There is both an art and a science of veterinary pathology.

All of us are familiar with the science. A good pathologist understands much of the technology that leads us to the correct diagnosis—histochemistry, electron microscopy, immunohistochemistry, as well as the infinite number of biochemical, genetic, and other molecular processes that shape animal tissue in health and disease. But our profession is an art, too, and the primary purpose of this course is to help you hone those skills. We all agree that the correct diagnosis is king—it is what we are paid for and how we gain our reputation. But there is much more to what we do.

In 1953, the first examination of the American College of Veterinary Pathologists was given, a test whose format stands much the same today. In that first exam, and in every test since, one part of the exam consisted of a series of 20 slides which attendees must not only correctly diagnose, but also describe—a process that requires excellent observational skills, a keen analytical thought process, and the ability to translate these thoughts into a logically structured discourse. In short, the architects of this examination identified communication as a cornerstone of our specialty—and this is as correct today as it was almost sixty years ago. The techniques which we will discuss in this course are much more, however, than just a way to help you pass an examination—they are techniques while have helped the faculty throughout our entire careers. As pathologists, we communicate our results in many ways—through consultation letters to clients, through correspondence to colleagues, even in our contributions to scientific journals and textbooks. The ability to communicate clearly is one of the greatest skills that a veterinary pathologist can possess.

The ability to diagnose correctly is the mark of a good pathologist; the ability to communicate those results to those around you will help to make you a great one.

Bruce Williams, DVM, DACVP
Course Director
NEOPLASMS

HISTORY: A rapidly growing cutaneous mass from a cat.

MORPHOLOGIC DESCRIPTION: Within, expanding and replacing the dermis, elevating and compressing the overlying superficial dermis, and extending to the cut border is a multilobulated, partially encapsulated, poorly demarcated, moderately cellular infiltrative mass composed of poorly defined interlacing streams and bundles of tightly packed spindle cells. The neoplastic cells have indistinct cell borders and a moderate amount of eosinophilic fibrillar cytoplasm. Nuclei are irregularly round to elongate with lightly stippled chromatin, prominent nuclear borders, and a single, usually central magenta nucleolus. There is scattered anisokaryosis and karyomegaly. Mitoses average 1 per 10 HPF but in areas are up to 2 per HPF. Multifocally within the mass are areas of necrosis with hemorrhage, fibrin, edema, and infiltrates of few lymphocytes, plasma cells, and macrophages (often containing hemosiderin). Multifocally lymphatics are distended by clear space (edema). Multifocally within the stroma and adjacent dermis are nodular perivascular aggregates of lymphocytes, plasma cells, and lesser macrophages. Multifocally there is minimal orthokeratotic hyperkeratosis of the overlying epithelium.


HISTORY: Sclerotic mass in the intestine of a cow.

MICROSCOPIC DESCRIPTION: Small intestine. Multifocally expanding and infiltrating all layers of the intestinal wall is an unencapsulated, poorly demarcated, poorly cellular infiltrative mass composed of widely scattered tubules supported by an abundant dense fibrovascular stroma. Neoplastic cells are cuboidal to columnar, with variably distinct cell borders and small to moderate amounts of granular eosinophilic cytoplasm. Nuclei are basilar with coarsely stippled chromatin and one to two basophilic nucleoli. The mitotic rate averages 1-3 per HPF. There is multifocal vascular invasion. Tubules often contain variable amounts of eosinophilic and karyorrhectic cellular debris admixed with small numbers of degenerate neutrophils and macrophages. Multifocally, the stroma contains small to moderate numbers of lymphocytes, plasma cells, and fewer macrophages, scattered neutrophils and eosinophils, and often contains moderate amounts of a foamy, amphophilic material (mucin). Within the lamina propria and submucosa of the remaining preexisting tissue, there is a moderate increase in lymphocytes, plasma cells, and eosinophils. Lymphatics in the submucosa are dilated and connective tissue fibers are loosely arranged (edema).

MORPHOLOGIC DIAGNOSIS: Small intestine: Adenocarcinoma, tubular, breed not specified, bovine.
INFLAMMATORY LESIONS

HISTORY: Two cutaneous masses, one on the right distal tibia and one on the left forelimb digit were excised from a 2-1/2 year old female grey kangaroo (Macropus fuliginosus).

