LABORATORY MANUAL

GENERAL VETERINARY PATHOLOGY

UNIT I

Prepared by,

Dr Jeny K John

Dr. Naresh Chandra

Name: ---------- --

ID No: ----------

Batch: ----------

Year:

DEPARTMENT OF PATHOLOGY, VETERINARY COLLEGE, HASSAN

Certificate

This is to certify that ---------- with the ID No. ---------- has satisfactorily completed the prescribed syllabus for the Practical component of the course titled ***General Veterinary Pathology*** *(Unit 1)* as per the VCI guidelines for the II academic year for the degree of B V Sc & AH for the year ……

Place:

Date: **Course Teacher**

GENERAL VETERINARY PATHOLOGY

UNIT I

CONTENTS

Exercise 1

IMPORTANCE OF POST-MORTEM EXAMINATION OF ANIMALS

Necropsy: Examination of the dead body. Postmortem examination of animals for finding the cause of death.

Autopsy : Examination of the dead body by one's own eyes.

Term used in humans for postmortem examination

Pre-requisites:

.

1. PM kit: Knives, Scalpels, forceps, surgical scissors, spatula, bone-cutter, bone forceps, chisels, hammer, cutting saw, magnifying glass.

Objectives of Post-Mortem:

1. Diagnosis of disease for preventing economic loss to farmers
2. To correlate clinical symptoms with post-mortem lesions
3. To assess the efficacy of the line of treatment followed
4. To issue an insurance certificate
5. To issue report in Vetero - legal cases

Exercise 2

STUDY OF GROSS PATHOLOGICAL SPECIMENS AND RECOGNITION OF PATHOLOGICAL LESIONS

Important gross changes in general pathology:

1. Oedema:

- Swollen, increase in weight
- Cold due to decrease blood flow and increase heat dissipation
- Less color
- Incision results in flow of fluid from cut surface
- Pits on pressure
- Fibrosis

2. Congestion:

- Organ throughout the body have an intense bluish red colour
- Veins are distended with blood
- Organs enlarged and on incision, blood oozes freely

3. Thrombosis:

- Granular, dry and rough
- White or pale in color
- Attached to the vessel wall

4. Hyperemia

- Organ will be enlarged, swollen and heavier

- Colour –bright red
- Blood vessels larger and distended with blood

5. Haemorrhage:

1. Petechial haemorrhage: tiny and punctuate(pin point size) having a diameter not larger than 1-2 mm
2. Purpura: haemorrhages upto 3-5 mm
3. Ecchymotic haemorrhages are large and blotchy about 1 -2 cm in diameter
4. Suffusion: Diffuse, flat, often irregular areas of bleeding
5. Linear haemorrhages: Haemorrhages appear as lines on the crests of folds in the mucous membranes of the intestine
6. Epistaxis:bleeding from nose
7. Hemoptysis: blood in sputum

6. Infarction:

- Infarcts are wedge shaped (cone shaped) with the occluding vessel at the apex and the periphery of the organ forming the base
- Red infarcts bulge
- Pale infarcts usually have a slightly depressed surface
- Once infarct get organized, contraction of connective tissue causes depressed surface and puckering of the organ

7. Cellular swelling:

- Affected organ is slightly enlarged, edges are slightly rounded and there is an increase in weight
- Organ appears pale or anemic
- When incised the cut surface bulges and its capsule draws back slightly

- Cut surface-cloudy, slightly opaque and appears as if it had been slightly scalded or cooked

8. Hydropic degeneration:

- Seen as blister on the skin
- Upon incision, fluid escapes and blister collapses
- If pyogenic bacteria –suppurative inflammation

9. Mucinous degeneration

- Mucus membrane is covered with a clear, white transparent material which is stringy and slimy in consistency
- Mucus membrane-hyperemic

10. Mucoid degeneration:

- Tissue is shrunken, flaccid and flabby in consistency and has a translucent jelly like appearance
- When incised, a watery, slimy, stringy material exudes from the cut surface

11. Hyaline change:

- Cellular hyaline: Occurs in cells other than those found in stratified squamous epithelium and connective tissue
- Cells in many organs are desquamated into a glandular lumen or cavty- fuse into a homogenous mass resembling starch or sand. These firm masses stain deeply with iodine and are called corpora amylacea (L.starch bodies)

12. Calcification:

- Calcium salts appears as fine, white granules, or as yellowish-white or grey chalky masses within tissues
- Have a gritty feeling
- Firm in consistency

13. Coagulative necrosis:

- Grey, white or yellow in colour
- Appear as if the tissues are coagulated or cooked and stand out distinctly from the surrounding normal tissue
- Borders are sharply demarcated and are usually surrounded by a red zone of inflammatory reaction
- If pyogenic bacteria present, abscess may form and when putrefactive bacteria enter gangrene may occur

14. Liquifactive necrosis:

- The tissue in the area is liquefied and may be watery, tenacious or semisolid in consistency
- Color is white, yellow or red
- Long standing case: connective tissue (CT) capsule formation

15. Caseative necrosis:

- Area of necrosis is a granular amorphous material resembling cheese.
- Mass is dry but creamy in consistency
- It is soft, friable and white grey in colour
- Calcium salts are frequently deposited in the dead tissue
- Caseous mass is enclosed within a CT capsule

16. Fat necrosis:

- Necrotic fat appears as white or yellowish white, chalky, opaque masses in the interstitial adipose tissue of the pancreas an in peripancreatic fat
- A zone of acute or chronic inflammation appears around the necrotic areas
- Connective tissue may undergo metaplasia and produce bone

17. Anthracosis

- Carbon appears as black pigment in the tissues
- Carbon in the lungs appears as focal accumulation or as a diffuse infiltration
- Lungs are black in colour
- Regional lymphnodes- medulla also pigmented

18. Hemosiderosis

- Golden yellow to brown granular or crystalline pigment deposition in tissues
- Hemosiderin laden macrophages are called heart failure cells seen in lungs

19. Melanin pigmentation:

- Black, brown or reddish pigment deposition in tissues

20. Photosensitization :

- Hairless, non-pigmented skin exposed to sun light
- **Horses:** face, nose, distal extremities
- **Cattle:** teats, udder, perineum, nose

- **Sheep:** pinnae, eyelids, face, nose, coronary band, facial eczema or "swollen head"
- Erythema, edema, blisters, exudation, necrosis and sloughing of necrotic tissue.

