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BSc (Hons) Animal Management

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An Introduction to Gross Pathology

The techniques used most often in the study of the disease process & hence diagnoses are:

- **Gross Pathology**: the recognition of disease based on macroscopic examination of surgical specimens generated at the time of surgery or at autopsy
- **Histology**: the microscopic study of tissues
- **Histopathology**: is the science of diagnosing diseases on the basis of the histological aspect of the diseased tissues
- **Cytology**: the study of detached cells
- **Cytopathology**: is the science of diagnosing diseases on the basis of the cytological aspects of detached cells. The most common application of this technique is the Pap smear
- **Clinical Chemistry**: the gathering, detection, & reporting of an incredible array of chemical measures found by the analysis of collected body samples
- **Immunology**: the use of specific immune markers & antibodies to aid in the diagnosis of disease
- **Flow Cytometry**: analysis of a process that allows for the identification of specific cells
- **Molecular Biology Techniques** (e.g. PCR & FISH) are increasingly useful to diagnose diseases, especially microbiological & cancer diagnoses

Describing Pathological Specimens

- <u>Do not bother describing those organs which are normal</u>

- Distribution:
  - **Focal**: one lesion
  - **Mulitfocal**: more than one lesion
  - **Milliary**: many lesions/ showering of bacteria
  - **Segmental**: lesions grouped into segments
  - **Diffuse**: lesions cover entire area of tissue

- Smell should always be noted
  - Not just of decomposition but if it is original and essential to diagnosis

- **Aetiological Diagnosis** = cause plus process
  - e.g. *Streptococcal lymphadenitis* in chimps

- Aetiology is the branch of medicine that deals with the causes or origins of disease
  - E.g. lyssavirus **causes** rabies in European bats

- Sometimes only a name is need for a diagnosis
  - BSE in ungulates
  - Does not have to be described to the site and infected organs

- Morphological diagnosis for non-neoplastic conditions:
  - Site
  - Process
  - Modifier
    - For example: pasteurellosis in sheep
      - **Site** = lung
      - **Process** = bronchopneumonia
      - **Modifier** = suppurative (pus)

- Morphological diagnosis for neoplastic conditions:
  - Site
  - Tumour
  - Metastases (A secondary cancerous growth formed by transmission of cancerous cells from a primary growth located elsewhere in the body)

Preparation for Necropsy

- Always read the history of the animal to determine any background illnesses and whether there may be any potentially dangerous pathogens (= zoonoses) involved
- Common examples:
  - Psittacosis in birds
  - BSE in ungulates
  - Lyssavirus (rabies) in bats

- Be aware of poisonous/ toxic species
  - Venom is a protein and in snakes deteriorates after death but can be accidentally injected into humans
  - Venomous spines on fish can inject poisons into skin
  - Amphibian skins can leach venom (although this is less of a problem with captive individuals)

Purpose of a Necropsy

- Not just to determine the cause of death (although this is a major reason)
- A death in a group / colony may be the index case of a potential outbreak, hence swift diagnosis can protect the other members in the group
- Death of an individual that was due for transport/ relocation/ reintroduction may halt scheme until cause of death determined
    - o Do not want infection of a new environment or the wild with alien parasites/ pathogens

- Determine the cause of mass death amongst wild animals (here the individual is less important)
- Determine if a wild animal has been killed illegally
    - o Hunting/ poaching/ poisoning
    - o If necropsy is for legal reasons then carcass parts should be saved

- Cosmetic necropsy is carried out to preserve specimens for a museum
    - o Care required with incisions and examination

Principles

- Always perform a thorough external examination
    - o External parasites may hold key to death

- More measurements are taken with a wild specimen rather than a domestic one
- If some samples are of special interest, the correct order of organ removal does not have to be followed
    - o Fragile tissues should be removed first and stored before they decompose (especially samples for bacteriology)

Shapes

Botyroid: shaped like a bunch of grapes

Irregular: use when no geometrical description can be given

Circular: use when describing a circular or disk shaped object

Oblong: self-explanatory

Ovoid: squashed circles (2D)

Polypoid: having or resembling polyps

- **Polyp** = spheroidal, solid mass tat protrude upwards or outwards from a normal solid surface
- **Cyst** = an abnormal sac, filled with gas, fluid or semi-solid material. Internal material can cause the cyst to protrude outwards/ upwards, hence resembling a polyp

Reniform = resembling a kidney

Spheroid: globular and 3D

Wedge-Shaped: most commonly caused by infarcts (lesions brought about by the occlusion of blood vessels in an organ system). A conical pattern is the result.

Circular (hepatic hemangiosarcoma)

Botyroid (cirrhotic liver)

Irregular (uterine adenocarcinoma)

Foreign body in small intestine

Ovoid (canine parvoviral enteritis)

Polypoidal (serosal cysts of the uterus)

Reniform (canine kidney)

Spheroid (axillary lipoma)
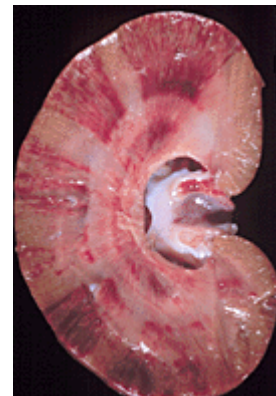
Wedge-shaped

(pyelonephritis)

Surfaces

Bulging: surface is taught and may burst

Cobblestoned: self-explanatory

Corrugated: pronounced rippling and distortion

Crusted: surface is composed of necrotic debris, degenerated inflammatory cells and serous fluid. Similar to diphtheritic membrane found on the surface of epithelial lined organs in the process of necrosis

Eroded: the skin appears sloughed-off and the wound is raw and open, this is typical of an eroded lesion. Note that erosion is restricted to the epidermis; the dermis and basement membrane are still intact. This is an important distinction between erosion and ulceration.

Erosion is a superficial or shallow ulceration.

Granular: marked by the presence of granules and grains

Pitted: surface of the infected organ becomes indented and irregular; functional cells are lost and may be replaced by fibrous tissue

Rough: uneven texture to surface and has an abrasive appearance

Smooth: no pitting, roughness or irregularity to the surface

Striated: striped or banded in an unusual colour

Ulcerated: local defect or excavation of the epithelium of an organ or tissue through the basement membrane; an ulceration is a deep lesion through several layers of tissue.
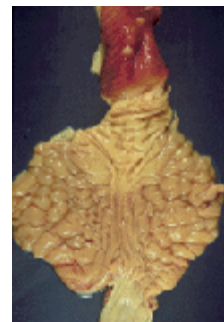
Umbilicated: a lesion marked by a depression resembling the umbilicus

Verruous: a lesion that resembles a wart
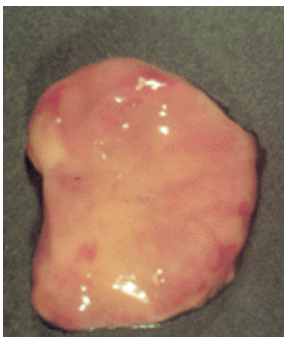
Left: Bulging (lymphoma)

Right: Cobblestoned (Hypoproteinemia with Bowel oedema)

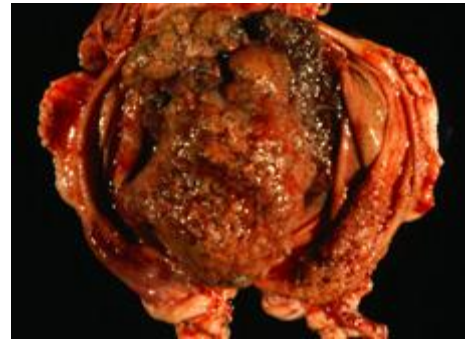Corrugated
(Johne's disese in the ileum)

Crusted (Acute Necrotic Ileocolitis)

Johne's Disease is an infection of cattle, sheep and goats cause by *Mycobacterium paratuberculosis* characterized by diarrhoea and thickening/ corrugation of the intestinal wall.

Eroded
(malignant catarrhal fever)

Granular
(pyogranulatomous* *Staphylococcus* infection)

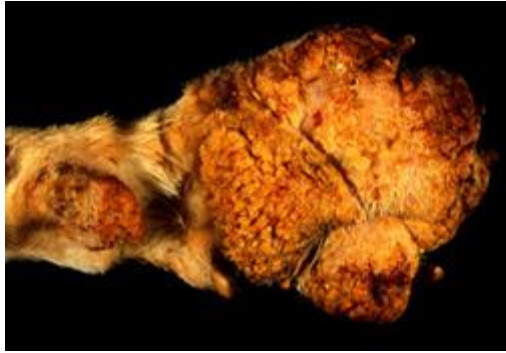*An infiltration of polymorphonuclear cells into an area of chronic inflammation characterized by mononuclear cells, macrophages, lymphocytes and even plasma cells

Pitted
(end-stage of kidney pyelonephritis*)

*Inflammation of the kidney and renal pelvis often by ascending bacterial infection

1: Smooth (Membranous glomerulonephritis in a kidney)
2. Rough (Lethal acrodermatitis*)
3. Striated (Atherosclerosis** in a canine heart)

* Lethal acrodermatitis is an inherited disease of bull terriers; homozygous individuals have an undetermined defect in zinc metabolism that does not respond to zinc supplementation. Affected dogs have a lighter colouration than normal and develop dull, brittle coats and cracked/crusted skin by age six weeks. Secondary infections together with diarrhoea and respiratory problems are common and most dogs die by the age of seven months.

**Atherosclerosis is a hardening of the arterial network of the heart leading to a loss of elasticity and a narrowing of the diameter of the arterial lumen; atherosclerosis is considered a form of arteriosclerosis. Atherosclerosis occurs when the inner layers of the vessel (intima and media) accumulate deposits of lipid, lipophages and cholesterol. The thickening of the vessel can lead to arterial occlusion and infarcts. Stenotic (caused by restricted flow) lesions are most common and most severe in the coronary arteries.
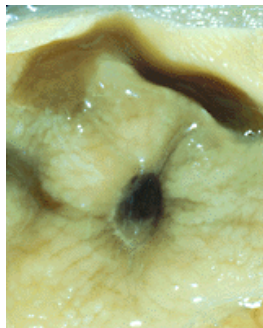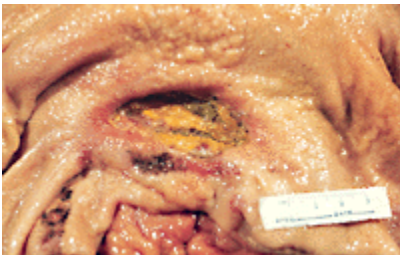
1: Ulcerated   2: Umbilicated   3. Verrucous

(equine squamous cell carcinoma)   (Gastric ulcer)   (Skin tag)

Margins

Indistinct: a lesion that blends into the surrounding tissue and cannot be readily delineated or defined

Infiltrative: the lesion has entered and actively destroyed the surrounding tissue - hence it is termed invasive or infiltrative. Invasiveness is generally a property of malignant neoplasms

Papillary: nipple-like; papillary projections are not quite as long as villous projections

Pedunculated: having a stalk of peduncle

Serpiginous: having a wavy border

Serrated: having a saw-like margin

Sessile: having a broad base

Villous: finger-like

Well-Demarcated: clear delineation between the lesion and the surrounding tissue

1: Indistinct   2: Infiltrative
   (Necrotising meningoencephalitis)   (Transitional cell carcinoma – canine UT)
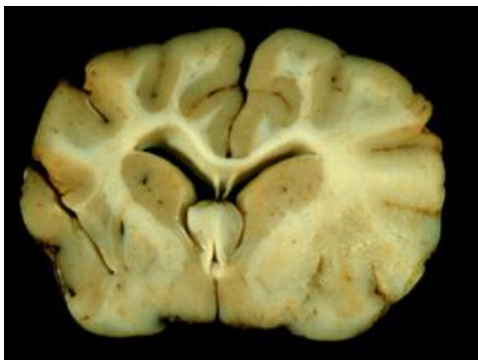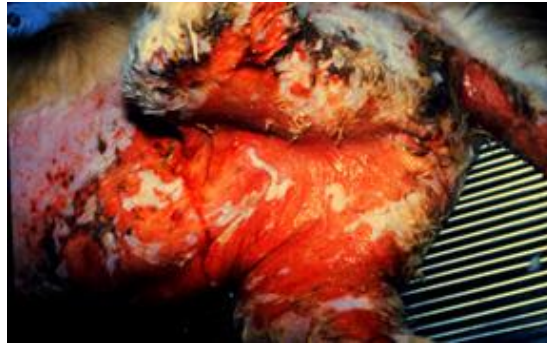

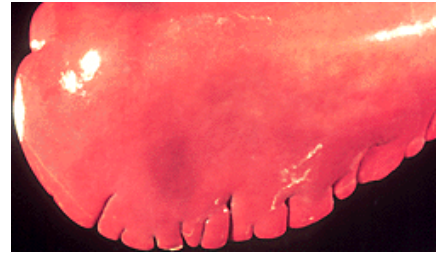Papillary (Papilloma caused by the papovavirus and cause a thickening of the epidermis)

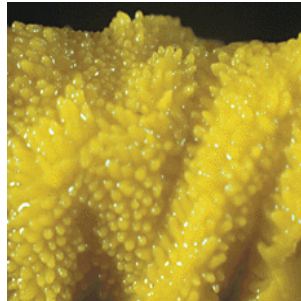| 1: Pedunculated (Skin Tag)	2: Serpiginious (Toxic epidermal necrolysis)	3: Serrated (Canine liver – normal)

1: Sessile (Histiocytoma*)	2: Villous (Lymphangiectasia**)	3: Well-demarcated (Canine Sertoli cell carcinoma)

* Histiocytoma is a common neoplasm of young dogs composed of round histiocytic cells, thought to be Langerhan's cells (large phagocytic cells). Most tumours spontaneously regress.

** Lymphangiectasia in the small intestine; congenital or acquired dilation of the lymphatic vessels.

Consistency

Consistency is not readily evaluated by simple observation – requires hands on approach.

Caseous (like cottage cheese)   **Leathery** (like dried meat)
Firm (solid to the touch)   **Resilient** (springs back easily)
Fluid (liquid, unclotted)   **Rubbery**
Friable (breaks apart easily)   **Soft**
Gritty   **Spongy**
Hard (as in bone)

Colours

Words that should **not** be used in a pathological description:

Vague: e.g. pale (does not give a significant description… pale what?!)

Redundant: adding meaningless words into a description. For example 'the kidney is brown in colour

Open to Interpretation: using words that have different meanings to different people. E.g. wine-coloured or honey-like

Food Descriptions: food is not uniform and hence saying something is 'grapefruit sized' is not consistent

Excessively Verbose: resist the urge to use creative, florid expressions (e.g. salmon pink or vermillion)

Words that should be used for pathological description:

Black: used to describe anything containing melanin. *note: a malignant melanoma is correctly termed a melanocarcinoma

Brown: e.g. metastatic (transferred to different, non-connected organs) adenocarcinoma in the lungs

Grey-Green: used usually in the description of necrotic tissue (e.g. acute pancreatic necrosis)

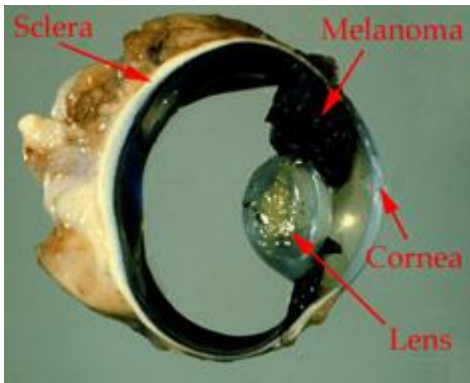**Mahogany**: use to describe the normal liver and canine kidneys

Red: raw/ inflamed tissue or oxygenated (fresh) blood

Tan: see picture of damaged kidney

White: healthy brain tissue/ bleached skeletal matter
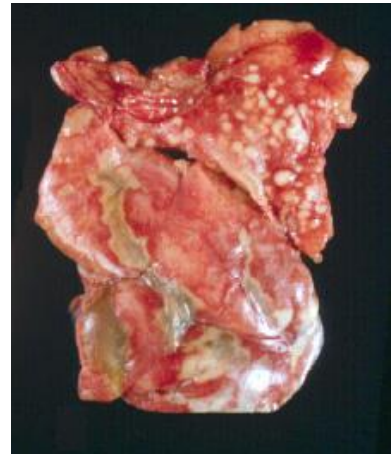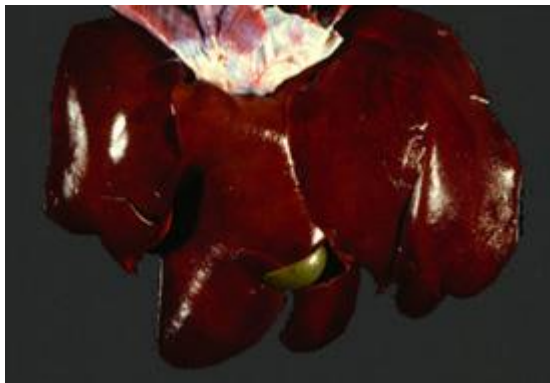
Yellow: pus/ discharge/ necrotic material
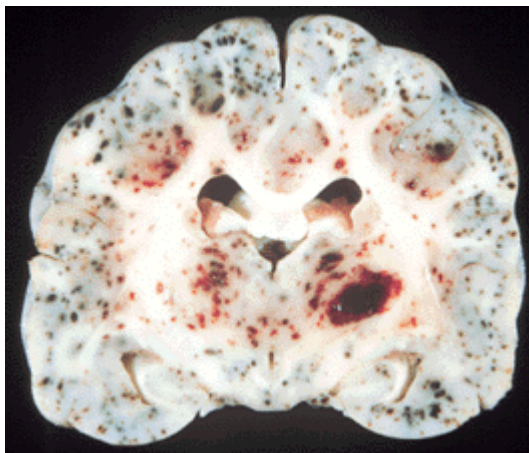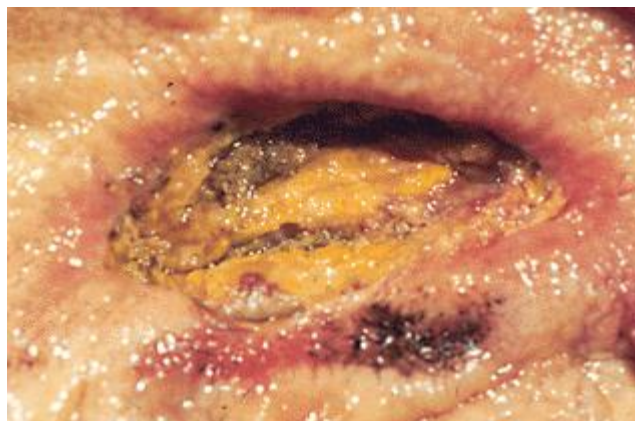
Black

Brown

Grey-Green

Mahogany

Red

Tan

White

Yellow
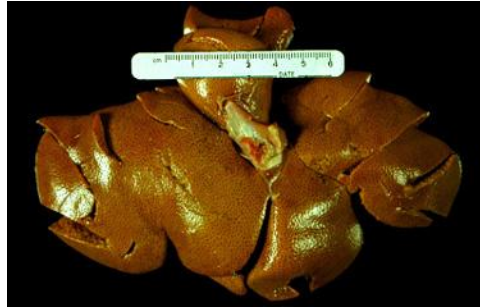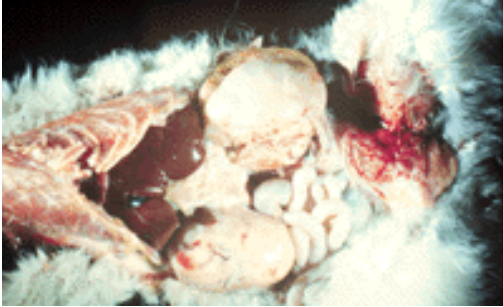
Location

Bilateral: affecting both sides and is usually used when something occurs on both sides of the body (below left: enlarged feline kidneys due to filtration of neoplastic lymphocytes)

Diffuse: the condition or substance is spread widely and evenly throughout the tissue and is not localized to a focal area (above right: feline fatty liver)

Focal: lesion/ infection is confined to one specific area (below left: equine renal adenoma*)

 *A benign epithelial tumour in which the cells form glandular structures or are derived from glandular epithelium
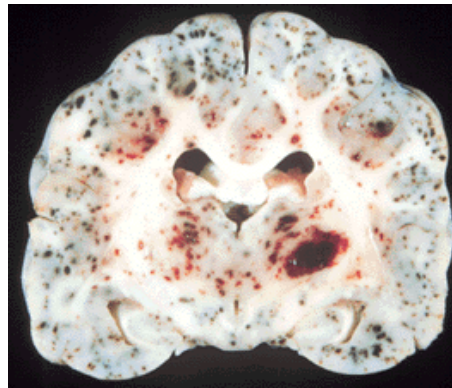

Multiple/Multifocal: lesions are of uniform size (foci) but are not be evenly spread throughout the organ (above right: Haemangiosarcoma in canine brain)

Patchy: lesion is not focal but is spread unevenly in patches throughout the organ (below: lymphosarcoma)
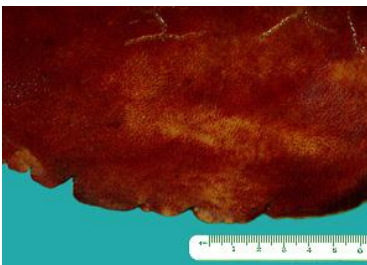
Unilateral: affecting only one side/ part of an organ

Below: In this specimen, a tumour involving one of the two adrenal glands; the tumour secreted glucocorticoids that elevated hormonal plasma levels. The elevated glucocorticoid levels then activated the hypothalamic-pituitary axis negative feedback system that in turn caused the hypothalamus to decrease production of ACTH.
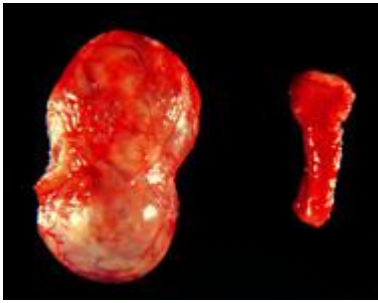
The lowered levels of ACTH caused the contralateral adrenal gland to atrophy due to lack of stimulation by ACTH. This produces a very large neoplastic adrenal gland on the ipsilateral side (the same side as the tumour) and a very small atrophied adrenal gland on the contralateral side (the side that does not have the tumour).

Morphological Diagnosis

Once a lesion has been described, it needs to be interpreted and a morphological diagnosis be formulated. This is a short phrase that sums up the important aspects of the lesion and is a way to communicate these aspects to other medical professionals in a precise way.

The Morphological Diagnosis has four components:

1. Severity (abbrev. 's')
2. Time (abbrev. 't')
3. Lesion (abbrev. 'l')
4. Anatomic Site (abbrev. 'a')

Distribution ('d') can also be used as a modifier in conjunction with the basic components listed above. Example: a swollen dark red spleen that dripped blood when incised would have the morphologic diagnosis of:

Severe Acute Diffuse Splenic congestion
   s   t   d   a   l

Not all morphological diagnoses can contain all four or five terms as many would be biologically inaccurate if applied to certain conditions. For example, neoplasms cannot really be timed or graded as to severity so they are used classified by anatomic site and lesion only.