MORPHOLOGIC DESCRIPTION: Haired skin: There is a focally extensive, verrucous proliferation of the epidermis, characterized by multiple, closely associated, elongate folds (up to 1/2 cm) which compress the interposed dermis and extend above and below the adjacent unaffected epidermis. Within this area, severe ballooning degeneration thickens the stratum spinosum and occasionally the stratum granulosum 4-5X normal thickness; affected cells frequently contain a large (15-20u), irregularly shaped, homogenous, eosinophilic to basophilic, intracytoplasmic inclusion body (Molluscum body) which displaces the nucleus. The epithelium of hair follicles is similarly affected. There is diffuse mild parakeratotic hyperkeratosis, often containing retained inclusion bodies admixed with necrotic cellular debris and hemorrhage; similar material often fills hair follicles. Mildly thickening the deep dermis are nodular aggregates of moderate numbers of lymphocytes and macrophages, admixed with occasional plasma cells and neutrophils. Scattered throughout, within the remaining dermis are similar inflammatory cells and occasional mildly dilated lymphatics (edema).

MORPHOLOGIC DIAGNOSIS: Haired skin: Hyperplasia, epidermal and follicular, focally extensive, severe, with eosinophilic intracytoplasmic inclusion bodies and chronic dermatitis (molluscum contagiosum)

HISTORY: Tissue from a Mangabey monkey that died shortly after arrival from the supplier.

MORPHOLOGIC DESCRIPTION: Lung: Diffusely, alveoli and bronchioles are partially to completely filled with abundant RBCs, fibrin and edema admixed with variable combinations and concentrations of often degenerate macrophages, neutrophils, and rare lymphocytes. In some areas of the section, alveolar septa are thin, fragmented and discontinuous, and replaced by karyorrhectic debris (necrosis). In other areas, they are mildly thickened with similar inflammatory cells, fibrin and edema as described previously. Multifocally, there is mild hemorrhage in the bronchiolar mucosa and smooth muscle and mild peribronchiolar and perivascular hemorrhage and edema. Bronchiolar mucosa is segmentally lost and bronchioles are occasionally lined by flattened epithelium covered by scattered, small, surface colonies of 1um basophilic cocci. Multifocally, low numbers of neutrophils, often degenerate, transmigrate the walls of pulmonary veins disrupting and fragmenting smooth muscle (vasculitis). There is diffuse mild congestion.

MORPHOLOGIC DIAGNOSIS: Lung: Pneumonia, fibrinohemorrhagic, acute, diffuse, with vasculitis and colonies of cocci, Mangabey monkey, primate.

ETIOLOGIC DIAGNOSIS: Pneumococcal pneumonia

ETIOLOGY: Streptococcus pneumoniae (Diplococcus)
HISTORY: Tissue from a dog with a two-year history of progressive ataxia and posterior paresis with pain.

MICROSCOPIC DESCRIPTION: Cerebral cortex and diencephalon: Multifocally within and expanding the neuropil of both grey and white matter, more severely in the diencephalon, are multiple randomly scattered, often periventricular, nodular aggregates (up to 3 mm in diameter) of large numbers of macrophages, lymphocytes, and plasma cells, with fewer neutrophils and rare Mott cells. Similar individual or small clusters of these inflammatory cells extend into the surrounding fragmented neuropil. The periventricular inflammatory foci expand into the ventricle and elevate the overlying ependyma. Within these areas are multiple, small blood vessels lined by plump endothelium (neovascularization). Within the adjacent neuropil there is minimal to mild microgliosis, rounded astrocytes with eosinophilic cytoplasm (gemistocytes) and a few eosinophilic spheroids (swollen axons). Multifocally, blood vessels are surrounded by cuffs of low to moderate numbers of lymphocytes and fewer plasma cells, which occasionally extend into the adjacent neuropil. Low to moderate numbers of macrophages contain one to ten, 2-4 um, round to oval yeasts with a central 1 um basophilic dot surrounded by a clear space.

Morphologic Diagnosis: Cerebral cortex and diencephalon: Encephalitis, granulomatous and lymphoplasmacytic, subacute to chronic, multifocal, moderate with intrahistiocytic yeasts, etiology--consistent with Histoplasma capsulatum, breed unspecified, canine.

HISTORY: Esophageal lesion found in a dog.

MICROSCOPIC DESCRIPTION: Esophagus: Within a focally extensive area, thickening the wall of the esophagus (2x), and elevating the overlying mucosa, there is a large (l x l.5cm), expansile nodule which replaces much of the submucosa and tunica muscularis. The nodule is composed of a thick, 1 to 3mm fibrous connective tissue capsule, containing numerous small blood vessels, with an inner rim of abundant plasma cells, and lesser lymphocytes and macrophages (many containing hemosiderin) enmeshed in strands of fibrous connective tissue, which in turn, surrounds a central cavity containing multiple sections of a large (1 mm dia.) metazoan parasite and abundant necrotic cellular debris. The parasite is characterized by a smooth cuticle, coelomarian-polymyarian musculature, prominent lateral cords, a pseudocoelom containing small amounts of an eosinophilic granular material, a large digestive tract lined by columnar epithelium with long microvilli, and reproductive organs. Multifocally within the adjacent muscularis, there are swollen and condensed muscle fibers (degeneration) often separated by small amounts of fibrous connective tissue. Diffusely, there is a mild increase in fibrous connective tissue within the lamina propria and remaining submucosa and there are low numbers of lymphocytes and plasma cells scattered throughout the section. There is a nodular focus on the adventitia containing occasional macrophages, haphazardly arranged fibrous connective tissue, necrotic cellular debris and numerous basophilic coccoid bacteria (probably postmortem overgrowth).

MORPHOLOGIC DIAGNOSIS: Esophagus, submucosa, tunica muscularis: Granuloma, focally extensive, severe, with nematode parasite consistent with Spirocerca lupi, breed unspecified, canine.
Example Microscopic Descriptions
Descriptive Path Course

**HISTORY:** Tissue from an adult rhesus monkey (*Macaca mulatta*).

**MICROSCOPIC DESCRIPTION:** Lung: Multifocally, bronchioles and bronchi have varying amounts of inflammatory and epithelial changes. Within the lumen and extending through the bronchiolar wall are moderate numbers of neutrophils and macrophages with fewer eosinophils, lymphocytes, and foreign body multinucleate giant cells. This inflammatory infiltrate often extends into adjacent alveoli. Mucosal epithelial cells vary from columnar to cuboidal to squamous and occasionally are denuded. Bronchiolar walls are also variably thickened by moderate to abundant amounts of increased fibrous connective tissue. Multifocally within bronchiolar walls and the pulmonary interstitium are numerous aggregates of large numbers of macrophages with intracytoplasmic golden-brown, globular to granular pigment containing refractile spicules. Also, there is a multifocal mild increase in peribronchiolar lymphoid aggregates (lymphoid hyperplasia) and there is a small focus of peribronchiolar hemorrhage. Three subpleural bronchioles contain round to oval sections of a metazoan parasite, 300-500µ in diameter. These parasites have a body cavity, striated musculature, and jointed appendages with a lightly chitinized cuticle which lacks external segmentation. Other identifiable structures include the brain, gut segments, and uterus. Often surrounding the parasite is a concentrated infiltrate of neutrophils.

**MORPHOLOGIC DIAGNOSIS** - Lung: Bronchitis, bronchiolitis, and peribronchiolitis, pyogranulomatous, chronic, multifocal, moderate with peribronchiolar pigmentation and intraluminal acarine parasites, rhesus monkey, *Macaca mulatta*.

**ETIOLOGIC DIAGNOSIS:** Pulmonary acariasis.

**ETIOLOGY:** *Pneumonyssus simicola*

**HISTORY:** Incidental finding in a squirrel monkey.

**MICROSCOPIC DESCRIPTION:** Liver: Multifocally within large bile ducts, distending and occluding the lumina, are cross-sections of a trematode parasite which is slightly flattened, measuring up to 700 x 400µ diameter, with a thin tegument overlying a narrow band of somatic muscle, and no discernible body cavity. Scant internal structures are suspended in a parenchymatous matrix, and consist of paired tubular organs lined by a ciliated epithelium (ceca), a few cells with small dense nuclei and globular, golden brown cytoplasm (vitellarian glands) and numerous yellow, thick shelled, rarely operculate eggs measuring up to 40 x 25µ, often containing deeply eosinophilic, basophilic, or black, multinucleate structures (morula). Diffusely, portal areas are infiltrated by moderate numbers of lymphocytes, plasma cells, and fewer macrophages of neutrophils. There is diffuse mild hepatocellular vacuolar change.

**MORPHOLOGIC DIAGNOSIS** - Liver: Hepatitis, lymphoplasmacytic, diffuse, periportal, mild, with intraductal trematodes, squirrel monkey, *Saimiri sciureus*, primate.

**ETIOLOGIC DIAGNOSIS:** Biliary distomiasis.

**ETIOLOGY:** Most likely *Athesmia foxi*, but *A. heterolecithodes, wehri* have been reported.
HISTORY - Tissue from a female rhesus monkey that had a poor appetite for several months. She had lost 4 kg of body weight prior to death, and on gross necropsy a firm palpable mass was found in the abdomen.

