VPM 152
Introduction to Pathology
January 2006

I. Definitions and Terminology

Disease: (2 definitions)

1. A disorder of structure or function, especially one that produces specific symptoms.
2. Any deviation from, or interruption of, the normal structure or function of any part, organ, or system of the body; which may be clinical (characteristic set of symptoms and signs) or subclinical and whose etiology, pathology and prognosis may be known or unknown.

Pathology: (2 definitions)

1. The study of disease; literally, the study (*logos*) of suffering (*pathos*).
2. The study of the functional, biochemical and morphological alterations in cells, tissues and organs that underlie disease.

General Pathology: The study of the basic reactions of cells and tissues to abnormal stimuli that underlie all diseases.

Systemic Pathology: The study of the specific responses of specialized organs and tissues to more or less well defined stimuli.

Four aspects of a disease form the core of pathology:

Ø **Etiology** - The cause of disease.
Can be intrinsic, eg genetic – or - extrinsic, eg infectious, chemical, physical, etc

Ù **Pathogenesis** - The mechanisms or sequence of events leading from initiation of cell or tissue injury to development of disease.

Ú **Morphologic Changes** - The structural alterations in cells or tissues that are often characteristic of the disease process.

Û **Functional Derangements / Clinical significance**
The nature of the morphologic changes and their distribution in organs / tissues influence normal function and determine the clinical features (*symptoms* and signs), course and prognosis of the disease.

Lesion: A circumscribed structural or functional abnormality. The change may involve an organ or tissue, cell or a subcellular organelle.

Pathognomonic: A lesion or sign that is specifically distinctive or characteristic of a disease or pathological condition.

Necropsy/Autopsy:

- Postmortem examination of the body to determine the nature of pathological processes that contributed to death or disease.
  - Autopsy is usually defined as examination of a human body.
  - Necropsy is the postmortem examination of any other animal.

Biopsy: The removal and examination of tissue from the living body to establish a precise diagnosis.

Diagnosis: A concise statement or conclusion concerning the nature, cause, or name of a disease.

Differential Diagnosis: A list of diagnoses that could account for the clinical signs or lesions in a case.

Clinical Diagnosis: A diagnosis based on the data obtained from the case history, clinical signs, and physical examination.

Morphologic Diagnosis: A diagnosis based on predominant lesion(s) in the tissue(s).

- It may be macroscopic (gross) or microscopic and describes the severity, duration, distribution, nature of the lesion and location (eg severe, acute, locally-extensive, fibrinous bronchopneumonia).
- Also known as a lesion diagnosis.

Etiologic Diagnosis: A definitive diagnosis that names the specific cause of the disease.

Disease Diagnosis or "Name the Disease": A specific diagnosis that states the common name of the disease.

- An 8-week old puppy presented to the veterinary clinic with severe bloody diarrhea of 2 days duration. The puppy died prior to complete clinical work up. A necropsy was performed.

1. Clinical Diagnosis..... Hemorrhagic diarrhoea
2. Morphologic Diagnosis..... Severe, acute, diffuse, necrohemorrhagic enteritis
3. Etiologic Diagnosis..... Parvoviral enteritis
4. Disease Diagnosis..... Canine Parvovirus

II. Who are Pathologists?

Î **Morphologic (anatomic) Pathologists vs Clinical Pathologists**

- Morphologic ! study morphologic manifestations of disease (gross, LM, EM, etc)
- Clinical ! laboratory analysis of disease in living patients (cytology, hematology, chemistry, etc)

Ï **Veterinary vs Medical vs Comparative Pathology**

- Veterinary pathologists ! mammalian, avian, zoo & wildlife, lab animals / primates, fish, etc.
- Medical pathologists ! human beings
- Comparative pathologists ! animal models of human disease.

Ð **Diagnostic Pathology vs Experimental/Molecular Pathology vs Toxicologic Pathology**

- Diagnostic ! necropsy and surgical biopsies.
- Experimental ! infectious, oncology, toxicologic, etc.
- Molecular ! Study the molecular / genetic basis of disease (PCR, RFLP, DNA sequencing, etc).
- Toxicologic ! Study changes elicited by pharmacological, chemical and environmental agents.

Ñ **Special systems –** Study a particular body organ or system.

- neuropathologists, dermatopathologists, immunopathologists, etc.

III. Descriptions in Gross Pathology

1. No interpretation should appear in descriptions. (It is possible for any person with a command of the language to describe perfectly a necropsy specimen, although she/he knows nothing of its significance).