21. Gout:

- Deposition on serous membrane appears as white chalky coating

22. Dry Gangrene:

- Area is dry, shriveled and appears mummified as a result of dehydration
- It is reddish brown, green, grey or black in colour (due to Fe sulphide)
- Pseudomelanosis due to black discoloration
- Dead tissue is demarcated sharply from the living by a line of severe inflammatory reaction

23. Wet Gangrene:

- Gangrenous tissue is moist and red, green, grey or black in colour
- Putrefaction produces gas and numerous gas bubbles are present within the tissues
- Intestine is distended with large quantities of gas
- No sharp line of demarcation between the living and dead tissue

24. Aplasia:

- Absence of organ or tissue
- In place of aplastic tissue, a fatty or fibrous mass may be present

25. Hypoplasia:

- Some of the organ or tissue is present but it never attains its normal adult size

26. Atropy:

- Decrease in size of the organ or tissue involved
- Organ will be flabby, soft and lacks its normal tissue tone
- Paler in colour

27. Hyperplasia:

- Increase in size of an organ or tissue

28. Metaplasia:

One adult type epithelium is replaced by another type of same germ layer

29. Dysplasia:

Disorderly non neoplastic proliferation

30. Acute inflammation:

1. **Redness (L. rubor)**: great increase of blood in the inflamed area as a result of hyperemia

2. **Swelling (L.tumour)**: partly due to hyperemia and secondly due to outpouring of protein rich fluid containing blood cells into the extravascular tissues (Exudate)

3. **Heat (L.calor):** An increase in heat at the site of inflammation results from increased blood flow through the area that carries warmth to the periphery from the higher interior temperature of the body.
   Also due to increased metabolism in the inflamed site

4. **Pain (L.Dolor):** partly from increased pressure on sensory nerve endings and by stretching of tissues from accumulation of exudate

5. **Loss of function (L functio-laesa):** combination of pain, swelling and destruction of tissues

31. Chronic inflammation:

- Tissue necrosis, new blood vessel and fibrous tissue proliferation
- Firm to touch

ORGAN	PATHOLOGICALGROSS LESIONS WITH DESCRIPTION OF LESION

Exercise 3

HISTOPATHOLOGICAL TECHNIQUES

1. Procedures of processing tissues for histopathological examination

Whole process in tissue processing can be divided into following steps

- ❖ Fixation
- ❖ Processing
- ❖ Section cutting
- ❖ Staining and mounting

1. Fixation

- o It is a chemical process in which biological tissues are preserved from decay, either through autolysis or putrefaction
- o Tissue specimens are fixed or preserved
  - to determine its micro-anatomy
  - allow localization of its various chemical constituents
- o Tissues should be fixed as soon as possible after death or removal from the body
- o Terminates any ongoing biochemical reactions
- o Increase the mechanical strength or stability of the treated tissues
- o Amount of fixative in jars should be 20-50 times the bulk of tissues to be fixed

Types of fixation

⦿ **3 types**

1. **Heat fixation**

   - Smear has been allowed to dry at room temperature
   - Passed through flame of a Bunsen burner several times to heat kill and adhere the organisms to a slide

2. **Perfusion**

   - Fixation via blood flow
   - Volume should match cardiac output
   - Advantage – preserving perfect morphology
   - Disadvantage-subject dies and cost is high

3. **Immersion**

   - Sample of tissue is immersed in fixative of volume at a minimum of 2/3rd greater than the volume of the tissue to be fixed
   - Fixative must diffuse through the tissue in order to fix, so tissue size [0.5 cm] is preferable

Types of fixatives:

1. Cross linking fixatives

Aldehydes -formaldehyde [40%neutral buffered formalin], gluteraldehyde [2%]

2. Oxidising agents

Osmium tetroxide –electron microscopy

3. Precipitating fixatives

Ethanol, methanol, acetone

11.Crosslinking fixatives

- Act by creating covalent bond between proteins in tissue
- Anchors soluble proteins to the cytoskeleton
- lends additional rigidity to the tissue

eg. Aldehydes

- Formaldehyde-gold standard of fixatives for routine histology
- Preserves protein, peptides ,nucleic acids and cellular components
- In presence of calcium good Preservative for lipids also

- Basic mechanism- formation of methylene bridges between reactive sites
- Change of quaternary and tertiary structures into secondary and primary structures

12.**Oxidising agents**

- React with various side chain of proteins and other biomolecules-formation of crosslinks
- Not used in light microscopy-penetration to thick sections poor

13.**Precipitating fixative**

- Act by reducing the solubility of proteins
- Disrupting hydrophobic interactions
- Acetic acid-denaturant –sometimes used along with this

2. Processing

⦿ Aim of Tissue Processing

-to remove water from tissues and replace with a medium that solidifies to allow thin sections to be cut.

⦿ Biological tissue must be supported in a hard matrix to allow sufficiently thin sections to be cut

⦿ 4-6 μm thick - light microscopy

⦿ 80-100 nm thick - electron microscopy

⦿ For light microscopy, paraffin wax is most frequently used

⦿ Paraffin wax –fairly hard in consistency, allows sections of only 4-6 microns in thickness to cut

Whole process can be divided into

A. Dehydration
B. Clearing
C. Impregnation
D. Block making

Washing

⦿ Specimens are kept in stainless steel in running tap water to remove formalin –overnight

a. Dehydration

- ⦿ To remove water from the washed tissues
- ⦿ Paraffin immissible in water
- ⦿ Samples are transferred through baths of progressively more concentrated ethanol to remove the water
- ⦿ Ascending grades of ethanol [70,80,90%, absolute ethanol I,II,III] 1 hour each
- ⦿ Isopropyl alcohol also using
- ⦿ Tissues should not be left in absolute ethanol for long -brittleness

b. Clearing

- ⦿ To replaces ethanol with some agent that are miscible in paraffin
- ⦿ Commonly used clearing agents-
  xylene, turpentine oil, chloroform, cedar wood oil
- ⦿ Cleared tissue has a translucent appearance
- ⦿ Usually takes 1-1.5 hours

c. Impregnation

- ⦿ Process in which clearing agents is completely removed and substituted with melted paraffin [MP-56-58 C]
- ⦿ Achieved in a paraffin oven kept at the temperature slightly more than the MP of paraffin
- ⦿ Decalcification should be done before embedding
- ⦿ Paraffin wax does not provide a sufficiently hard matrix for cutting very thin sections for electron microscopy
- ⦿ Instead, resins are used
- ⦿ Epoxy resins are the most commonly used, but acrylic resins are also used if immunohistochemistry is required
- ⦿ Thicker sections (0.35μm to 5μm) of resin-embedded tissue can also be cut for light microscopy

- Above processes are almost always automated for the large volumes of routine tissues processed
- Automation consists of an instrument that moves the tissues around through the various agents on a preset time scale

Stage	**Time Required**
Washing	Overnight
70% Ethanol	1 hour
80% Ethanol	1 hour
90% Ethanol	1 hour
95% Ethanol	1 hour
100% Ethanol-I	1 hour
100% Ethanol-II	1 hour
100% Ethanol-III	1 hour
Benzene + Ethanol	1 hour
Benzene-I	1 ½ hour
Benzene-II	1 ½ hour
Paraffin wax-I	1 hour
Paraffin wax-II	1-6 hour