MICROSCOPIC DESCRIPTION: Colon, mesentery and mesenteric lymph nodes: Multifocally within the tunica muscularis, extending into and replacing glands of the mucosa, and present within the mesenteric fat are discreet foci of tortuous glandular tissue surrounded by abundant, densely cellular stroma. The glands are lined by a pseudostratified columnar epithelium with palisading, often anti-basilar nuclei and moderate amounts of a clear to lightly eosinophilic cytoplasm (uterine glands). The stroma is composed of stellate to spindled cells with scant eosinophilic, fibrillar cytoplasm and oval to elongate nuclei. Mitoses in these areas are 1/HPF (uterine stroma). There is within the mesenteric fat a single focus of glands and stroma, as described, which is undergoing lytic necrosis, with scattered pyknotic and karyorrhectic cellular debris and infiltration by moderate numbers of viable and degenerate neutrophils, occasional macrophages and moderate hemorrhage, which extends into the adjacent adipose tissue.

The lymph node contains mildly increased numbers of erythrophagocytic macrophages within the paracortical and medullary sinuses.

MORPHOLOGIC DIAGNOSIS: Colon, mesentery: Endometriosis, transmural, moderate.

HISTORY: Incidental finding in a Sprague-Dawley rat.

MORPHOLOGIC DESCRIPTION: Small intestine and mesentery: Diffusely affecting up to 85% of mesenteric and mural arteries and arterioles, thickening the walls up to 20x normal are numerous plump fibroblasts which extend from the media to the adventitia and into the perivascular connective tissue. The intima and media of most vessels is disrupted, with segmental fragmentation of collagen bundles, loss of the internal elastic lamina, scattered karyorrhectic debris, and infiltration by moderate numbers of neutrophils, macrophages and fewer fibroblasts (necrotizing vasculitis). Occasionally the media is replaced by abundant, amorphous to flocculent, brightly eosinophilic material (fibrinoid necrosis). Within the media, adventitia and, less often, perivascular tissue there are moderate numbers of neutrophils, fewer lymphocytes, plasma cells, macrophages and eosinophils, with scattered minimal hemorrhage.

MORPHOLOGIC DIAGNOSIS: Small intestine and mesentery, arteries: Vasculitis, proliferative and necrotizing, chronic-active, diffuse, moderate.

CONDITION: Polyarteritis nodosa
**HISTORY:** Tissue from a male German shepherd that developed an abnormal gait with a progressive loss of proprioceptive and motor nerve function.

**MICROSCOPIC DESCRIPTION:** Spinal cord (2 sagittal and 2 cross sections with dura and nerve roots): There is diffuse moderate degeneration of white matter affecting all funiculi and nerve roots with large variation in the diameter of axon sheaths, ranging up to 50 um. Swollen sheaths contain axons which are swollen and rounded up to 30 um diameter (spheroids). Sheaths also contain acidophilic fibrillar material, single or rarely multiple macrophages with abundant foamy cytoplasm (Gitter cells), or clear space (loss of axons, demyelination). On sagittal section, there are numerous linear 30 x 50 um clear spaces containing degenerative/necrotic axons and gitter cells (ellipsoids, digestion chambers). There is a mild gemistocytic gliosis within white matter. Scattered neurons contain an intracytoplasmic finely granular, yellow-brown pigment (lipofuscin). One cross section contains multifocal dural ossification with bone marrow.

**MORPHOLOGIC DIAGNOSIS:**
1. Spinal cord and nerve roots: Degeneration, axonal, with swollen axon sheaths, and digestion chambers, diffuse, moderate
CYTOLOGY

Tissue from the lymph node of a dog.

CYTOLOGIC DESCRIPTION: Two images from a good quality, markedly cellular fine needle aspirate. The aspirate contains clusters and individualized neoplastic epithelial cells, admixed with large numbers of viable and degenerate neutrophils, and lesser numbers of lymphocytes, lymphoblasts, macrophages, erythrocytes, and rare spindle cells on a pale blue proteinaceous background. There is also a cholesterol crystal in one image. Within clusters, neoplastic cells exhibit anisokaryosis, and have moderate amounts of dark blue cytoplasm with prominent vesicular clearing in the perinuclear area. Neoplastic cells exhibit moderate anisokaryosis and nuclear molding. Rare mitotic figures are present. Scattered throughout the aspirate are large polygonal cells with distinct cell borders and brightly lucent blue cytoplasm (keratinized cells).

CYTOLOGIC DIAGNOSIS(ES): Lymph node: Metastatic squamous cell carcinoma