2. Description should be
   - Ø Concise
   - Ù Grammatically correct
   - Ú Anatomically Precise

3. No comparative reference to food or sports equipment is necessary.

4. Avoid making a description based on a preconceived diagnosis (3 Steps Useful in Veterinary Medicine)
   - Ø **OBSERVE** carefully
   - Ù **DESCRIBE** completely
   - Ú **DIAGNOSE** (DEDUCE or INTERPRET) confidently

5. Points you need to describe (not all are applicable in every case).
   - Ø TISSUE.....Identify the organ or structure. **Te**
   - Ù NUMBER .....How many lesions are present? **N**
   - Ú DISTRIBUTION.....Focal, multifocal, locally-extensive, diffuse **Di**
   - Û SHAPE.....spherical, approximately rectangular, symmetrical, etc **S**
   - Ü COLOUR .....Please - no unusual color terms. **C**
   - Ý SIZE..... metric length, area, weight, % of organ involved **S**
   - Þ PATTERN .....centrolobular, reticulated, cobblestone **Pa**
   - ß CONSISTENCY ..... soft, firm, hard, fluctuant, fluid **Ce**
   - à SPECIAL FEATURES ...Attached, pedunculated **S**
   - á Other
     - Odor: significant and distinctive odors, eg: sweet, foul, sulphur-like, etc
     - Lumen of tubular organs: patent, dilated, narrowed, obstructed, obliterated, branched, etc
     - Surface: smooth, rough, nodular, shiny, dull, pitted, ulcerated, elevated, depressed, glistening, etc

6. You must know the NORMAL before you can recognize the ABNORMAL!

7. Avoid using the word "lesion" in your description. A lesion is any abnormal structural or functional change in organ, tissues, or cells. Therefore, it is an imprecise word to describe a focus, nodule, etc.

8. Morphologic Diagnoses: include the following modifiers/qualifiers,
   - Ø Severity - mild, moderate, marked/severe
   - Ù Duration - peracute, acute, subacute, chronic, chronic-active
   - Ú Distribution - focal, multifocal, coalescing, locally extensive, diffuse, bilateral/unilateral, symmetric.
   - Û Nature of the lesion – If inflammatory type of exudate - (purulent, fibrinous, necrotizing).
     If degenerative – type of degeneration.
     If neoplastic – type of neoplasia.
   - Ü Organ +/- anatomic modifiers
     (eg, nephritis, interstitial nephritis, glomerulonephritis, pyelonephritis)

Anatomic Terminology

ORGAN + OPATHY (any disease of the organ).
eg, **Hepatopathy** - Any disease of the liver (usually refers to a non-inflammatory condition).
Endocrine Dermatopathy - disease of the skin resulting from an endocrine disorder.

ORGAN + OSIS (any disease of an organ, especially one not characterized by inflammation).
eg, **Nephrosis** - Any disease of the kidney; especially when degeneration and/or necrosis of renal tubules.

ORGAN + ITIS (an inflammatory disease of the organ).

eg, **Tracheitis** - inflammation of the trachea.

Classification of Inflammatory Lesions

(modified from **Mechanisms of Disease, Slauson & Cooper, 2002, p149**)

Severity	Duration	Distribution	Exudate	Anatomic Modifiers	Organ
Minimal	Peracute	Focal	Suppurative / purulent	Interstitial	Nephritis
Mild	Acute	Multifocal	Fibrinous	Broncho-	Hepatitis
Moderate	Subacute	Locally extensive	Necrotizing	Glomerulo-	Enteritis
Marked or Severe	Chronic	Diffuse	Fibrinopurulent		Pneumonia (pneumonitis)
	Chronic-active		Granulomatous		Encephalitis

C examples of morphologic diagnoses

- Multiple compound (open) fractures of the left femur
- Moderate, diffuse, bilateral, adrenal cortical hyperplasia
- Mild left ventricular hypertrophy (heart)
- Squamous cell carcinoma of the ear
- Moderate, acute, multifocal, necrotizing, hepatitis
- Subacute, locally extensive, ulcerative, dermatitis
- Severe diffuse bilateral nephrosis
- Uterine rupture, locally-extensive, severe
- Hypertrophic cardiomyopathy, severe

FREQUENTLY USED TERMINOLOGY USED IN PATHOLOGY

SYSTEM	INFLAMMATION	NON-INFLAMMATORY
RESPIRATORY	bronchopneumonia, tracheitis, embolic pneumonia, bronchiolitis, laryngitis, rhinitis, sinusitis	atelectasis, emphysema, pulmonary carcinoma, pulmonary hemorrhage
DIGESTIVE	abomasitis, rumenitis, gastritis, esophagitis, stomatitis, enteritis, colitis, typhlitis, enterocolitis	bloat, dental tartar, gastric torsion, gastric ulcer, intestinal carcinoma, intestinal infarction, intussusception
URINARY	glomerulonephritis, cystitis, nephritis, pyelonephritis, urethritis	glomerular amyloidosis, renal cysts, hydronephrosis, nephrosis, renal calculus, renal cortical necrosis, renal dysplasia, renal hypoplasia
INTEGUMENT	dermatitis, folliculitis, furunculosis, panniculitis, epidermitis, cellulitis	acanthosis, alopecia, epitheliogenesis imperfecta, histiocytoma, hyperkeratosis, macule, seborrhoea, dermatopathy, dermatoses
FEMALE GENITAL	cervicitis, metritis, placentitis, salpingitis, vaginitis, pyometra, endometritis, mastitis	cystic uterine hyperplasia, granulosa cell tumour, mammary dysplasia, parovarian cysts, uterine leiomyoma
MALE GENITAL	balanoposthitis, epididymitis, orchitis, prostatitis	penile fibroma, seminoma, testicular degeneration, testicular hypoplasia
LIVER	cholangiohepatitis, hepatitis, cholangitis	hepatic necrosis, hepatic lipidosis, massive necrosis, nodular hyperplasia, passive congestion, periacinar necrosis, hepatosis
PANCREAS	pancreatitis	nodular hyperplasia, diabetes, pancreatic atrophy
PERITONEUM	peritonitis	ascites, mesothelioma, abdominal fat necrosis
CARDIOVASCULAR	arteritis, endocarditis, myocarditis, epicarditis, lymphangitis, phlebitis, omphlalophlebitis, vasculitis	arteriosclerosis, atherosclerosis, cardiomyopathy, endocardiosis, fibrinoid necrosis, hemangioma, lymphangiectasia, myocardial degeneration, myocardial hypertrophy, thrombosis
BONE & JOINTS	arthritis, osteitis, osteomyelitis, tenovaginitis, desmitis - ligament	chondrodystrophy, osteodystrophia fibrosa, osteogenic sarcoma, osteomalacia, osteoporosis, osteosis, prolapsed intervertebral disc, skeletal dysplasia
BLOOD & LYMPH	lymphadenitis, splenitis,	anemia, hemorrhagic diathesis, marrow dysplasia, myelogenous leukemia, purpura, splenic nodular hyperplasia, splenic siderotic nodules, splenic torsion, splenomegaly, thymic atrophy
ENDOCRINE	pituitary abscess, adrenalitis, thyroiditis	goiter, nodular hyperplasia, pheochromocytoma, pituitary adenoma
MUSCLE & FAT	myositis, fasciitis, steatitis	arthrogryposis, atrophy, mineralization, myodegeneration, muscle dystrophy
NERVOUS	encephalitis, myelitis, encephalomyelitis, meningitis, meningoencephalitis, neuritis, radiculitis	cerebellar hypoplasia, cerebral edema, demyelination, encephalomalacia, polioencephalomalacia, leukoencephalomalacia, hydranencephaly, hydrocephalus, neuronolipidosis, syringomyelia
EYE	choroiditis, conjunctivitis, keratitis, retinitis, uveitis, anophthalmitis, blepharitis	cataract, anophthalmia, corneal edema, glaucoma, hypoplasia of optic nerve, microophthalmia, retinal atrophy
EAR	otitis externa, otitis media	hypoplasia

IV. PRACTICAL INFORMATION ABOUT HISTOLOGIC STAINS

1. Classes of biologic stains:

a. General tissue stains

- These differentially stain the nucleus and the cytoplasm of cells and permit differentiation between the different tissue types, eg:
  - Ø **Hematoxylin and Eosin**
    Nucleus stains blue
    Cytoplasm stains red
  - Ù Polychromatic stains, eg **Wright's** and **Giemsa**
    Provide good color range to differentiate between blood leucocytes.

b. Special staining procedures

- For more refined identification of cell types, intracellular components and extracellular materials (most of the stains described below fall in this category).

COMMONLY USED STAINS AT THE ATLANTIC VETERINARY COLLEGE

TYPE OF STAIN	SPECIAL USE
Hematoxylin & Eosin (H&E)	General stain used in routine pathology
Oil-Red-O (on frozen sections)	Lipid
Toluidine Blue	Mast cell granules
Phosphotungstic acid-haematoxylin (PTAH)	Fibrin, cross striations of skeletal muscle fibres
Masson's trichrome	Connective tissue, collagen
Periodic acid-Schiff (PAS)	Glycogen, fungi
Congo Red	Amyloid
Gram Stain (Taylor's)	Bacteria
Gomori Methenamine Silver (GMS)	Fungi
Von Kossa	Calcium salts
Luxol Fast Blue (LFB)	Myelin
Acid fast stain	Mycobacterial organisms & other acid fast + organisms
Giemsa	Bone marrow
Fontana Masson's	Melanin and argentaffin cells
Reticulum silver	Reticulum fibres
Verhoeff VanGieson (VVG)	Elastic fibres