Automatic tissue processor

d.Block making

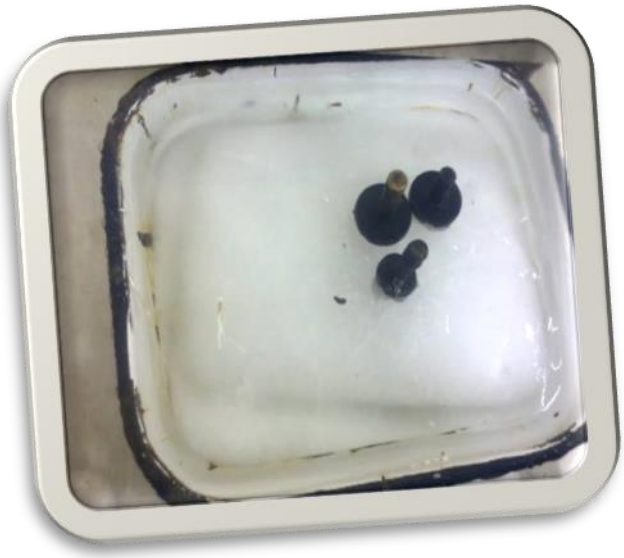
- External embedding
- Tissue samples are placed into moulds along with liquid embedding material (such as agar, gelatine, or wax)
- Apply glycerine on slab
- Put paraffin in moulds /tissue capsule and remove air bubble
- Put tissues and press with forceps
- Apply specimen number and collect blocks after 30mts

Tissue cassettes

Block making

Hardening

- This is achieved by
  - cooling in the case of paraffin wax - heating (curing) in the case of the epoxy resins
- Hardened blocks containing the tissue samples are then ready to be sectioned.



Hardening in ice

- Alternatives to paraffin embedding include various plastics that allow thinner section
- Plastics include methyl methacrylate, glycol methacrylate, araldite, and epon

3.Section making

- Cutting of good section depends upon thorough knowledge of equipments used and practical experience
- Vertical sectioning perpendicular to the surface of the tissue is the usual method
- Horizontal sectioning - evaluation of the hair follicles and pilosebaceous units

Microtome

- A **microtome** is a sectioning instrument that allows for the cutting of extremely thin slices of material, known as sections

- For light microscopy, a steel knife mounted in a microtome is used to cut 5-micrometer-thick tissue sections which are mounted on a glass microscope slide
- For transmission electron microscopy, a diamond knife mounted in an ultramicrotome is used to cut 50-nanometer-thick tissue sections which are mounted on a 3-millimeter-diameter copper grid.
- Frozen tissue embedded in a freezing medium is cut on a microtome in a cooled machine called a cryostat

Important steps in section cutting

- Sharpening knife or honing
- Stropping –process of polishing an already fairly sharp edge of section cutting knife
- Trimming the block

Wax is removed with a sharp knife until $1/8^{th}$ inch remain in all sides of the tissues

- Cutting the section -4-6micron thick
- Once sections are cut, they are floated on a warm water bath that helps to remove wrinkles
- Then they are picked up on a glass microscopic slide
- Glass slides are then placed in a warm oven for about 15 minutes to help the section adhere to the slide

Blade sharpener

Water bath

Staining method

Basic steps in staining and mounting paraffin section are as follows:

- Removal of wax with xylene
- Hydration with graded alcohols
- Staining
- Dehydration through graded alcohol
- Clearing in xylene
- Mounting under a cover slip

- Haematoxylin and eosin stain is one of the most commonly used stains in histology
- Permanent stain
- Other common stain is phosphotungstic acid haematoxylin, a mix of haematoxylin with phosphotungstic acid

Hematoxylin

- ⦿ Hematoxylin - extracted from the heartwood of the logwood tree [*Hematoxylon campechianum]*
- ⦿ When oxidized it forms hematein (Ripening of hematoxylin – keeping for few months or ripened hematoxylin commercially available)forms strongly coloured complexes with certain metal ions, fe(iii) and al(iii) salts[mordents]
- ⦿ Metal-hematein complexes are used to stain cell nuclei

Blueing:

- During staining, alum haematoxylin-stained sections are usually passed on to a neutral or alkaline solution (e.g. hard tap water or 1% ammonium hydroxide)
- In order to neutralize the acid
- Form an insoluble blue aluminium haematin complex

Types of hematoxylin solutions

- Ehrlich's hematoxylin
- Weigert's Iron Hematoxylin
- Harris's hematoxylin
- Mayer's hematoxylin
- Gill's Hematoxylin

Eosin

- Fluorescent red dye resulting from the action of bromine on fluorescein
- It can be used to stain cytoplasm, collagen and muscle fibers
- Structures that stain readily with eosin - eosinophilic
- Alcoholic eosin

  Eosin -1 gm
  Ethyl alcohol -99ml

Variants of eosin:

- Eosin Y (also known as eosin Y ws, eosin yellowish, acid red 87, C.I. 45380, bromoeosine, bromofluoresceic acid, D&C red no. 22)-slightly yellowish cast
- Eosin B (eosin bluish, acid red 91, C.I. 45400, saffrosine, eosin scarlet, or imperial red)-faint bluish cast

⦿ Eosin Y is a tetrabromo derivate of fluorescein
⦿ Eosin B is a dibromo dinitro derivate of fluorescein

⦿ Eosin - acidic dye - basic parts of the cell, i.e. the cytoplasm
⦿ Haematoxylin - basic dye - acidic part of the cell like the nucleus
⦿ For staining, eosin Y is typically used in concentrations of 1 to 5 percent weight by volume, dissolved in water or ethanol
⦿ Prevention of mold growth in aqueous solutions- thymol
⦿ 0.5 % acetic acid usually gives a deeper red stain to the tissue

Mounting

⦿ Put 1 or 2 drop DPX (distyrene plasticizer xylene) on cover slip
⦿ Earlier used –canada balsam
⦿ Wipeout excess xylene from stained slide
⦿ Mounting is done avoiding presence of air bubble

Exercise 4

STUDY OF HISTO-PATHOLOGICAL CONDITIONS AND RECOGNITION OF PATHOLOGICAL LESIONS

Description of histopathological lesions seen in general pathology:

1. Oedema:

- Space between adjacent cells widened
- During life space filled with fluid
- H&E stain - fine granular material - stains faintly pink
- Atrophy of parenchymatous cells
- Fibrosis - chronic cases

2. Congestion

- Veins and capillaries are distended with blood
- Atropy and fibrosis also present

3. Thrombosis

- Clotted mass of blood attached to endothelium
- Endothelium is damaged and rough
- Partially organized

4. Haemorrhage

- Escape of blood from the vessels

5. Infarction

- Wedge or cone shaped
- Pale or red in colour

6. Cellular swelling

- Cells become swollen and their edges become rounded
- Cytoplasm stains slightly more intense with eosin
- Internal structures of the cell are slightly hazy
- Granular cytoplasm

7. Hydropic degeneration

- Increase in size of the cell
- Small clear vacuoles may be seen within the cytoplasm- vacuolar degeneration
- Hydropic fluid stains pink with eosin
- In skin- prickle cell layer

8. Mucoid degeneration

- Degenerating tissue stains blue with hematoxylin, the nuclei are hyperchromatic and the fluid in the inter cellular spaces has a slightly bluish tinge

