses to complete myelinolysis, leaving clusters of naked but intact axons. The prominence of vascular spaces is due to perfusion of the specimen. The dilated spaces are further accentuated in the malacic foci.

Contributor. Department of Pathology, Colorado State University, Fort Collins, CO 80523.

Slide 29

History. A 2-year-old German shepherd cross was presented for seizures without other clinical abnormalities. A specific cause for seizures was undetermined. Routine fecal examination revealed hookworm and Paragonimus ova. Appropriate treatments for both parasites were administered, with resultant cessation of fecal shedding. The dog had been fed leftover crayfish used as fishing bait. Despite a reported absence of respiratory signs, thoracic radiographs were characterized by multifocal pulmonary parenchymal densities and a few small radiolucent cysts. Although treatment appeared to be successful, the patient was unmanageable as a pet and euthanasia was performed.

Diagnosis. Lung: Pneumonia, granulomatous, chronic-eosinophilic, focally extensive, with associated trematode adults, eggs, and fluke pigment.

Comment. Identification of the trematode parasite was based on (1) absence of coelomic cavity, (2) absence of calcareous corpuscles, (3) presence of an intestinal tract, and (4) associated birefringent thick-shell operculated eggs. Paragonimus is the only trematode genus having the lung as its final habitat.

Contributor. Veterinary Reference Laboratory, P.O. Box 660187, Dallas, TX 75266-0187.

Slide 30

History. This is tissue from a 2-year-old male castrated Merino sheep. It was one of 50 animals affected from a flock of 600 mixed-age sheep grazing partially cleared bush country. Losses occurred over 3 months. Affected animals were first observed to stagger and collapse when driven and would eventually become weak and permanently recumbent, although remaining alert and responsive. They would survive if cared for, but none recovered and eventually they died or were destroyed.

Diagnosis. Brain stem: Neuronal pigmentation, brown, granular, diffuse, moderate.

Comment. The following rule-outs were included based on history and histological findings: (1) Gomen disease, (2) inherited ceroidlipofuscinosis, (3) Trachyandra toxicosis, and (4) chronic Phalaris toxicosis. Based on histological presentation alone, asymptomatic lipofuscin deposition of normal aging should be considered. In Gomen disease reported in horses of New Caledonia there is a loss of Purkinje cells as well as neuronal pigmentation. Genetically determined neuronal lipofuscinosis occurs in genetically similar animals in a frequency suggestive of an autosomal recessive trait. This inherited condition has been reported in cattle (Beefmaster), sheep (South Hampshire), dogs (English setters, dachshunds, and Chihuahuas), and cats. Trachyandra toxicosis is characterized by lipofuscin accumulation much more severe than that occurring as a senile change. Periodic acid-Schiff (PAS) is a useful procedure in differentiating the causes of neuronal pigmentation. The lipofuscin that accumulates in Trachyandra toxicosis and in inherited ceroid-lipofuscinosis is strongly PAS positive. In Gomen disease, the pigment is variably PAS positive, while the melanin that accumulates in Phalaris toxicosis is PAS negative.

Contributor. School of Veterinary Studies, Murdoch University, Perth, Western Australia 6150.

Slide 31

History. This is tissue from an 11-year-old male Belgian Tervuren. The

dog had a 3-year history of dermatologic disorders characterized by a thin hair coat and alopecia. Periodic diarrhea and weight loss were also noted. On several occasions bradycardia and lipemic serum were reported. Congestive heart failure and hypothyroidism were diagnosed 1 month prior to death.

Diagnosis. Heart, arteries, and arterioles: Atherosclerosis, multifocal, moderate to severe.

Comment. In addition to atherosclerosis of arteries and arterioles noted within the sections of heart muscle, there are also foci of myocardial fibrosis (not present in all sections). Naturally occurring degenerative arterial lesions in dogs are mainly sclerotic rather than atheromatous. Canine atherosclerosis comparable to the natural disease may be induced by feeding a high cholesterol diet coupled with chemically or surgically induced hypothyroidism. In contrast to the human disease, in the dog the induced vascular lesions appear initially in small arteries rather than in the aorta. Also, lesions are primarily medial, with secondary involvement of the intima. The return of these dogs to normal diets and to a euthyroid state results in regression of lesions. High levels of cholesterol intake and reduced lipoprotein lipase activity (due to hypothyroidism) are associated with high levels of beta-low-density-lipoprotein (beta-VLDL). The models most relevant to human disease include hypercholesterolemic nonhuman primates (primarily old world monkeys), swine, and the watanabe heritable hyperlipidemic rabbit. The latter is a model for endogenous familial hypercholesterolemia due to defective low-density lipoprotein receptors.

Contributor. Sterling-Winthrop Research Institute, Columbia Turnpike Rensselaer, NY 12144.

Slide 32

History. This is tissue from a 6-month-old Santa Gertrudis bovine. The owner lost several animals from his herd the year before this calf died.

Diagnosis. Cerebrum, gray matter: Erythrocytic parasitemia, with focally extensive mild congestion.

Comment. Babesia sp and Anaplasma sp were considered as differentials in this case. The degree of difficulty in clinical differentiation of the two depends on the stage of the disease process and the number of the few distinguishing characteristics that may be present. Anaplasmosis has no pathognomonic lesions; however, the absence of hemoglobinuria and the presence of a strong regenerative erythroid response (due to intracellular red cell destruction rather than intravascular hemolysis of erythrocytes) may facilitate its diagnosis. Definitive diagnosis can be made with serologic testing. In infections with Babesia bovis (syn B argentina, B berbera, and B colchica) and B bigemina, the lesions are similar; however, in the latter there is minimal capillary congestion. Therefore the presence of a flushed (deep pink) cerebral

and cerebellar gray matter is considered a diagnostic feature of B bovis. Additionally, B bovis is not abundant in circulating blood (organisms are rarely seen in more than 5% of circulating RBC's) but is best demonstrated in smears of blood expressed from superficial skin scrapings. B bigemina on the other hand can frequently be found in circulating blood during severe clinical signs. B bigemina causes a less severe syndrome even though there are greater numbers of circulating parasitized red blood cells. This difference is attributed to the lack of the vasoactive and erythrocyte-adherence factors that are present with B bovis. The "sludging" as observed in this case has also been noted in cases of Plasmodium falciparum in primates. The organisms in this particular case were noted to be extraerythrocytic and intraerythrocytic. Meningeal melanosis was an incidental finding in some sections.

Contributor. Department of Pathology, Ondestepoort 010, Republic of South Africa.

Suggested reading. Everitt, J. I., Shadduck, J. A., Steinkamp, C., and Clabaugh, G.: Experimental Babesia bovis infection in Holstein calves. Vet. Pathol. 23: 556-562, 1986.

Slide 33

History. This is tissue from a 3-year-old female quarter horse. The animal was presented with anorexia, lethargy and weight loss of 3 to 4 weeks' duration. The owner elected euthanasia.

Diagnosis. Ovary: Dysgerminoma.

Comment. Without more specific information one would have to include solid carcinoma, lymphosarcoma, and dysgerminoma in the differential diagnosis. Histologic characteristics of the sections, including the multifocal aggregates of lymphocytes scattered randomly throughout, are very suggestive of seminoma/dysgerminoma. Immunohistochemical stains for leukocyte common antigen and cytokeratin should be negative in dysgerminoma.

Contributor. Department of Veterinary Pathology, School of Veterinary Medicine, Louisiana State University, Baton Rouge, LA 70803.

Slides 34 and 35

History. These are tissues from 12-week-old female nude mice (CD-1 nu/nu) Mus musculus. A section of brain from one nude mouse and the liver from another nude mouse are submitted. These mice were two of several nude mice and CD-1 haired mice placed in quarantine for 10 days after receipt from the vendor. Following quarantine, they were given triamcinolone suspension subcutaneously once a week for 2 weeks. The object was to exacerbate any subclinical infection they might have acquired in the facility. All mice in this quarantine group were killed and necropsied 24 days after receipt from the vendor.

Diagnosis. (1) Liver: Hepatitis, random, necrotizing, subacute, multifocal. (2) Cerebrum: Encephalitis, nonsuppurative, necrotizing, multifocal, minimal.

Comment. Based on the nonspecific liver lesions observed in most of the sections, murine hepatitis virus (MHV), ectromelia, lymphocytic choriomeningitis, and Tyzzer's disease were considered in the differential diagnosis. Some sections display syncytial cells, a characteristic of the MHV coronavirus. The primary target for various strains of MHV are the respiratory or intestinal tracts; MHV then disseminates to multiple organs including liver, brain, and lymphoreticular organs. The susceptibility or resistance of mice to MHV is related to the age of the mouse and to its genotype and lymphoreticular function.

Contributor. Pfizer Central Research, Drug Safety Evaluation, Eastern Point Road, Building 174, Groton, CT 06340.

Slide 36

History. This is tissue from a 21-month-old female Fisher 344 rat. This rat was a control in a 2-year carcinogenicity study. It developed diarrhea 5 days before it died.

Diagnosis. Stomach: Rhabdomyosarcoma, well-differentiated.

Comment. It is speculated that the neoplasm may have originated in the esophagus, diaphragm, or displaced mesodermal anlage within the stomach wall. Rhabdomyosarcomas arising in displaced mesoderm have been called metaplastic rhabdomyosarcomas by some, in accordance with the human tumor classification. Not all rhabdomyosarcomas display such easily identifiable characteristic features. Although it was not necessary for the recognition of the striations, phosphotungstic acid hematoxylin was employed to accentuate them. Immunohistochemical staining for desmin has also been shown to be a specific marker for rhabdomyosarcomas of man and rat.

Contributor. Ethicon Research Foundation, Ethicon, Inc., Sommerville, NJ 08876.

Slide 37

History. This is tissue from a 13-year-old female miniature poodle. The dog was presented for a routine physical examination and teeth cleaning. A large palpable abdominal mass was found in the left abdomen.

Diagnosis. Kidney: Renal cell carcinoma.

Comment. There are four distinct types of neoplasms that arise in the canine kidney: renal tubular, transitional cell, nephroblastic, and

nonepithelial (to include interstitial cell tumors) origin. Neoplasms of renal tubular cell origin may be either adenomas or carcinomas; differentiation of these two may be impossible on histologic criteria alone. The carcinoma is the most frequent primary renal tumor in dogs, and, as in humans, there is a distinct predilection (2:1) for males . Histologically, these masses may be solid or tubular or may display papillary differentiation. Large vacuolated cells (clear cells), as seen in the human counterpart, are variably present. In this particular case several "clear cells" were noted in some sections. The histological patterns are of limited prognostic significance in that frequently more than one pattern is present in a single mass. No breed predilection is recognized except for the hereditary renal cystadenocarcinoma reported in German shepherds. This entity is reported in association with dermatofibrosis.

Contributor. Department of Pathology and Parasitology, College of Veterinary Medicine, Auburn University, Auburn, AL 36849.

Slide 38
History. This is tissue from a 24-year-old Morgan mare. Her right mammary gland had been enlarged for 3 years.

Diagnosis. Mammary gland: Adenocarcinoma.

Comment. The two cases of equine mammary tumors referenced by the contributor were both solid carcinomas. Metastasis was reported in one of these. This particular case is an adenocarcinoma in which there were no observed metastases. Lymph node enlargement was noted but was attributed to the attending inflammation. The apparent mineralization in the mass was more than likely leached nuclear material rather than mineral.

Contributor. George A. Parker, DVM, P.O. Box 350, Great Falls, VA.

Slide 39
History. This is tissue from a 3-year-old quarter horse. She was presented recumbent to an equine medical center with a heart rate of 100, pale mucous membranes, and no gastrointestinal sounds. Examination revealed a severely distended urinary bladder and a painful left kidney. Clinical signs and clinicopathologic abnormalities progressed despite therapy. Three days after presentation, euthanasia was performed on the mare. Postmortem examination was performed immediately after euthanasia.

Diagnosis. (1) Skeletal muscle: Necrosis, diffuse, severe with hemorrhage. (2) Kidney: Nephrosis, multifocal, moderate, with tubular dilatation, regeneration, and intratubular myoglobin/hemoglobin.

Comment. Compartmental syndrome refers to local muscle ischemia and contracture resulting from edema and increased pressure in a muscle trapped within an osteofascial compartment; crush syndrome refers to the systemic

manifestations of muscle necrosis, including myoglobinuric renal failure, shock and cardiac sequellae of acidosis, and hypercalemia. The pathogenesis of these two syndromes begins with prolonged limb compression (of variable etiology) causing direct muscle trauma, which leads to muscle ischemia, histamine release and resultant edema, rising compartment pressure, and compartment tamponade. Compartment tamponade has two sequelae--(1) further muscle ischemia and (2) neural injury. Progressive muscle ischemia results in more edema and also eventually causes muscle infarction. This additionally causes the myoglobinemia with subsequent myoglobinuric nephrosis and possible renal failure.

Contributor. George A. Parker, DVM, P. O. Box 350, Great Falls, VA 22066.

Slide 40

History. This is tissue from a 2-1/2-year-old male wild-caught Macaca mulatta. The animal had been assigned to a research project; however, 4 months later it developed leukocytosis and abdominal discomfort. Exploratory laboratomy revealed multiple abdominal abscesses. The animal was subjected to euthanasia 2 months later.

Diagnosis. (1) Liver, spleen, lymph node: Pyogranulomas, multifocal, with central filamentous bacterial colonies and associated Splendore-Hoeppli phenomenon. (2) Stomach, intestine, serosa: Pyogranulomatous, multifocal, with central filamentous bacterial colonies and associated Splendore-Hoeppli phenomenon.

Comment. Based on the variety of tissues examined, the differential diagnosis for the gross lesions in this case includes tuberculosis and nocardiosis. Microscopically, Actinomyces sp, Yersinia sp, and Staphylococcus sp should be considered. We were unable to stain the organisms using a variety of acid-fast stains, including a Fite modification. Nocardia asteroids was isolated from abdominal abscesses.

Contributor. Division of Animal Medicine, University of Washington, Seattle, WA 98195.

Slide 41

History. This is tissue from a 1-1/2-year-old male cockatoo. The bird was lethargic and was not eating for some time. It seemed to be wasting away. Vomition had occurred off and on for several weeks.

Diagnosis. (1) Proventriculus and ventriculus: Leiomyositis, subacute, interstitial, multifocal, mild to moderate. (2) Proventriculus and ventriculus, serosa: Serositis, granulomatous, multifocal, moderate, with multifocal foreign material on serosal surface.

Comment. Although macaw wasting disease (proventricular dilatation

syndrome) was first reported in macaws and cockatoos, other species have been affected, including a variety of parrots, conures, and cockatiels. Clinical signs consist of anorexia, lethargy, intermittent regurgitation, diarrhea (feces may contain undigested seeds), and weight loss. Neurologic signs have been reported but not elaborated on.

Gross changes are identified primarily in the proventriculus and ventriculus and less commonly in the crop. There is thinning of the walls, mucosal ulceration, and impaction of ingesta.

Histologic changes consist of mononuclear cell infiltration of intrinsic and extrinsic nerves of the crop, proventriculus, ventriculus, and duodenum. Ganglioneuritis has been observed in the heart as well as various large ganglia. Nonsuppurative encephalitis with mononuclear perivascular infiltration has also been reported. Some reports note intranuclear and cytoplasmic eosinophilic inclusion bodies within nerve cell ganglia in affected birds, suggesting a viral etiology. A paramyxovirus is suspected. These findings are variable, and the etiology is still in question. The serositis noted in several slides is in response to foreign material in the coelomic cavity and is not directly related to the primary lesions.

Contributor. Veterinary Reference Laboratory, P.O. Box 30633, Salt Lake City, UT 84130.

Slide 42

History. Tissue from an adult male great blue heron (Ardea herodias). This is one of three wild great blue herons that were found unable to fly or stand and that had large amounts of firm, lobulated subcutaneous and cavitary fat. This bird's condition improved markedly following daily oral supplementation with vitamin E. When vitamin E supplementations were decreased, clinical signs returned and the bird died.

Diagnosis. Skeletal muscle: Necrosis and degeneration, diffuse, severe, with mineralization and associated histiocytic reaction.

Comment. Steatitis (yellow fat disease) has been observed in a number of species, including cats, mink, pigs, crocodileans, and birds. The disease most commonly occurs in captive animals or in those maintained on a restricted diet. In this case the birds were wild. Interestingly, 1 year after these particular birds were affected, others were found in the same vicinity with similar signs. It is speculated that the birds may have (1) fed primarily on a species of fish with high concentrations of polyunsaturated fatty acids or (2) possibly had an increase of heavy metals in their diet. Any one or a combination of these could deplete body stores of vitamin E.

Contributor. National Zoological Park, Department of Pathology, Washington, DC 20008.

Suggested reading. Nichols, D. K., Campbell, V. L., and Montali, R. J.: Pansteatitis in great blue herons. J. Am. Vet. Med. Assoc. 189: 1110-1112, 1986.

Slide 43

History. This is tissue from a 1-year-old male whoopping crane (Grus americana). Seven of 39 whooping cranes from the Patuxent Wild Life Research Center died over a 7-week period. Another species of crane, the Sandhill crane, kept in adjacent pens remained normal throughout that period.

Diagnosis. (1) Spleen, Schweigger-Seidel sheaths: Necrosis, diffuse, severe. (2) Liver: Necrosis, multifocal to focally extensive, random, severe, with subacute portal inflammation.

Comment. Clostridium limosum was cultured from the ascitic fluid of this bird. No other bacteria were isolated, nor were fungi or Chlamydia present. A togavirus was identified in several tissues from the crane presented and from others affected in the outbreak. Brown granular material was noted in the cytoplasm of numerous hepatocytes. Their content remains undetermined, but they are suspected of being iron. In normal avian spleens there is absence of sharp demarcation of white and red pulp.

Contributor. Department of Pathology, National Zoological Park, Washington, DC 20008.

Slide 44

History. This is tissue from a 6-year-old female thoroughbred. The animal experienced complete dysphagia of 3 weeks' duration. Nerve conduction tests indicated lack of function, and euthanasia was performed.

Diagnosis. Gutteral pouch: Inflammation, necrohemorrhagic and suppurative, diffuse, with focally extensive superficial fungal hyphae consistent with Aspergillus spp.

Comment. Aspergillus spp can be isolated in normal gutteral pouches. It is speculated that the pathogenesis of this lesion was vascular thrombosis resulting in ischemia and necrosis, which facilitated an opportunistic infection by the fungus.

Contributor. New Bolton Center Laboratory, Large Animal Pathology, 382 West Street Road, Kennett Square, PA 19348.

Slide 45

History. This is tissue from a 2-year-old female colony born Macaca nemestrina. She weighed 1.83 kg and was observed to be severely lethargic. The animal was not eating, and its abdomen was distended and firm.

Diagnosis. (1) Small intestine: Fibromatosis, subserosal, diffuse, severe. (2) Small intestine, colon: Amyloidosis, multifocal, moderate.

Comment. Considering histologic features alone, some limited microscopic fields appear as granulation tissue, chronic inflammation, and fibrous neoplasia. Amyloid in the lamina propria is an unusual finding in macaques according to one source, although in older individuals splenic and pancreatic amyloidosis is a relatively common finding.

Fibrous tissue invasion of the mesentery as well as the inguinal canal and diaphragm has been described in retroperitoneal fibromatosis. In some sections from this case, the fibrous proliferation is observed infiltrating into and through the muscular tunics of the bowel and into the submucosa.

Contributor. Division of Animal Medicine, University of Washington, Seattle, WA 98195.

Slides 46 and 47

History. This is tissue from a 6-year-old female rhesus monkey (Macaca mulatta) that was housed in an indoor-outdoor pen with five other female rhesus monkeys. This animal was subjected to euthanasia after a positive tuberculin test to intrapalpebral old tuberculin. A morphologic diagnosis of tuberculosis had already been made in two positive reactors housed two cages from this animal.

Diagnosis. Lung and lymph node: Necrogranulomas, multifocal to coalescing, with numerous intracellular acid-fast organisms.

Comment. Avian tuberculosis in old world monkeys produces histopathologic features similar to paratuberculosis, with infiltrates of acid-fast bacilli-laden macrophages within the lamina propria of the intestines and in lymph nodes. Focal discrete accumulations of these macrophages have been observed in the liver, spleen, bone marrow, and lungs as well. Organized granulomas with central necrosis have been noted in only a few cases. Multinucleated giant cells are observed in almost half of the cases of one study (18 total cases). Primates with nontuberculous mycobacterial infections display an altered immune status, with increased gammaglobulin levels, decreased numbers of T lymphocytes, and decreased mitogen responses. M. avian is another disease entity associated with primates with acquired immune deficiencies.

Contributor. Bowman-Gray School of Medicine, Department of Comparative Medicine, 300 South Hawthorne Road, Winston-Salem, NC 27103.

Slide 48

History. This is tissue from an adult male opossum (Didelphis virginiana).

Diagnosis. (1) Lung: Paracytic cysts, multiple, with occasional granulomatous inflammation around degenerative cysts; etiology--consistent with Besnoitia darlingi. (2) Lung: Osseous metaplasia, multifocal, mild.

Comment. Cysts containing bradyzoites within this section appeared to have three distinct layers. The outer most layer is birefringent fibrous connective tissue, which is part of the host tissue and not part of the protozoal cyst proper. The next layer is a parasite-manufactured, PAS-positive extracellular layer that consists ultrastructurally of fine fibrils and small dense granules embedded in an electron-lucent matrix. Inside this layer is the host cell membrane, usually a fibroblast with hyperplastic and hypertrophic nuclei. The cyst wall surrounds numerous bradyzoites. Besnoitia spp can be differentiated from other protozoal cysts (Toxoplasma spp, Hammondia spp, Levinea spp, and Sarcocystis spp) by size of the organism, its location in many organs, and its nonseptate thick-walled cyst that contains bradyzoites. Besnoitia spp have a wide range of intermediate hosts. Other organisms considered in the differential diagnosis were Emmonsia and Rhinosporidium, but cursory histopathological evaluation can eliminate these fungi.

Contributor. Department of Pathology, UTHSCD, 5323 Harry Hines Boulevard, Dallas, TX 75235.

Slide 49

History. This is tissue from a 2-year-old female English cocker spaniel. The animal was presented with a 1-week history of lethargy, anorexia, polydypsia, polyuria, and vomiting. The mucous membranes were pale. The bitch came from a kennel where a number of young dogs had died of renal failure.

Diagnosis. Kidney: Glomerulosclerosis, diffuse, segmental to global, with multifocal tubular ectasia and multifocal subacute interstitial nephritis.

Comment. The pathogenesis of these lesions is unclear. In several breeds, including the cocker spaniel, the condition has been demonstrated to be heritable, but the exact defect is unknown. Immune-mediated glomerulonephritis with secondary tubular and interstitial changes was included in the differential diagnosis. Without complete information regarding breeding history, medical status of siblings, and electron-microscopic studies, a more definitive diagnosis is impossible.

Contributor. Division of Veterinary Biology, School of Veterinary Studies, Murdoch University, Murdoch, WA 6510.

Slide 50

History. This is tissue from a 3-year-old male Doberman pinscher. The dog had developed progressive dyspnea, lethargy, and weakness over several weeks. After euthanasia, fresh lung tissue was submitted.

Diagnosis. Lung: Pneumonia, pyogranulomatous, diffuse, severe, with associated fungal yeast displaying unidimensional broadbased budding in macrophages and giant cells.

Comment. The differential diagnosis in this case included cryptococcosis, coccidioidomycosis, and blastomycosis. Coccidioides immitis is larger (20 - 200 mm) with endosporulating spherules in tissue. Cryptococcus neoformans (2 - 20 mm) usually has a wide mucicarmine-staining capsule. Also, the pyogranulomatous inflammatory response is an aid in differentiating this case from C neoformans, which generally evokes a histiocytic response.

Contributor. Veterinary Science Department, P.O. Box 2175, South Dakota State University, Brookings, SD 57007.

Slide 51

History. Tissue from a 5-week-old Cornish hen. A group of twenty Cornish chicks experienced a mortality rate of 60% in the first 3 weeks of life. Two live, but weak and emaciated, chicks were submitted for diagnostic testing. Both chicks were positive for pullorum disease by the pullorum blood plate test.

Diagnosis. Heart, lung, liver, ventriculus: Inflammation, pyogranulomatous, mild to severe.

Comment. Salmonella pullorum, S gallinarum, S arizonae, S cholerae were included in the differential diagnosis. The distribution of lesions suggested vascular dissemination. On initial attempt to demonstrate the presence of S pullorum organisms in lesions, a Giemsa stain is the best technique. In some sections of liver there is a parenchymal focus of necrosis interpreted to be an infarct. In addition to the necrotic and granulomatous lesion within the liver there are accumulations of lymphocytes. This lymphocytic infiltrate is commonly seen in domestic fowl in the Maryland area and is usually periportal but can also be random.

Contributor. Maryland Department of Agriculture, Animal Health Laboratories, 4901 Calvert Road, College Park, MD 20740.

Slide 52

History. This is tissue from an 11-year-old female quarter horse. This animal incurred a dislocated patella at breeding time. Three months after the incident she was in much pain and losing weight and so was killed. There was no history of respiratory disease.

Diagnosis. Lung: Granular cell tumor.

Comment. Granular cell tumors (GCT) have been reported in man (frequently

in submucosal and subcutaneous tissue, especially of the head and neck regions, and in the tongue, heart, and thoracic wall) and in several species of animals: dog (tongue, brain, heart), horse (lungs), rat (pituitary and leptomeninges), and mouse (cervix). It has been suggested in more recent reports that the origin of these spindle-shaped to globoid tumor cells is neural crest tissue. The cells of GCT (1) are variably positive for S-100 protein, (2) are positive for neuron-specific enolase, (3) are negative for neurofilaments and positive for vimentin (as are melanoma and embryonic neuroepithelial cells), (4) have granules biochemically similar to myelin, (5) lack the basement membrane glycoprotein, laminin, around individual tumor cells (seen around Schwann cells), (6) are negative for lysozyme and alpha-1-antitrypsin (unlike histiocytes), (7) are negative for striated muscle proteins of myoglobin and myosin, and (8) are associated with neuronal tissue.

In a recent article on the spontaneous tumors of meninges in rats, the authors speculate that meningeal granular cell tumors may arise from progenitor meningothelial arachnoid cells (arachnoid cells are neural crest derived).

Contributor. School of Veterinary Medicine, North Carolina State University, 4700 Hillsborough Street, Raleigh, NC 27606.

Suggested reading. Mitsumori, K., Maronpot, R. R., and Boorman, G. A.: Spontaneous tumors of the meninges in rats. Vet. Path. 24: 50-58, 1987.

Slide 53

History. This is tissue from an 8-month-old female white Carneau pigeon. This pigeon was the only spontaneously diseased bird among a group of 22 that were acquired for research. No signs of clinical illness were apparent. Lesions were detected when the bird was killed and necropsied.

Diagnosis. Proventriculus: Dilatation, glandular, multifocal, marked, with nematode parasites.

Comment. The spirurid nematode is identified by the presence of a pseudocoelom with eosinophilic amorphous material, coelomyarian/polymyarian musculature, an intestinal tract lined by uninucleated cuboidal cells with a brush border, uteri with embryonated and unembryonated eggs, lateral cords, lateral alae, and by the host and the location of the parasite within the host. Documented hosts include pigeons, ducks, and many gallinaceous birds. The grasshopper, cockroach, sowbug, and pillbug have been reported as intermediate hosts.

Contributor. U.S. Army Medical Research Institute of Chemical Defense, Attention: SGRD-UV-YC, Aberdeen Proving Ground, MD 21010-5425.

Slide 54

History. This is tissue from a 10-year-old crossbred male dog. It was

presented with a lobulated ulcerating mucosal mass at the angle of the jaw on the left side. The mass was deeply embedded in pharyngeal soft tissue and extended into the soft tissue. An ulcerated area measuring 1 x 3 cm was present caudal to the left upper molars. The mass was observed 4 weeks prior to surgery together with symptoms of halitosis. Regional lymph nodes were normal on palpation. The tumors recurred locally 7-1/2 months after excision causing pharyngeal obstruction. The dog was subjected to euthanasia.

Diagnosis. Oral mucosa: Malignant neoplasm, suggestive of amelanotic melanoma.

Comment. The differential diagnosis for this mass included amelanotic melanoma and poorly differentiated carcinoma. In this case, numerous silver-positive granules in neoplastic cells were demonstrated with the Warthin-Starry technique. The prognosis for oral melanomas in the dog, whether pigmented or not, is poor.

Contributor. Pathology Department, Smith Kline & French, Ltd. The Frythe, Welwyn, Herts, AL 6 9AR, UK.

Slide 55

History. This is tissue from a 3-month-old crossbred pig. Six feeder pigs from a group of 100 died without prior signs of illness. An additional four pigs in the group were depressed and losing condition. Heart and lung tissue from two of the dead pigs was submitted.

Diagnosis. Heart, myocardium: Degeneration and necrosis, multifocal and coalescing, with hemorrhage, mineralization and associated acute to subacute inflammation.

Comment. Affected pigs usually present with multifocal hyalin necrosis and calcification of myocytes, fibrinoid necrosis of intramyocardial arteries and arterioles, and microthrombi of myocardial capillaries.

Common concurrent lesions associated with selenium-vitamin E deficiency in pigs are hemorrhagic necrosis of the liver (hepatosis dietetica) and ulceration of the esophageal portion of the gastric mucosa.

Contributor. Department of Veterinary Science, South Dakota State University, Box 2175, Brookings, SD 57007.

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History. This is tissue from a 136-day-old female beagle. She presented with a temperature of 103°F and was severely lethargic and in shock. The next day the animal was comatose and died.

Diagnosis. Small intestine: Necrosis and regeneration, crypt enterocytes, with loss of villi, condensation of lamina propria, and diffuse lymphoid necrosis of gut associated lymphoid tissue.

Comment. The intestinal changes present are typical of those caused by parvovirus infection.

Contributor. Inhalation Toxicology Research Institute, Lovelace Biomedical & Environmental Research Institute, Inc., P.O. Box 5890, Albuquerque, NM 87185.

Slide 57

History. This is tissue from a 5-week-old Persian kitten from a cattery that has had several cases of upper respiratory infection with conjunctivitis and nasal discharge.

Diagnosis. Lung: Pneumonia, interstitial, acute, fibrino-necrotic, diffuse, moderate to severe, with necrotizing bronchitis/bronchiolitis, intranuclear inclusion bodies, and mild, subacute vasculitis.

Comment. Feline herpesvirus infection is normally confined to the upper airways and involves the lung only in rare fulminating infections. Herpesviruses commonly affect the lung in other species, including pigs (certain strains of pseudorabies virus), equine foals and fetuses (rhinopneumonitis), and cattle (cytomegalovirus infection). Concomitant Toxoplasma infection was suggested in this case; however, examination of several sections failed to reveal the protozoan.

Contributor. College of Veterinary Medicine, Virginia Tech, Blacksburg, VA 24061.

Slide 58

History. This is tissue from an adult male C3H/HeN mouse. One week after shipment, several male mice, newly purchased for breeding stock, had nodular subcutaneous swellings located in the pubic area as much as 1 cm cranial to the prepuce. Twenty mice were submitted for diagnosis; 19 of these were affected.

Diagnosis. Preputial gland: Adenitis, subacute, focal, moderate, with adjacent abscess.

Comment. Although not evident in all sections, the subcutaneous abscess is connected via a fistulous tract to the inflamed preputial gland. Other changes noted in and around the gland include multiple ectatic ducts, foci of squamous metaplasia and fat necrosis. The cells lining the subcutaneous abscess are macrophages, apparently responding to cellular debris and glandular secretions

free within the subcutis. Sections contain an array of the secondary sex glands of the male mouse, including ampullary, vesicular (seminal vesicle), coagulating, bulbourethral, preputial glands, and dorsal and ventral prostate.

Contributor. Department of Comparative Medicine, University of Alabama in Birmingham, Birmingham, AL 35294.

Slide 59
History. This is tissue from a wild-caught female Humboldt penguin (Spheniscus humboldti) that had been maintained in a state-side zoo. The animal experienced moderate to severe weight loss, but prior to death it was active.

Diagnosis. (1) Liver: Hepatitis, subacute, multifocal, random, mild to moderate, with protozoal schizonts. (2) Lungs: Congestion, diffuse, moderate, with protozoal schizonts.

Comment. Plasmodium sp, Haemoproteus sp, Leucocytozoon sp, and Toxoplasma sp were included in the differential diagnosis. Due to the hepatic infiltrate with numerous mitotic figures, lymphoid leukosis was also considered. In Leucocytozoon sp infection, there are large primary schizonts (20-40 u in diameter) within hepatocytes and larger (100-200 u in diameter) secondary schizonts in phagocytic cells. The intraerythrocytic gametocytes (14-22 u x 4.5-5.5 u) are prominent.

Schizogony of malarial organisms occurs in red blood cells and endothelial cells (e.g., Plasmodium relictum, P gallinaceum) or in cells of the hematopoietic system (e.g., P elongatum, P vaughani). P elongatum can parasitize any type of blood or blood-forming cell, including thrombocytes.

Of the various species of avian malaria only P relictum and P elongatum have been reported in penguins.

Pigment noted in the sections of liver is hemosiderin.

Contributor. Registry of Veterinary Pathology, Armed Forces Institute of Pathology, Washington, DC 20306-6000.

Slides 60 and 61
History. This is tissue from an 18.5-month-old NIH Swiss male mouse. A subcutaneous mass was observed on the left rear limb. This was an incidental finding.

Diagnosis. Spleen and skin: Mast cell tumor.

Comment. Mast cell neoplasms are rare in mice, having an approximate 1.5% occurrence rate.

Contributor. NIH-NCI Registry of Experimental Cancers, Landow Bldg., Rm 1020, Bethesda, MD 20892.

Slide 62

History. This is tissue from an 8-month-old, Pekin duck that was part of a study of duck hepatitis B virus.

Diagnosis. Coelomic mass: Teratoma.

Comment. Teratomas of fowl usually occur in the testis, ovary, spinal cord (lumbosacral region), and pineal gland and in retroperitoneal sites (adrenal and kidney). This particular mass was not associated with any of these sites. Well-differentiated structures representative of the three germ layers are present in this mass.

Contributor. North Carolina State University, School of Veterinary Medicine, 4700 Hillsborough Street, Raleigh, NC 27606.

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History. A 4.5 kg 4-month-old mixed-breed male dog ingested 30 grams of rat and mouse bait. The dog was depressed and anorectic 36 hours after ingestion of the bait. Vomition was observed at this time. There was no improvement over the next 24 hours. Blood was observed in the vomitus. Temperature, pulse, and respiratory rates were 99.2, 100, and 24 degrees Fahrenheit, respectively. Mucous membranes were pale and dry. Capillary refill time was 2.5 seconds. The dog died of cardiac asystole approximately 72 hours after the ingestion of the bait.

Diagnosis. (1) Lung, alveolar walls, bronchial and bronchiolar epithelial basement membranes: Mineralization, multifocal, severe, with associated acute fibrinohemorrhagic pneumonia. (2) Kidney: Necrosis, tubular, multifocal, with epithelial, basement membrane and vascular mineralization.

Comment. Special stains, particularly the alizarin red stain, highlighted mineral deposits in basement membranes adjacent to viable epithelial cells as well as in necrotic debris and inflammatory infiltrates. Alizarin red stain is specific for calcium whereas the von Kossa's technique identifies phosphates and carbonates rather than calcium itself.

The exact mechanism of calcium deposition in vitamin D toxicosis is unclear.

Contributor. Dept. of Veterinary Pathobiology, Univ. of Illinois, 2001 South Lincoln Avenue, Urbana, IL 61801.

Slide 64

History. This is tissue from an 11-year-old male Boston terrier. The dog had a history of tricuspid and mitral valve insufficiency. It developed diarrhea with malabsorption and then died in the hospital shortly after undergoing surgery for biopsy of several sites in the GI tract.

Diagnosis. Lung: Pneumonia, granulomatous, multifocal, moderate, with associated basophilic, anisotropic bodies.

Comment. This condition is encountered sporadically in the tissues of military working dogs examined at the AFIP. It is generally an incidental finding, unassociated with clinical signs. Affected dogs are usually dolicocephalic and are not necessarily old.

Contributor. University of California, Davis, School of Veterinary Medicine, Department of Pathology, Davis, CA 95616.

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History. Tissue is from (1) a 6-week-old 200-lb female bovine (calf A) and (2) a 3-month-old 300-lb male bovine (calf B). Both calves were Hereford-Holstein cross.

For 6 to 8 weeks, 40 calves had been housed in a barn that had some of the pen partitions made of old painted doors. Over the last month, a couple of calves had done poorly. Calf A had acted "crazy" according to the farmer, was "charging the attendant" and had died. Calf B is from the same farm, 6 weeks later; it had been stiff-legged for 5 weeks, was anorectic and thin, had long hair, finally "went down", and was euthanatized.

Diagnosis. Kidney: Nephritis, chronic, interstitial, multifocal, mild.

Calf A kidney: necrosis, tubular, multifocal, with gray, hyalin intranuclear inclusions within tubular epithelial cells.

Calf B kidney: necrosis, tubular, multifocal, with epithelial cell mineralization and gray, hyalin, intranuclear inclusions within tubular epithelial cells.

Comment. The tissues are mildly autolytic and intranuclear inclusions are less numerous in the kidney of Calf B. X-ray spectrographic analysis confirmed the presence of lead within the nuclei of tubular epithelial cells.

Contributor. Veterinary Lab. Services, OMAF, Box 3612, Guelph, Ontario Canada N1H 6R8.

Slide 66

History. This is tissue from a 4-year-old female golden retriever that presented with acute onset of vomiting, diarrhea, and dehydration and on the next day developed dyspnea and metabolic acidosis. The only radiographic finding was hyperinflated lungs. The dog died 2 days after presentation.

Diagnosis. (1) Lung: Necrosis, septal, multifocal, with severe diffuse hemorrhage and segmental necrotizing vasculitis. (2) Kidney: Necrosis, tubular epithelium, multifocal, with multifocal granular and occasionally mineralized intraluminal material.

Comment. Included in the differential diagnosis were acute paraquat toxicosis and heritable or induced/acquired (warfarin, radiation, neoplasia) coagulopathies. Laboratory results indicated paraquat levels of 4.5 ppm in

vomitus and 0.45 ppm in pooled liver and kidney samples. Regarding the chronic response to paraquat toxicity, some references state that type II pneumocyte hyperplasia and fibroplasia are superimposed on earlier exudative changes while others caution that these changes may be iatrogenically induced by oxygen therapy and that the basic lesion is heavy infiltration of primitive connective tissue cells (profibroblasts) into alveolar spaces with subsequent maturation and occlusion of many alveolar spaces. Later, alveolar walls degenerate and there is coalescing of aggregates of fibroblasts and obliteration of alveolar architecture.

Contributor. University of Tennessee, Dept. of Pathobiology, P.O. Box 1071, Knoxville, TN 37901-1071.

Suggested reading. Fukuda, Y., et. al.: The role of intraalveolar fibrosis in the process of pulmonary structural remodeling in patients with diffuse alveolar damage. Am. J. Pathol. 126: 172-181, 1987.

Slide 67

History. This 1-week-old guinea pig was one of three neonates from a litter that became depressed, hunched, ruffled, and dyspneic several days following a transient breakdown of the air conditioning system (and dramatic elevation of room temperature).

Diagnosis. Lung: Pneumonia, fibrinopurulent, diffuse, severe, with bronchiolar and bronchial ectasia and bacterial colonies.

Comment. Numerous bacterial species have been isolated from the lungs of guinea pigs with pneumonia, including Bordetella bronchiseptica, Streptococcus spp, Staphylococcus spp, Pasteurella multocida and Klebsiella pneumoniae. Also adenovirus, with and without secondary bacterial infections, has been associated with cavian pneumonia. In this case numerous necrotic respiratory epithelial cells were noted to have intranuclear structures suggestive of viral inclusions, thus indicating a possible viral coinfection. Other changes noted were medial hypertrophy of pulmonary arteries (common in guinea pigs and cats), and reactive pleural mesothelial cells, probably associated with the underlying pneumonia.

Contributor. Dept. of Laboratory Animal Resources, A-115 Scaife Hall, University of Pittsburgh, Pittsburgh, PA 15261.

Slide 68

History. This 5-year-old Brown Swiss cow had a chronic intermittent diarrhea and bloating and did not respond to symptomatic treatment. Rectal examination revealed a large mass involving the intestine; the cow was humanely killed and necropsied.

Diagnosis. Colon: Solid carcinoma.

Comment. Based on hematoxylin-and-eosin-stained sections alone, a diagnosis of solid carcinoma was made. Vascular and/or lymphatic invasion was noted in several sections. Carcinoids are infrequently reported in cattle.

Contributor. Department of Veterinary Pathology, LSU School of Veterinary Medicine, Baton Rouge, LA 70803.

Slide 69
History. This is tissue from an aborted 7-month-old female Holstein fetus.

Diagnosis. Lung: Pneumonia, bronchiolar and alveolar, pyogranulomatous, mild, with associated intraluminal yeast.

Comment. Torulopsis glabrata has been reclassified as Candida glabrata. C glabrata, especially when present in macrophages, must be differentiated from Histoplasma capsulatum var capsulatum. Yeast forms of C glabrata are slightly larger, bud more frequently and are more often extracellular. Unlike other Candida sp, C glabrata does not produce hyphae. The organisms were probably inhaled rather than of hematogenous origin.

Contributor. Livestock Disease Diagnostic Center, University of Kentucky, 1429 Newton Pike, Lexington, Kentucky 40511.

Slides 70 and 71
History. The samples submitted are from two white-faced, cross-bred 2-day-old female lambs. One was a lamb in which a specific disease was experimentally induced. The other is an age-matched unaffected control lamb. The affected lamb was born with a generalized, constant whole-body tremor and was unable to stand. The control lamb was clinically normal at birth.

Diagnosis. Spinal cord: Hypomyelination, diffuse, severe.

Comment. Developmental anomalies associated with border disease are determined by the strain of virus, dose, route of infection, and host immune and genetic factors. The cause of hypomyelination is currently not known; however, investigators suggest that it may be secondary to viral infection of oligodendrocytes or due to depressed levels of circulating thyroid gland hormones caused by noninflammatory and noncytolytic infection of the thyroid gland by border disease virus.

Contributor. University of California, Davis, School of Veterinary Medicine, Department of Pathology, Davis, CA 95616.

Suggested reading. Anderson, C. A., et. al.: Border disease. Virus-induced decrease in thyroid hormone levels with associated hypomyelination. Lab. Invest. 57(2): 168, 1987.

Slides 72 and 73
History. This is tissue from a 2-month-old Malay bantam pullet that was thin and lethargic and had ruffled features.

Diagnosis. (1) Liver: Hepatitis, necrotizing, pyogranulomatous, multifocal, random, mild to severe, with intralesional protozoa. (2) Liver: Cholecystitis, subacute, diffuse, mild. (3) Cecum: Typhlitis, necrotizing, pyogranulomatous, diffuse, severe, transmural, with intralesional protozoa.

Comment. The organisms noted in the intercellular spaces of the cecum and liver are the aflagellate form. In this particular case many of them were markedly periodic acid-Schiff-positive. Although routinely associated with gross and microscopic lesions in cecae and liver, Histomonas meleagridis affects other organs. The heart in particular was noted.

Contributor. Battelle Columbus Division, Pathology Section, Room 6144/B-505 King Ave., Columbus, Ohio 43201-2693.

Slide 74

History. The tissue specimen is from a large mass in the ventral cervical region of a newborn Nubian kid. This was one of triplets born to a backyard nanny. All were born weak and died within 3 hours of birth.

Diagnosis. Thyroid: Follicular cell hyperplasia and hypertrophy (hyperplastic goiter), diffuse, severe.

Comment. Tissue identification was facilitated by a few colloid-filled follicles noted in several sections. The differential diagnosis included goiter and solid or solid-follicular carcinoma. Immunohistochemical techniques for thyroglobulin, using reagents specific for human antigens, were unrewarding.

Contributor. Department of Pathology, College of Veterinary Medicine, Colorado State University, Ft. Collins, CO 80523.

Slide 75

History. This is tissue from a 22- to 25-year-old male rhesus (Macaca mulatta). During an annual physical examination, a 2- to 3-cm expansile mass was noted in the right mandible. Months later, a tooth was lost and a draining tract developed. The animal was humanely killed.

Diagnosis. Mandible: Ameloblastic odontoma.

Comment. Ameloblastic odontomas (syn. odontoameloblastoma, adamanto-odontoma, soft and calcified odontoma) are rare tumors in man and animals alike. The odontomatous portions of this particular mass are considered the least differentiated; therefore it is diagnosed as an odontoma with an ameloblastic component. This does not imply that there are two separate neoplasms growing in unison but that there is unrestrained proliferation of the odontogenic component. In some sections there is focal vesicle formation with minimal neutrophilic infiltrates in the overlying gingival mucosa.

Contributor. Letterman Army Institute of Research, SGRD-ULV-P ATTN: Pathology, Presidio of San Francisco, CA 94129-6800.

Slide 76

History. Five similarly affected live nestling parakeets (Melopsittacus undulatus) from a large aviary in the Texas panhandle were submitted for

necropsy. The submitting veterinarian stated that the aviary of origin was clean and well managed. A persistent problem was that about 10% of the nestlings failed to feather normally and the feathers were often curved. Some of the affected birds would "grow out of the problem," but most died or were killed. One or all nestlings in a clutch might be affected and a breeding pair would commonly have interspersed affected and non-affected clutches.

Diagnosis. (1) Crop: Ballooning degeneration, multifocal, mild to moderate, with karyomegalic intranuclear inclusions. (2) Feathered skin: Ballooning degeneration and karyomegalic intranuclear inclusions, with segmental feather degeneration.

Comment. There were little or no inflammatory infiltrates; therefore the lesions were coded as above. Ballooning degeneration was noted in epidermal cells of the crop, skin, feather follicles, and developing feathers (basilar layer, rachus, cells in the rami and penaceous barbules of the barbs and the corneous layer). These lesions are compatible with budgerigar fledgling disease, a condition caused by a papovavirus. This is not to be confused with feather and beak disease (FBD), which has been observed to cause necrosis of epidermal cells of feathers and the beak in selected species of cockatoos. A recent study suggests that the etiologic agent of FBD may be a virus, possibly a parvovirus or picornavirus.

Contributor. Pathology Associates, Inc., P.O. Box 26, MC 923, Jefferson, Arkansas 72079.

Slide 77

History. This is tissue from a 3-month-old brown female canary (Serinus canarius) from a small private aviary that began experiencing a syndrome of progressive debilitation and death in fledgling canaries. The birds were normal until removal from the parents at 2 months of age. Progressive lethargy and anorexia began soon after, and death occurred by 3 months of age. The problem had not been present in previous years, but song sparrows and European gold finches had been introduced to the aviary 4 to 6 months earlier. These birds were caged separately from the canaries but were in the same room. There had also been a change in diet to a product said to be of very high quality. Nine (all) fledglings died, and five were necropsied. Four were DOA, and the bird from which the submitted tissue was taken was killed in extremis. Gross and microscopic findings were similar in all cases.

Diagnosis. (1) Small intestine: Enteritis, granulomatous, diffuse, moderate, with intracytoplasmic protozoa (macrophages and mucosal epithelial cells). (2) Small intestine, epithelium: Hyperplasia, diffuse, moderate.

Comment. Investigations of Isospora serinii have revealed that there are five asexual generations (5 schizont types) in macrophages. Intrahistiocytic schizonts are evident in the lamina propria in most sections and within the mesenteric attachment of some. The last two asexual stages and the sexual stages occur in the intestinal epithelium, which are also evident in these sections. In Isospora serini these intestinal forms are usually located on the luminal side of the epithelial cell nucleus, contrary to I canaria, in which they are usually below the nucleus. The oocysts of both species are passed unsporulated.

Contributor. College of Veterinary Medicine, Drawer V, Mississippi State, Mississippi 39762.

Slide 78

History. This is tissue from an immature (under 2 years old) Macaca mulatta.

Diagnosis. Liver: Hepatitis, subacute, portal and random, with mild scattered single cell necrosis.

Conference Note. To date there are at least five different human hepatic diseases caused by different viruses. These are hepatitis A (picornavirus), hepatitis B (hepadnavirus), hepatitis D (defective RNA virus that requires the "helper function" of hepatitis B virus), hepatitis non-A non-B (an unclassified, 30-50 nm virus), and an "epidemic" form of non-A non-B hepatitis (an hepatitis A-like virus that is unrelated to the agent of "classical" non-A non-B hepatitis). Animal models for these diseases have been developed in a few species of nonhuman primates: hepatitis A--the chimpanzee (Pan troglodytes), the marmoset (Saguinus mystax and S labiatus), and the owl monkey (Aotus trivirgatus); hepatitis B--the chimpanzee, the gibbon (Hylobates lar), and the cynomolgus monkey (Macaca fasicularis); hepatitis D and hepatitis non-A non-B--the chimpanzee; and the "epidemic" form of non-A non-B hepatitis--the marmoset. Histologic changes are not always specific and thus complete serological profiles are usually necessary to confirm the diagnosis, as in this case.

Contributor. Department of Safety Assessment, Merck & Co., Inc., West Point, PA 19486.

Slide 79

History. This is tissue from an 11-year-old male rhesus (Macaca mulatta). The monkey was depressed and reluctant to move and had limited joint flexion. Radiographs demonstrated radiolucent areas and periosteal proliferation of the lower limbs. The animal was humanely killed.

Diagnosis. Long bone, cortex: Hyperostosis, diffuse, moderate.

Comment. Changes observed in hypertrophic osteopathy (hypertrophic pulmonary osteoarthropathy) include increased peripheral blood flow in the distal half of affected limbs, hyperemia and edema of the periosteum, with proliferation of vascular connective tissue, mild focal infiltration of lymphocytes and plasma cells, and deposits of new, spicular bone. The initial bony changes are rapid and are characterized by rays of spicular bone deposited perpendicular to cortical bone. In this particular case the sections are probably from older lesions in which there is remodeling of new bone with lateral bridging. The newer bone can be distinguished from the original cortex by the comparative paucity of osteon formation in the former.

Contributor. Letterman Army Institute of Research, SGRD-ULV-P, ATTN: Pathology, Presidio of San Francisco, CA 94129-6800.

Slide 80

History. This is tissue from a 16-month-old female fawn-hooded rat. She was observed to have thickened pinna 45 days prior to euthanasia. The extent of thickening increased progressively after the initial observation. She had prolonged bleeding (greater than 15 minutes from 2 mm tail tip excision).

Diagnosis. Ear: Chondritis, pyogranulomatous, multifocal, mild with focally extensive chondrohyperplasia and osseous metaplasia.

Comment. Auricular lesions, as noted in this case, have been reported as spontaneous lesions in Sprague-Dawley-derived rats (180/4876, 3.7%) as well as in fawn-hooded rats (29/200, 15%). Experimentally, similar lesions have been reproduced in Wistar-Lewis rats sensitized to type II collagen with bovine type II collagen. It is not known if the spontaneous rodent lesions are associated with autoantibodies to type II collagen as are the lesions of polychondritis of man. Similarities of the human and animal condition are the primary involvement of cartilage and the chondrolysis seen in early lesions (not observed in our sections). The dissimilarities include the additional involvement of cartilage of the nose, larynx, trachea, and bronchi; the pain associated with the lesions; and the acute inflammatory response observed in polychondritis. As stated in the history, this fawn-hooded rat displayed prolonged bleeding time. This is a genetic trait (one of the pleiotropic effects of the autosomal recessive red-eyed dilution(r) gene) resulting in a platelet storage pool deficiency, a deficiency in which platelets are unable to store and secrete adenine nucleotides and serotonin.

Contributor. WSU, Dept. Vet. Micro/Path, Pullman, WA 99164-7040.

Slide 81

History. This is tissue from a 7-year-old Arabian-cross gelding that had recurrent moderate bilateral epistaxis. A discrete, slightly raised, ulcerated mass (approx. 2 cm in diameter) was in the alar folds of the medial wall of each nostril. Both masses were surgically resected.

Diagnosis. Nasal mucosa and submucosa: Rhinitis, pyogranulomatous, diffuse, moderate, with marked amyloid deposits.

Comment. The differential diagnosis for nasal amyloidosis includes fungal granulomas of the nasal septum, ethmoid hematoma, dental tumors of the maxilla eroding into the nasal cavity, and glanders.

Contributor. Department of Veterinary Pathology, University of Liverpool, P.O. Box 147, Liverpool L69 3BX, England.

Suggested reading. Shaw, D. P., Gunson, D. E., and Evans, L. H.: Nasal amyloidosis in four horses. Vet. Pathol. 24: 183-185, 1987.

Slide 82

History. This is tissue from a 6-month-old mixed-breed female dog. She had been vomiting for 5 days and had a BUN of 260, a creatinine level of 9, and serum phosphorus level of 18. Renal failure was diagnosed and euthanasia was elected.

Diagnosis. Tooth, dentin: Dysplasia, focally extensive, with diffuse odontoblast degeneration.

Comment. Based on the H&E-stained sections examined, the dentin dysplasia is characterized by wavy, sparse tubules; in the coronal area there is degeneration of dentin with interspersed denticles. Involvement of enamel could not be assessed in the sections.

Contributor. School of Veterinary Medicine, University of Wisconsin, 2015 Linden Drive West, Madison, WI 53706.

Slide 83

History. This is tissue from a 7-year-old Holstein cow. This cow was one of four in a herd of 59 that had developed a generalized pruritic dermatitis characterized by extensive areas of alopecia and mild excoriation. The affected cows were anorexic with moderate loss of weight; one cow had aborted. Onset of clinical signs coincided with the cows having access to an alfalfa pasture.

Diagnosis. Heart: Myocarditis, granulomatous, eosinophilic, multifocal and coalescing, severe.

Comment. The differential diagnosis includes eosinophilic myocarditis. Neither fungal elements nor acid-fast organisms were noted on special stains. The mixed cellular infiltrate and multinucleated giant cells are consistent with hairy vetch (Vicia villosa) toxicity. This is a systemic granulomatous disease observed in cattle and horses grazing on V villosa. The infiltrates have been reported in a wide variety of tissues. The mechanism of toxicity is unknown.

Contributor. C. E. Kord Animal Disease Lab., P.O. Box 40627, Melrose Station, Nashville, TN 37204.

Slide 84

History. This is tissue from a 1-year-old male Mastomys natalensis that was one of many aged animals in a colony that developed multiple skin lesions.

Diagnosis. Haired skin: Multiple epithelial tumors with follicular differentiation.

Comment. The expression of the endogenous papilloma virus within the different epithelial cell types of hair follicles accounts for the variety of trichoepitheliomatous differentiation within these tumors. This rodent is not a common laboratory animal. Its use is restricted because it is a documented reservoir of Lassa fever virus.

Contributor. Laboratory of Pathology, Univ. of Pennsylvania, School of Veterinary Medicine.

Slide 85

History. This is tissue from a 16-year-old male (castrated) Cairn terrier. A firm nodule, 2 cm in diameter and of unknown duration, was removed from the ventral abdomen.

Diagnosis. Haired skin: Lipoma with multifocal chondroid differentiation.

Comment. Chondroid differentiation is more common in malignant than in benign soft tissue neoplasms. The cartilage in the mass is extraordinarily mature. We prefer to apply the term "differentiation" to the description of such changes in neoplasms, reserving "metaplasia" for changes in non-neoplastic tissues.

Contributor. Laboratory of Pathology, University of Pennsylvania, School of Veterinary Medicine.

Slide 86

History. This is tissue from a mass removed from the left side of the face of a 4-1/2-year-old domestic shorthair female cat.

Diagnosis. Haired skin: Dermatitis, ulcerative, pyogranulomatous, diffuse, severe, with numerous intrahistiocytic yeast forms.

Comment. The differential diagnosis in this case includes Candida spp, Histoplasma capsulatum, and Trichosporon spp. Cats are naturally susceptible to this fungus; therefore, affected individuals are not necessarily immune-compromised. Lesions may be of a cutaneous or a lymphocutaneous form, and 50% of an experimentally infected group of cats developed disseminated disease. Intact organisms may be shed in feces. The spread of S schenckii is usually through puncture wounds; however, exposure of intact skin to infected wounds has resulted in infection. There have been several reports of feline-to-human transmission. There is usually a mixed purulent and granulomatous reaction, as noted in this case.

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History. This is tissue from a 3-month-old male Arabian horse. The animal appeared normal at birth. Soon after birth the foal became ataxic and hypermetric and began having intention tremors and headbobbing. These signs progressively worsened until the animal was humanely killed.

Diagnosis. Cerebellum: Abiotrophy, diffuse, severe, with paucity of Purkinje cells and hypocellularity of the granular cell layer.

Comment. The differential diagnosis for ataxia in a foal includes heritable and acquired cerebellar developmental defects, cervical vertebral stenotic myelopathy, equine protozoal myeloencephalitis, cerebellar nematodiasis, neuritis of the cauda equina, sacrococcygeal vertebral trauma, complications of otitis media, toxins (mycotoxins, sudan and sorghum grass), as well as bacterial, viral, and fungal infections.

Cortical changes within the granular, molecular, and Purkinje cell layers were variable within and between sections. Regarding the heterotopia of Purkinje cells, normal cerebellar cytoarchitectural development, including maturation and positioning of Purkinje cells, depends on the establishment of orderly synaptic complexes by microneurons (basket, stellate, and granular cells). This orderly arrangement and subsequent, inductive influences require the proper differentiation and migration of microneurons from the external granular layer to their respective sites within the cerebellar folium. Malpositioning of Purkinje cells within the cerebellar white matter has been observed in certain human genetic abnormalities.

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History. This is tissue from a 6-month-old (gender and breed unknown) lamb. The sample was submitted from a farm on which three other lambs died with similar symptoms. According to the owner the animal had deteriorated over a period of 1 week. The lamb would lag behind, and it eventually died. At the time of death foam was running out of the lamb's nose.

Diagnosis. Lung: Adenocarcinoma (pulmonary adenomatosis), multicentric.

Comment. Pulmonary adenomatosis, also known as jaagsiekte, sheep pulmonary adenomatosis, and bronchiolo-alveolar adenocarcinoma, is a virus-induced infectious bronchiolo-alveolar tumor that behaves as a low-grade carcinoma metastasizing most often to bronchial and/or mediastinal lymph nodes and less often to extrathoracic sites such as muscle or kidney.

Initial morphological and biochemical characterization of the jaagsiekte virus indicates that it is a retrovirus (jaagsiekte retrovirus, JSRV).

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Suggested reading. Querat, G., Barban, V., Sauze, W., Vigne, R., Payne, A., York, D., DeVilliers, E. M., and Verwoerd, D. W.: Characteristics of a novel lentivirus derived from South African sheep with pulmonary adenocarcinoma (jaagsiekte). Virol. 158: 158-167, 1987.

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History. This is tissue from a stillborn standardbred male horse. The two sections are from different areas of placenta. This fetus and its twin were stillborn and term. The placentae were presented separate from each other.

Diagnosis. Placenta, chorioallantois: Villous aplasia, focal, severe, with squamous metaplasia and organizing fibrinous clot.

Comment. Twinning is the single largest cause of abortion and perinatal death in horses. There is breed variation in the reported incidence of twinning, with the incidence in thoroughbreds being the highest (1-2% vs

0.2-0.3% in Arabian mares). There are three morphological categories (types A, B, and C) of fetal positioning that are based on the location of the chorionic sacs within the uterus. In type B, villous surface areas are approximately evenly divided, while in type A the larger twin occupies all of one horn and most of the uterine body. Type C has the greatest disparity in surface areas, with the smaller twin occupying only part of one horn. This disparity of surface areas does not always explain fully the fetal losses and abortions. In some instances (type A) the larger fetus has died and the smaller survived. Regions of the placenta that normally lack villi are: the cervical star, the ostia (opposite the fallopian tubes), endometrial cup sites, the site of yolk sac attachment, and the placental folds.

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History. This is tissue from a 10-day-old Holstein calf. The owner had three calves, born on two consecutive days, that were unable to rise, in opisthotonus, and blind. The clinical signs were present from birth. Three calves born subsequently were clinically normal.

Diagnosis. (1) Eye, retina: Dysplasia, with fibroglial proliferation, diffuse, severe. (2) Eye, cornea: Keratitis, ulcerative, chronic-active, focally extensive, moderate with neovascularization.

Comment. The result of embryonic or fetal infection with bovine diarrhea virus (BVDV) is dependent upon the gestational age of the calf and the viral biotype (cytopathic and noncytopathic). Stillbirths and congenital defects, as in this case, are induced by fetal infection between 120 and 150 days of gestation with either cytopathic or noncytopathic BVDV. Congenital defects may vary in severity depending on time of fetal infection within the 30-day window. Earlier infection of a fetus (40-120 days of gestation) with cytopathic BVDV results in abortion; however, infection of a similar aged fetus with a noncytopathic biotype results in a BVDV seronegative new born that is persistently infected.

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