9. Mucinous degeneration

- Mucin first appears in the cytoplasm of the cell as small droplet
- As more droplet appear, they coalesce forming larger droplets and displaces nucleus to one side
- At last cell enlarges and ultimately ruptures
- Mucin stains blue with haematoxylin and red with thionine, mucicarmine and Periodic Acid Schiff staining

10. Hyaline change

In squamous cell carcinoma- epithelial pearls are seen

14. Calcification

- Deep blue colour deposits in tissues
- Von Kossas silver nitrate test- black colour

15. Coagulative necrosis

- Architectural outline of the tissue or organ is maintained but the cellular details are lost

16. Liquifactive necrosis

- No Architectural or cellular detail is visible in the area of necrosis
- Dead tissue is homogenous and stains pink with eosin
- If bacteria are present, neutrophils in varying degree of disintegration are found
- Entire necrotic mass is surrounded by a zone of acute or chronic inflammation

17. Caseative necrosis

- Necrotic foci is composed of structure less, amorphous granular debris enclosed within a distinctive ring of granulomatous inflammation
- Neither architectural nor cellular detail is present
- Calcification commonly occurs in the necrotic areas especially in sheep and cattle
-

18. Fat necrosis

- Only shadowy outlines of necrotic fat cells may be seen, with basophilic calcium deposits and a surrounding inflammatory reaction

19. Gout

- Clusters of urate crystal appears as pale, elongated, needle shaped structures in tissue sections
- Crystals are surrounded by an inflammatory reaction of macrophages, lymphocytes, fibroblasts and foreign body giant cells
- Crystals not visible in paraffin sections only clefts in which urate was present can been seen

20. Dry Gangrene

- Structure less necrotic area stained pink is seen with numerous bacteria
- A few gas bubbles are evident by clear spaces
- An acute inflammatory reaction is present at the junction of the living and dead tissue

21.Hemosiderosis

- Golden yellow to brown granular or crystalline pigment deposition in tissues
- Hemosiderin laden macrophages are called heart failure cells seen in lungs

22. Melanin pigmentation:

- Black, brown or reddish pigment deposition in tissues

23. Anthracosis

- Carbon appears as black pigment in the tissues
- Carbon in the lungs appears as focal accumulation or as a diffuse infiltration
- Lungs are black in colour
- Regional lymphnodes- medulla also pigmented

24. **Hypoplasia**

- Cell size are not as large as normal cells
- Fewer in number
- Excess amount of fat and connective tissue

25. Atropy

- Cells are smaller than normal and fewer in number
- Marked increase in the number of autophagic vacuoles
- Presence of lipofuscin granules
- Brown discolouration of tissue- brown atropy

26. Hypertrophy

- Increase in the size of cells and therefore there are fewer cells in each microscopic field

27. Hyperplasia

- Increase in the number of cells in tissue

28. Amyloidosis

- Amyloid appears as an amorphous eosinophilic hyaline extracellular substance

- Deposited between cells in various tissues and organs

29. Acute inflammation

- Infiltration of neutrophils
- Exudate present
- Hyperemia

30. Chronic inflammation

- Tissue necrosis
- Infiltration of lymphocytes, plasma cells, macrophages and giant cells
- Proliferation of blood vessels and fibrous tissue

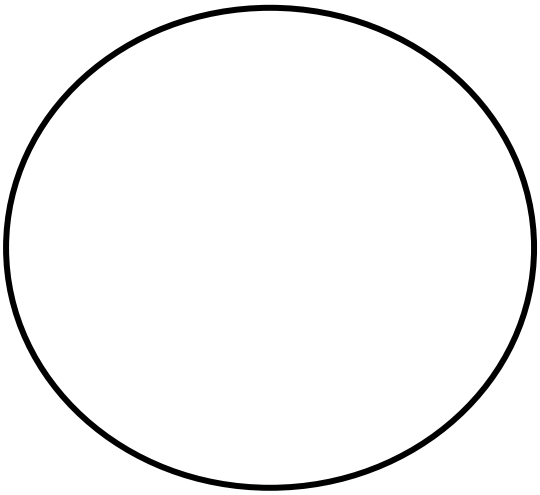
Draw the histopathological lesions of various conditions

Organ:

Stain:

Lesion:

Condition:

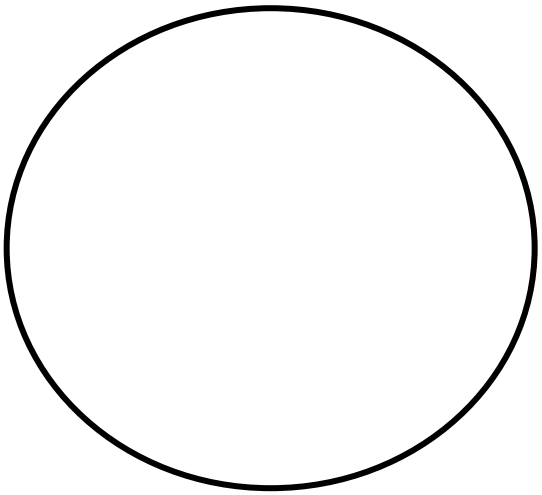


Organ:

Stain:

Lesion:

Condition:

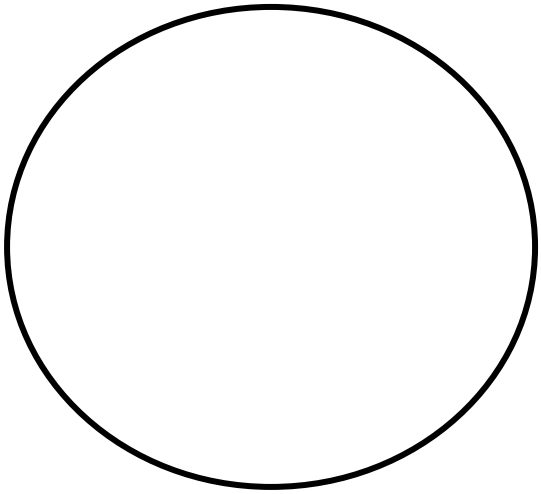


Organ:

Stain:

Lesion:

Condition:

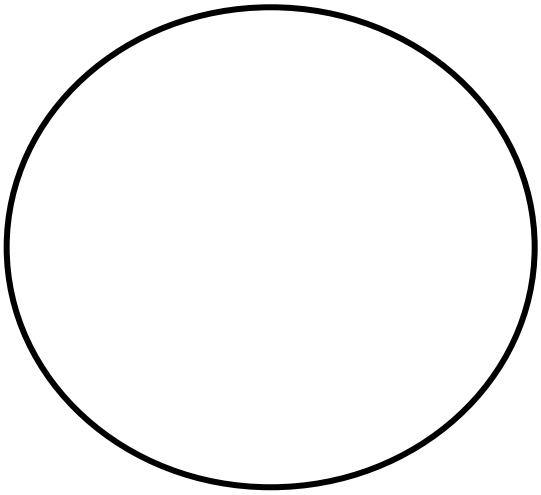


Organ:

Stain:

Lesion:

Condition:

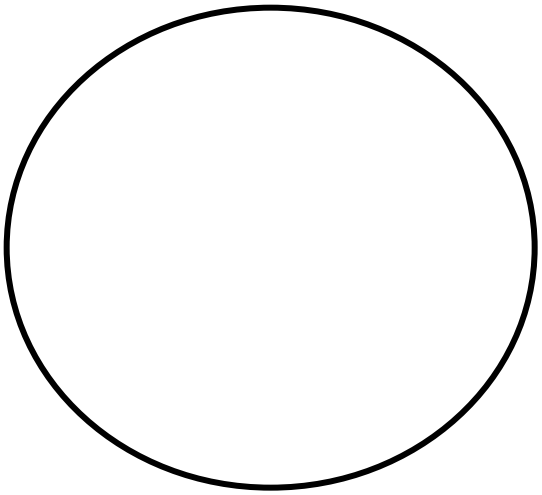


Organ:

Stain:

Lesion:

Condition:

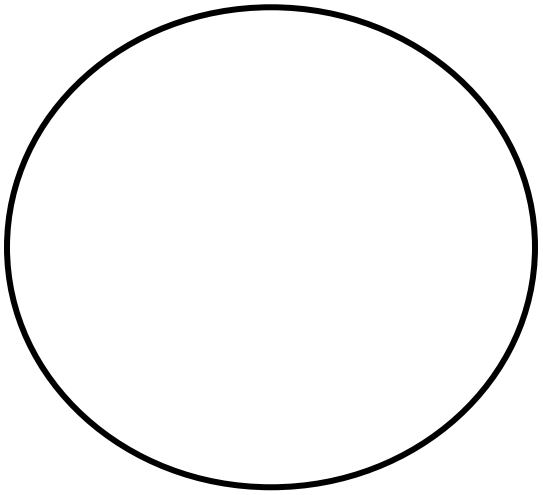


Organ:

Stain:

Lesion:

Condition:

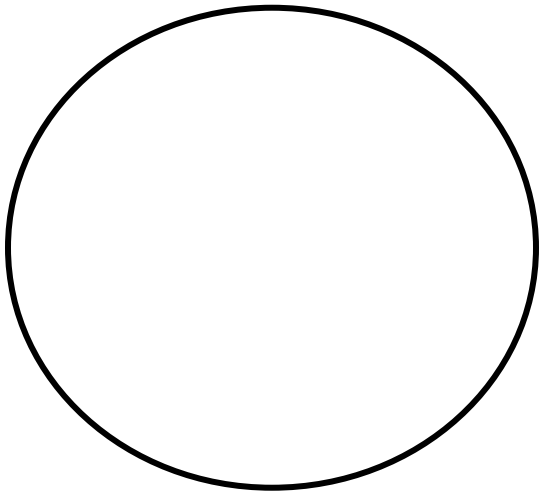


Organ:

Stain:

Lesion:

Condition:

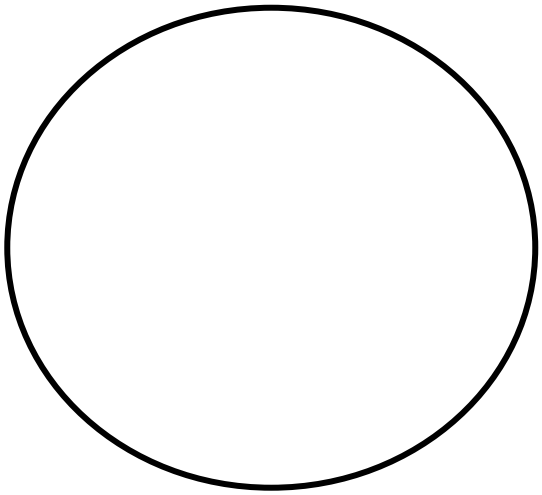


Organ:

Stain:

Lesion:

Condition:

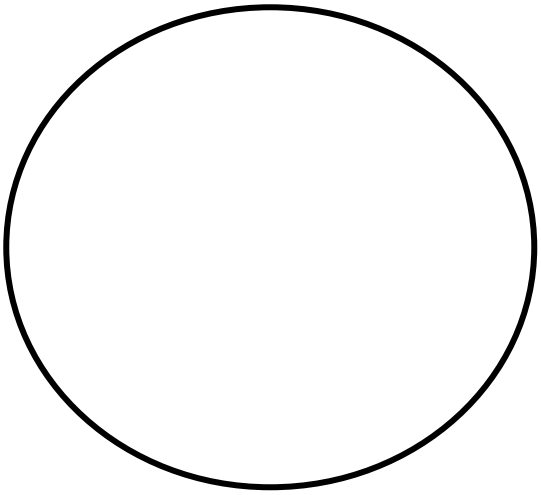


Organ:

Stain:

Lesion:

Condition:

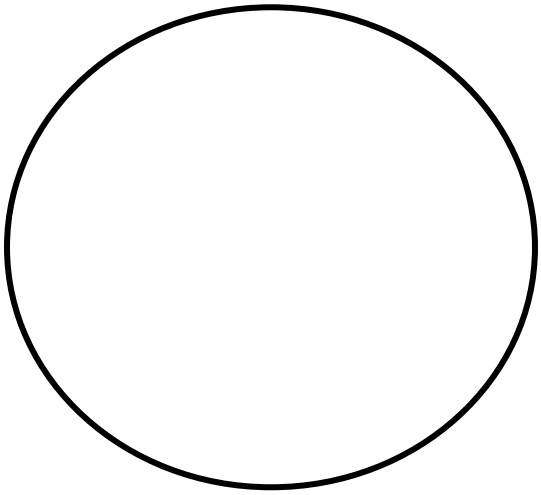


Organ:

Stain:

Lesion:

Condition:

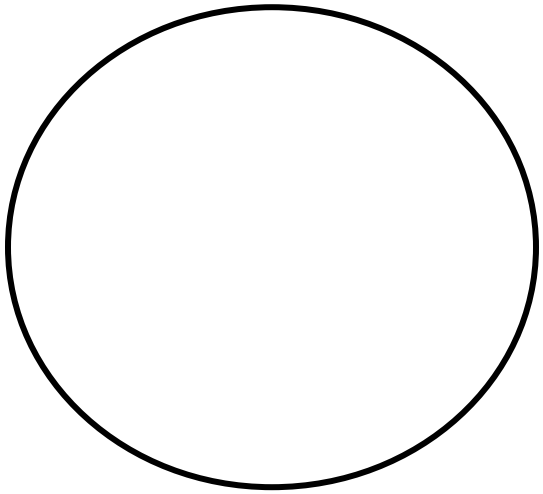


Organ:

Stain:

Lesion:

Condition:

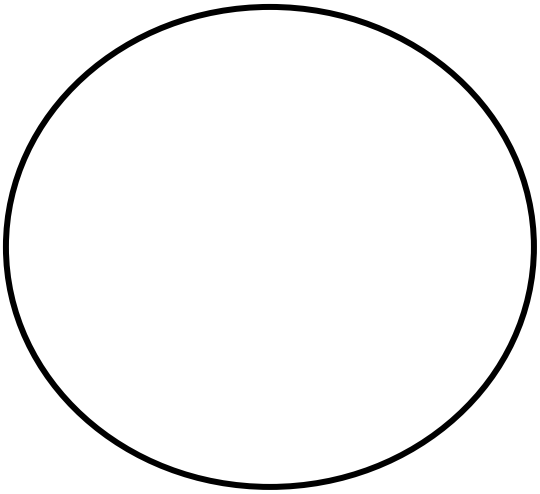


Organ:

Stain:

Lesion:

Condition:

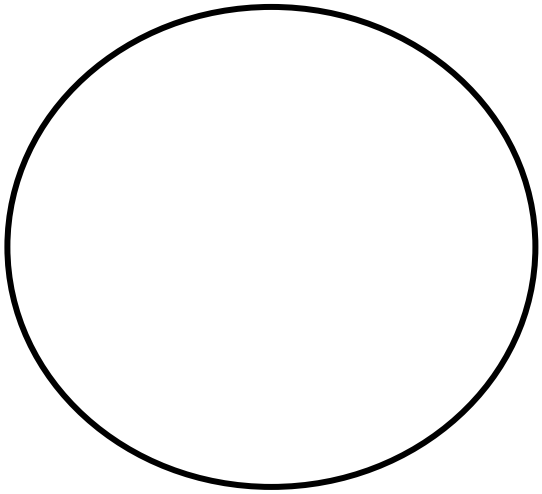


Organ:

Stain:

Lesion:

Condition:

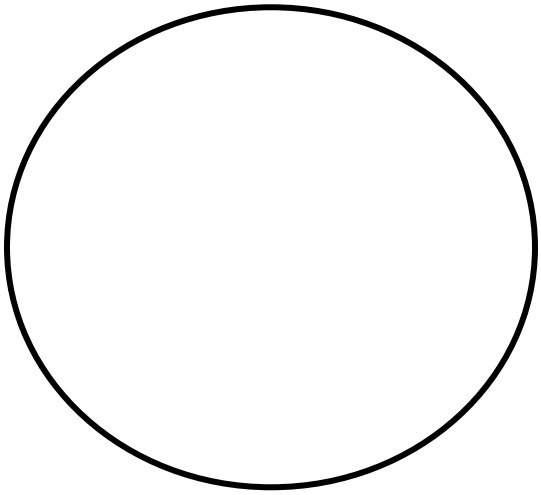


Organ:

Stain:

Lesion:

Condition:

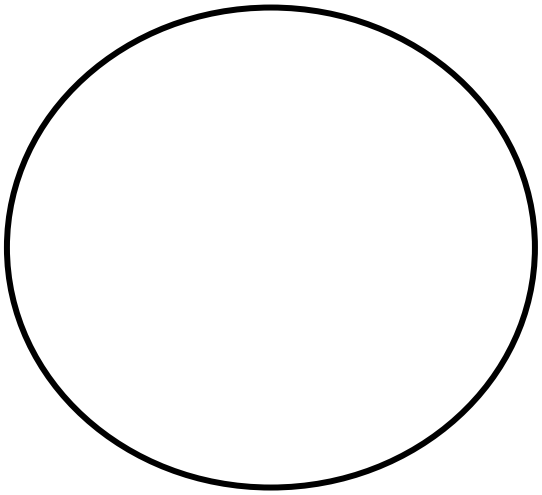


Organ:

Stain:

Lesion:

Condition:

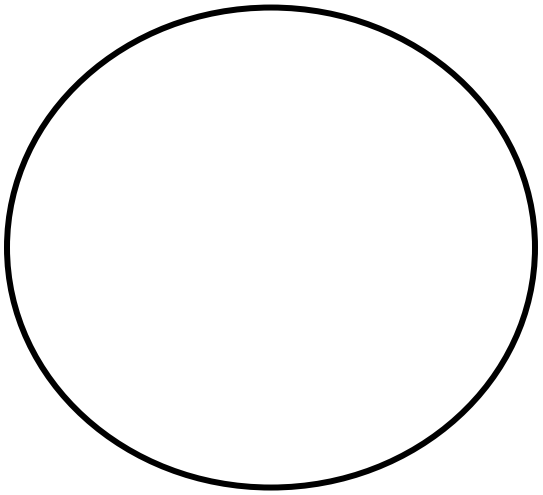


Organ:

Stain:

Lesion:

Condition:

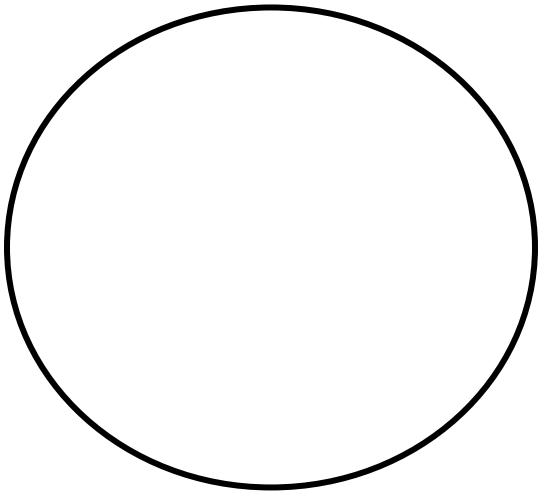


Organ:

Stain:

Lesion:

Condition:

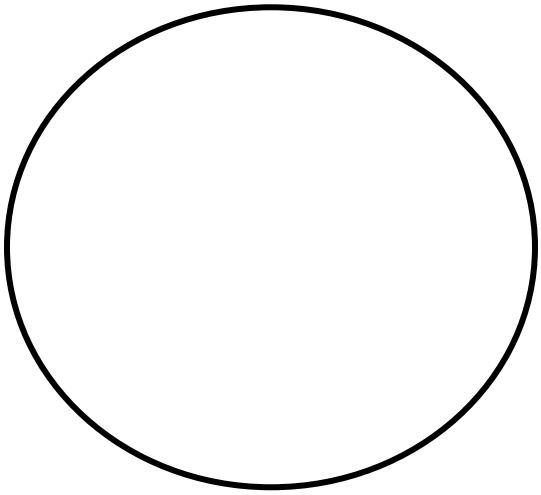


Organ:

Stain:

Lesion:

Condition:

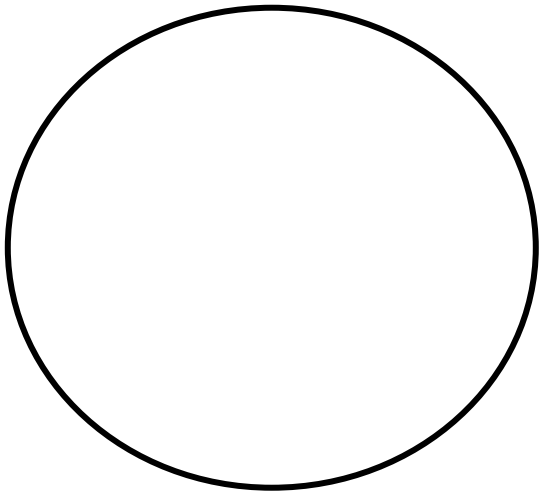


Organ:

Stain:

Lesion:

Condition:

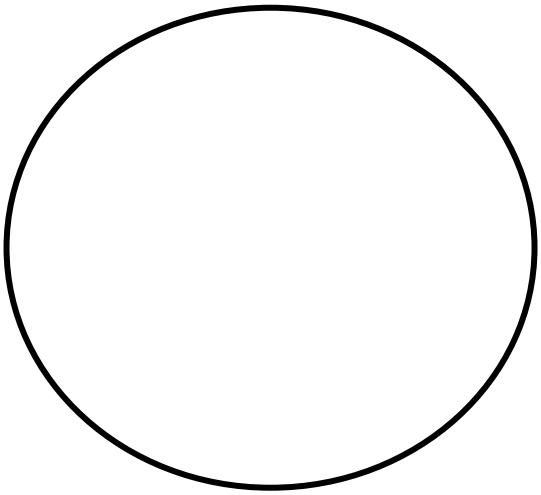


Organ:

Stain:

Lesion:

Condition:

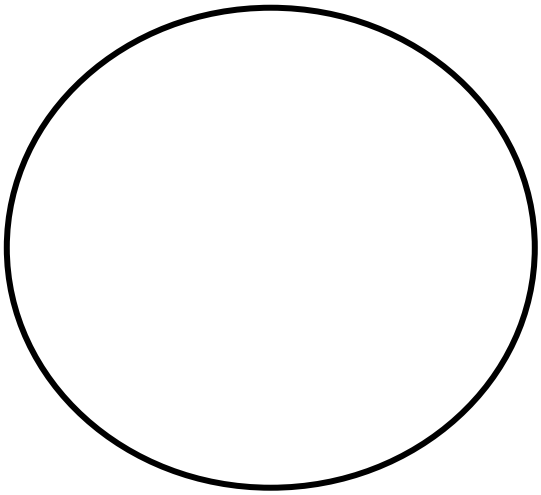


Organ:

Stain:

Lesion:

Condition:

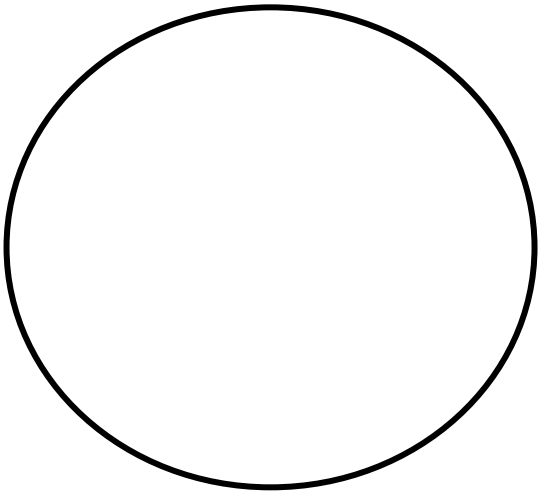


Organ:

Stain:

Lesion:

Condition:

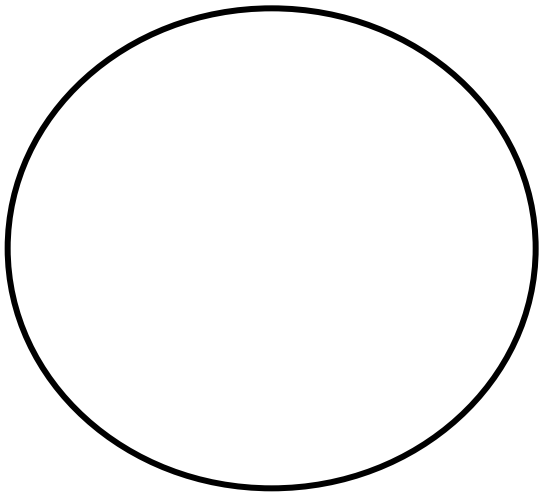


Organ:

Stain:

Lesion:

Condition:

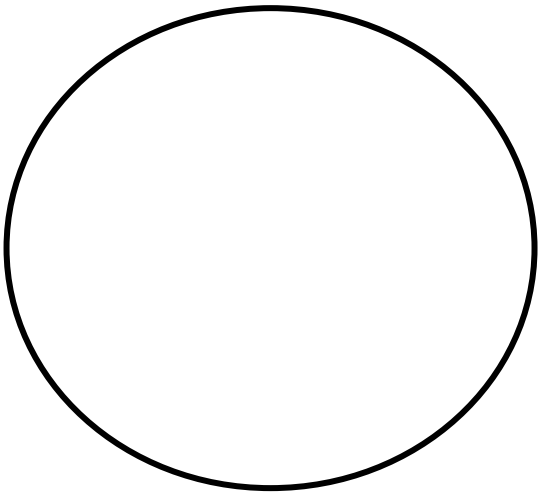


Organ:

Stain:

Lesion:

Condition:

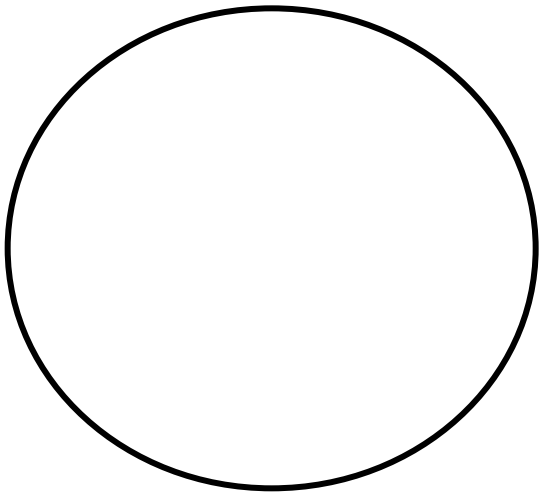


Organ:

Stain:

Lesion:

Condition:

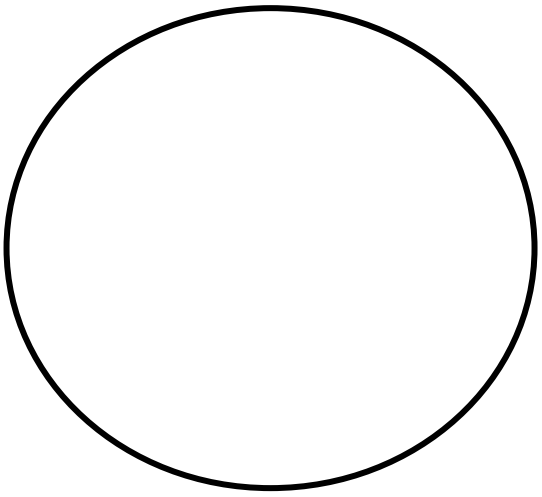


Organ:

Stain:

Lesion:

Condition:

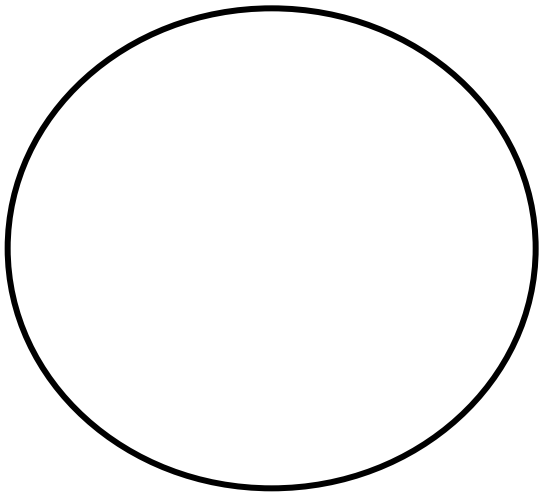


Organ:

Stain:

Lesion:

Condition:

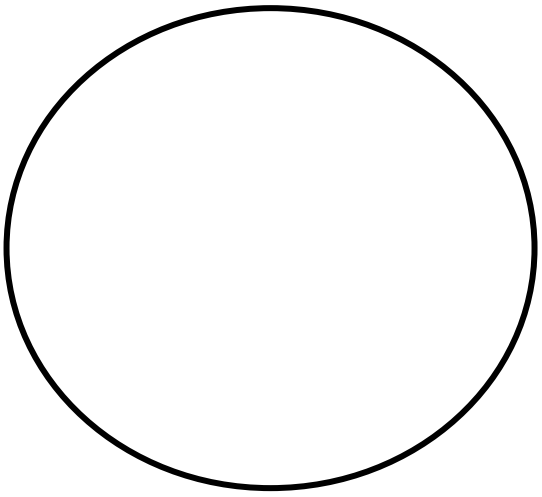


Organ:

Stain:

Lesion:

Condition:

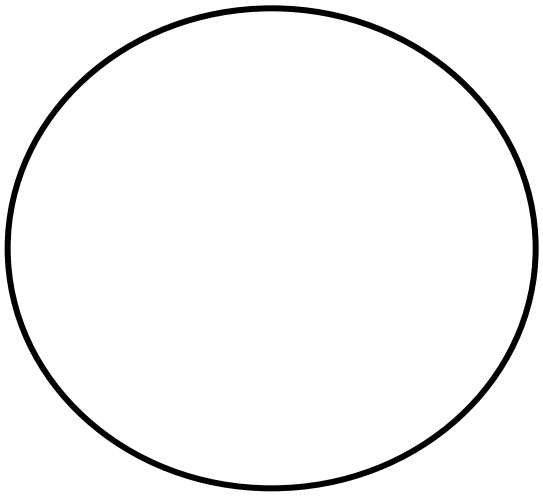


Organ:

Stain:

Lesion:

Condition:

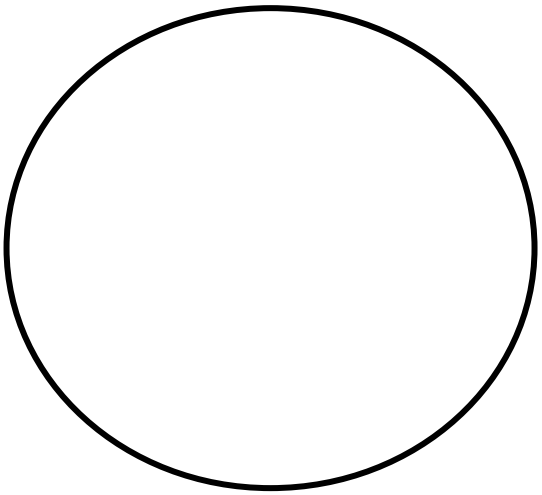


Organ:

Stain:

Lesion:

Condition:

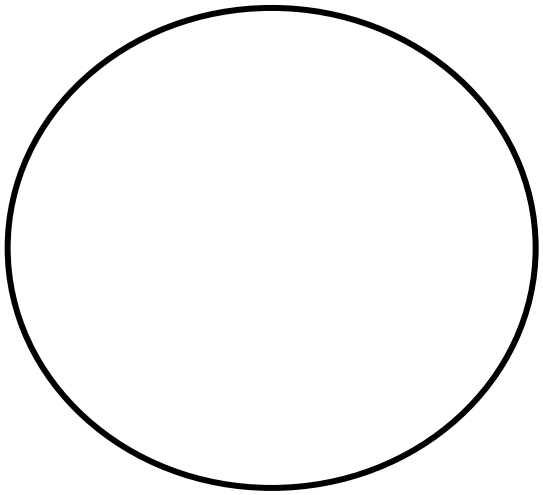


Organ:

Stain:

Lesion:

Condition:

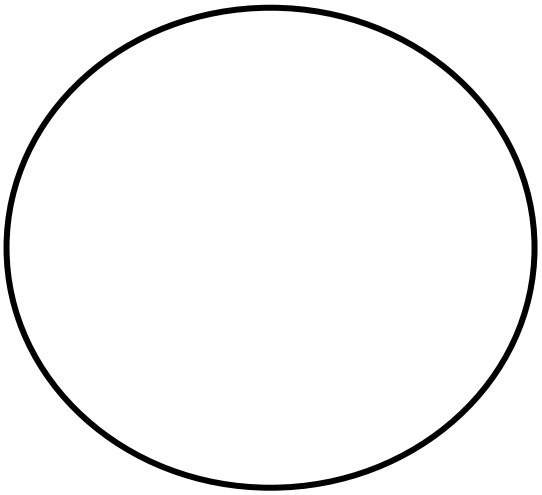


Organ:

Stain:

Lesion:

Condition:

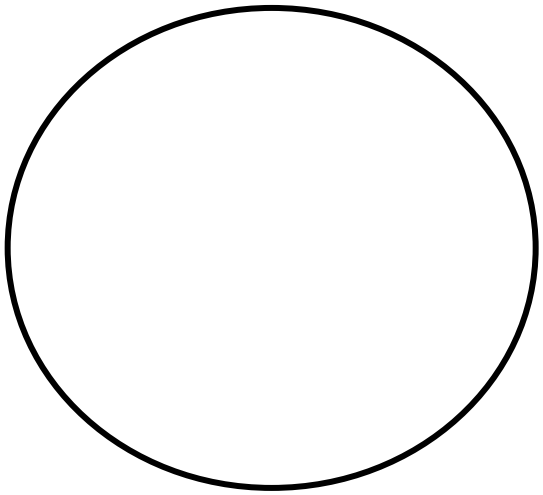


Organ:

Stain:

Lesion:

Condition:



Organ:

Stain:

Lesion:

Condition: