

THYMUS

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WHAT IS THYMUS?

The thymus is of a pinkish-gray colour, soft, and lobulated on its surfaces.

A primary lymphoid organ and the initial site for development of T cell immunological function.

The morphologically similar across species.

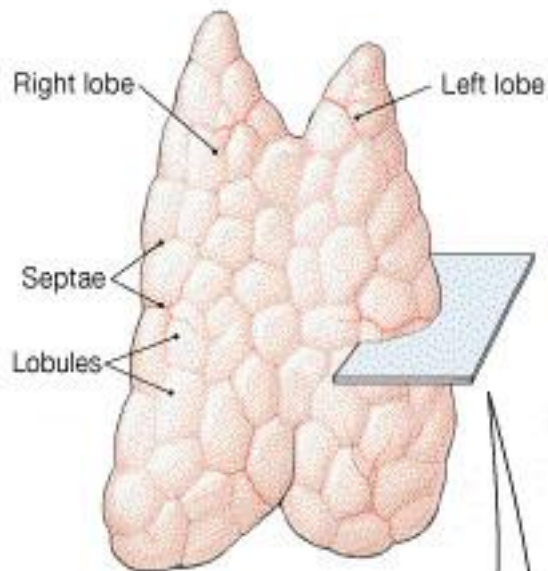
It is actually an epithelial organ in which its epithelial cells provide a framework containing T cells as well as smaller numbers of other lymphoid cells.

ANATOMY OF THYMUS

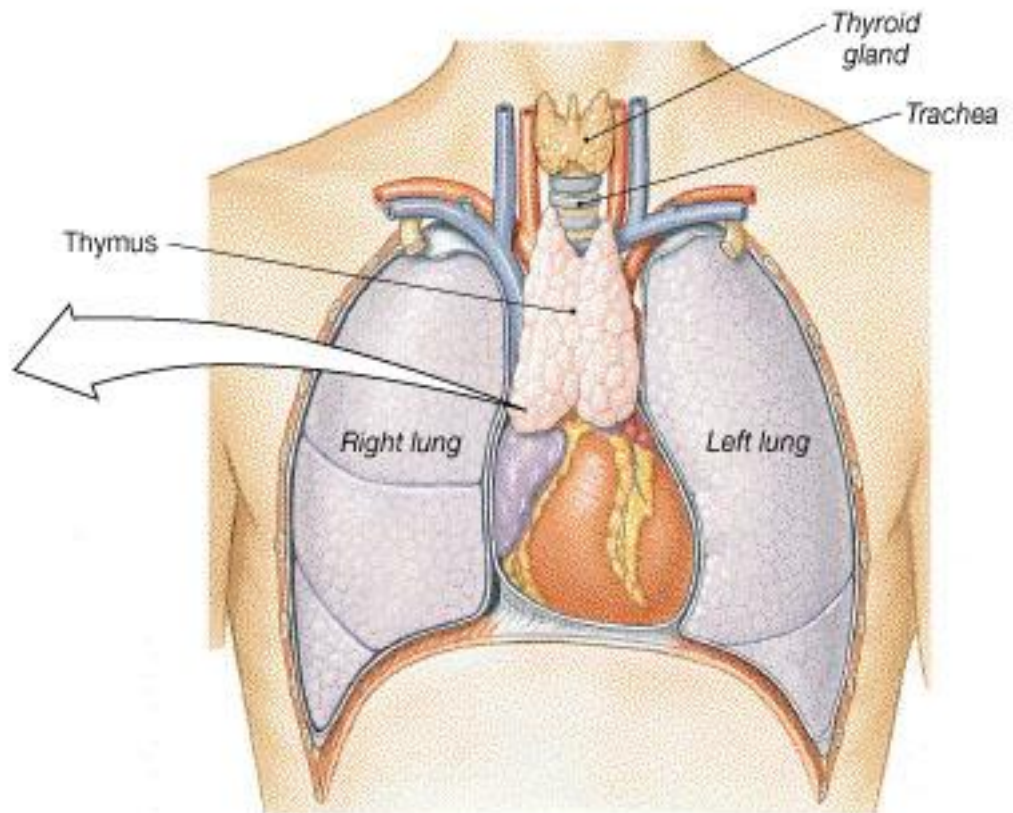
The mammalian thymus is located in the pericardial mediastinum, anterior to the major vessels of the heart, and ventral to the base of the heart and aortic arch.

The thymus consists of two distinct lobes connected by a connective tissue isthmus.

A thin connective tissue capsule surrounds each lobe and, in most species, gives rise to septae, that partially subdivide the thymus into interconnecting lobules of variable size and orientation



(b) Thymus

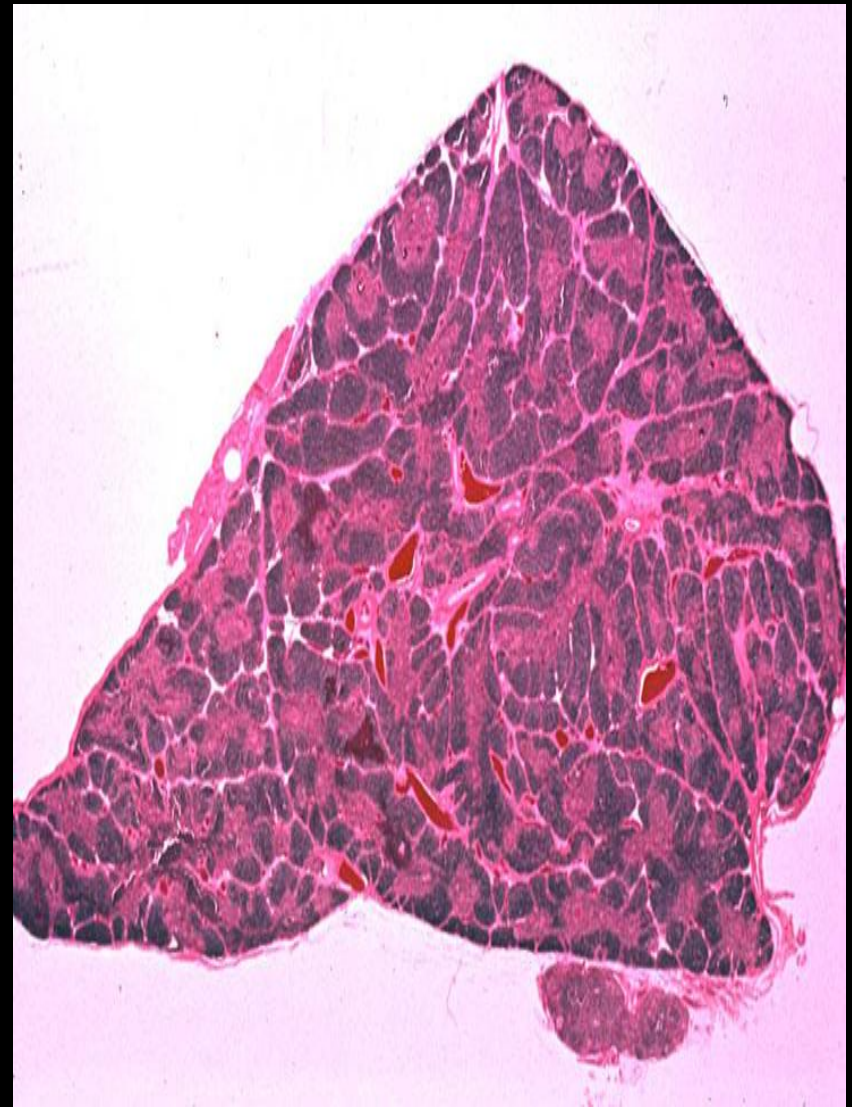


(a) Location of thymus within thoracic cavity

HISTOLOGY OF THYMUS

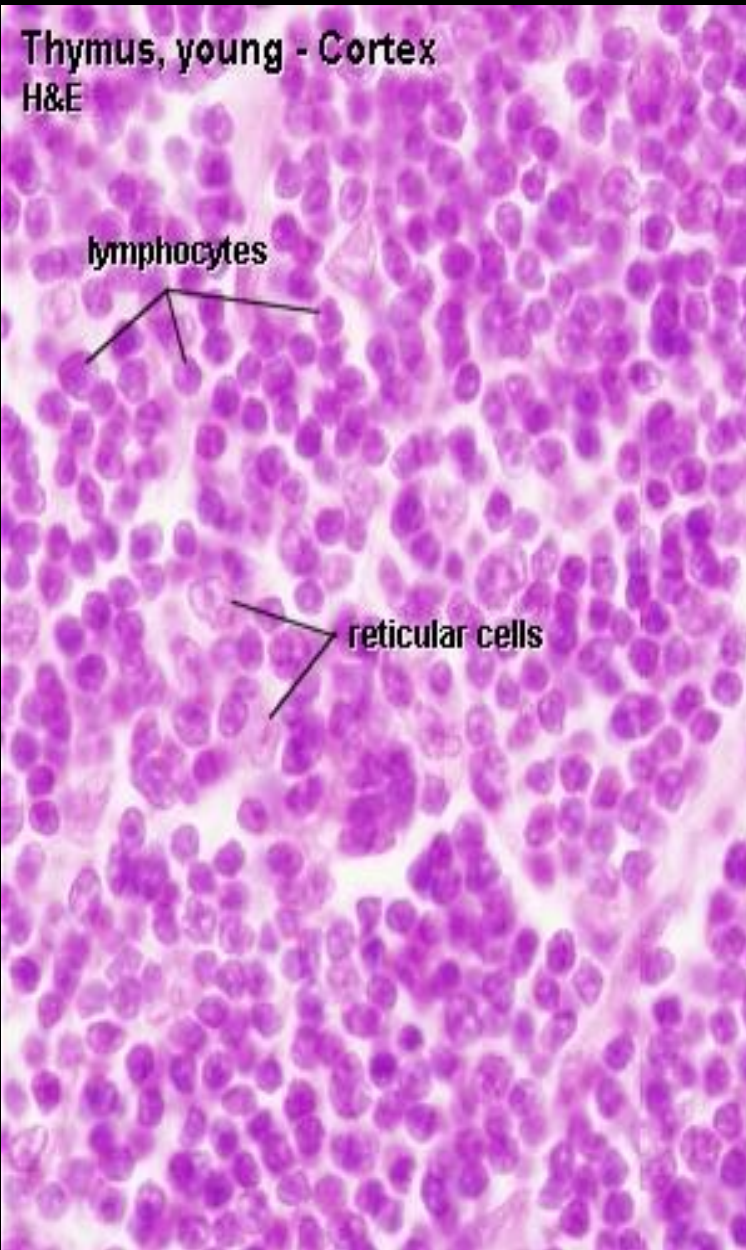


- ▶ The gland is organized into numerous lobules.
- ▶ Each lobule contains a dark-staining outer cortex. (due to high cell density of lymphocyte)
- ▶ interlobular septa—separate the lobules.
- ▶ The capsule and septa contain blood vessels, lymphatics and nerves.

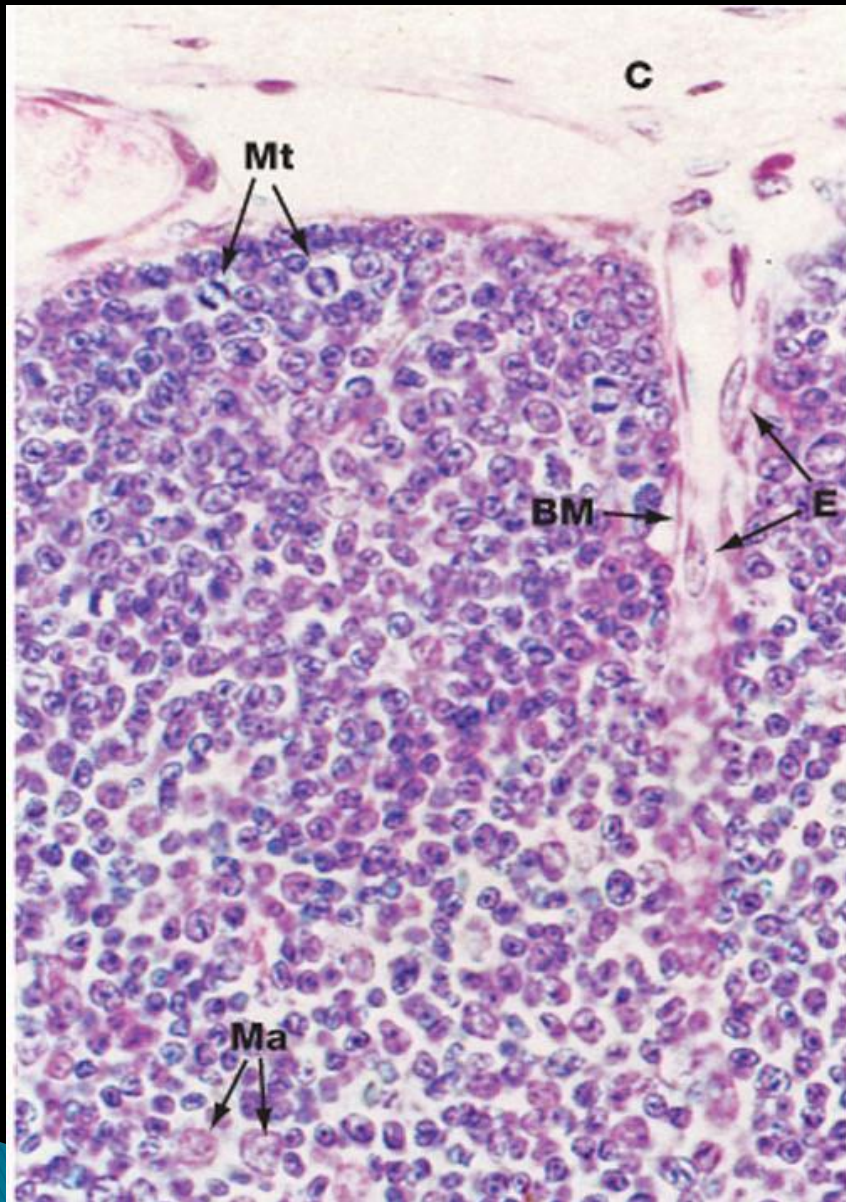


What you can find in cortex?

- ▶ Lymphocyte- t- lymphocyte
- ▶ Reticular cells
- ▶ macrophages



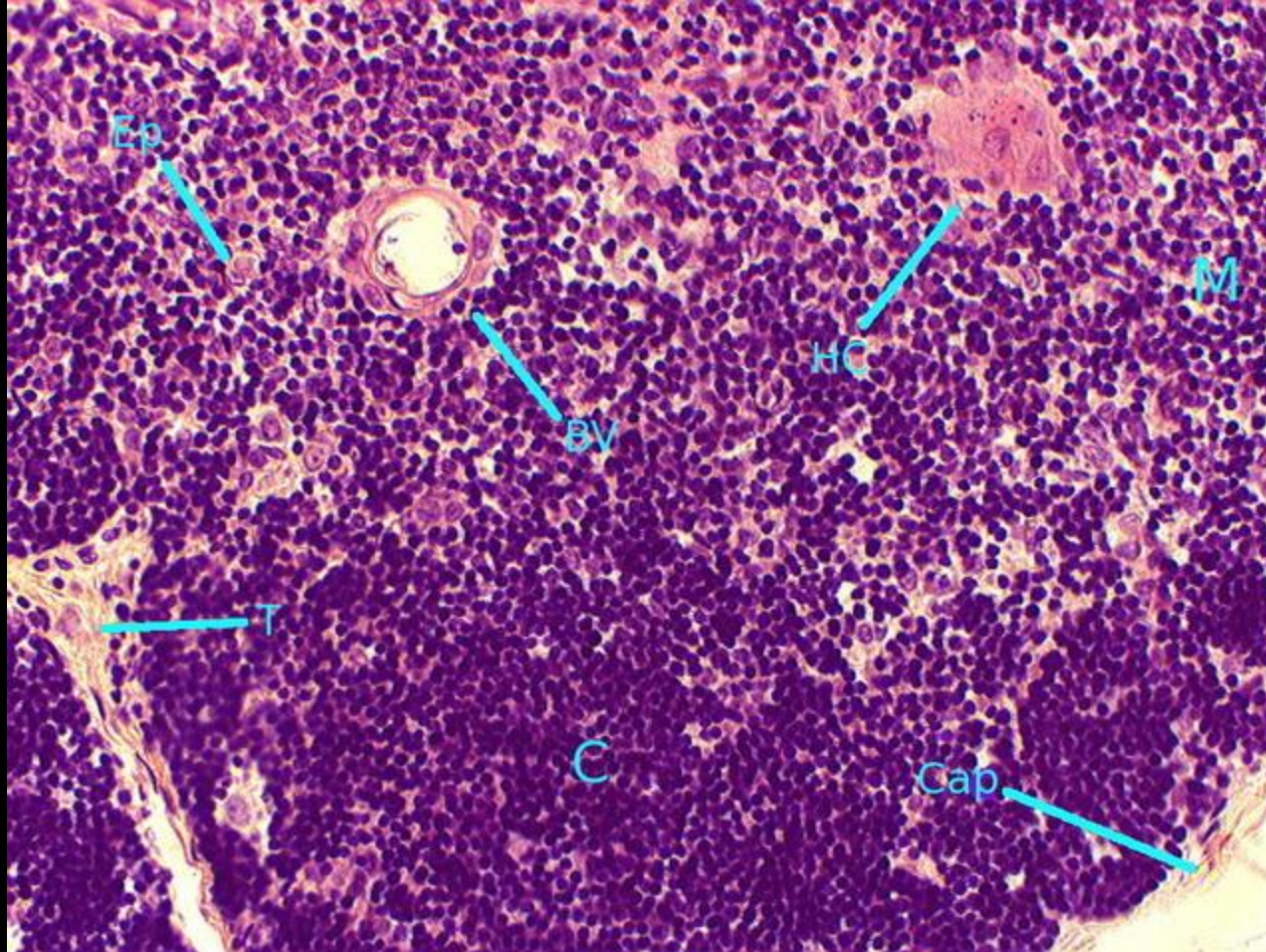
- ▶ **Cortex**
- ▶ The cortical portion is mainly composed of lymphoid cells,
- ▶ supported by a network of finely-branched epithelial reticular cells, which is continuous with a similar network in the medullary portion.



- ▶ At the outer cortex, it is common to find **mitotic figures (Mt)**. These are dividing lymphoblasts in the process of producing clones of smaller mature T-cells.
- ▶ At the corticomedullary junction, one can find pale-stained **macrophages (Ma)**. – remove lymphocytes that have failed to develop properly.

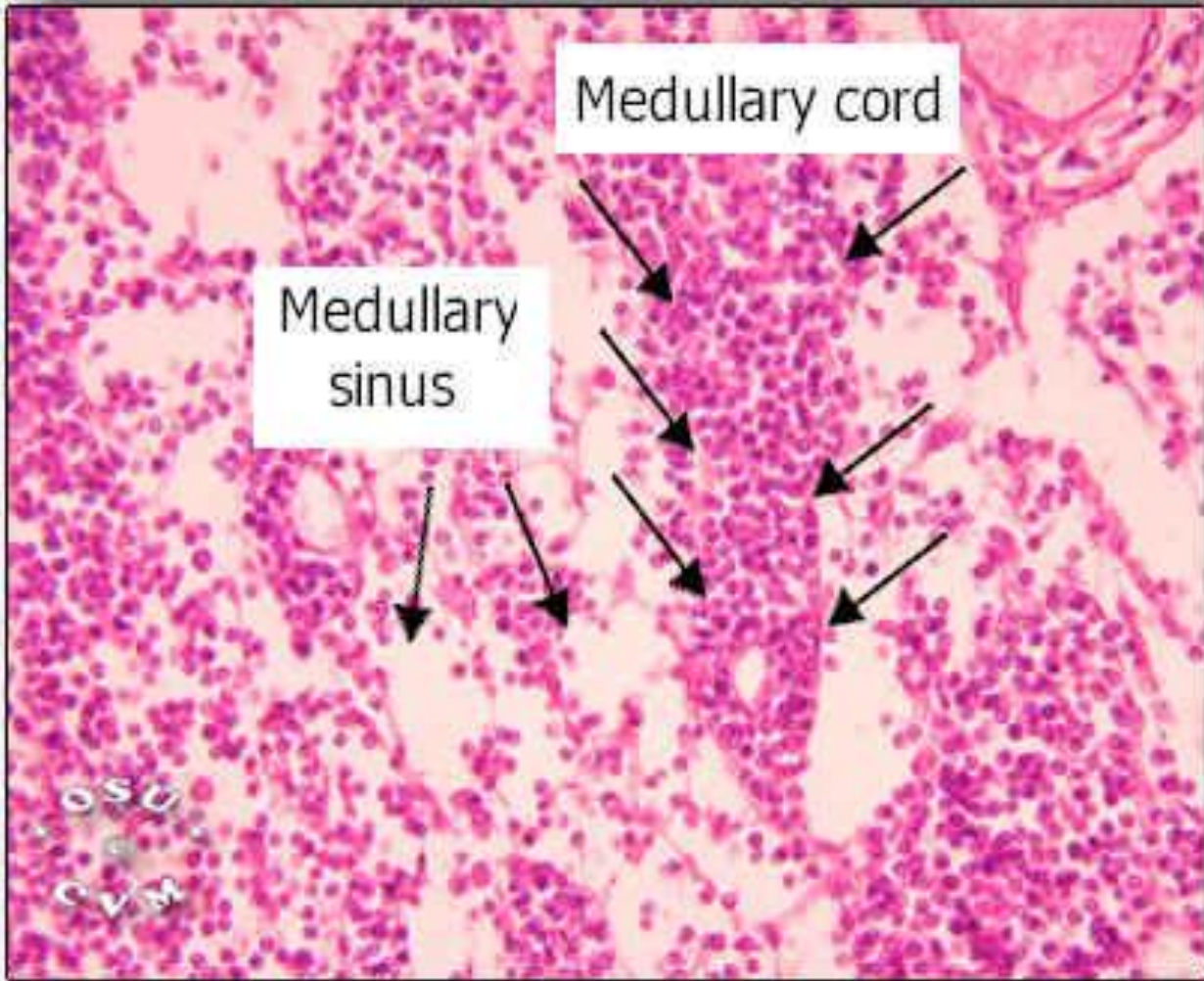
Medulla

- ▶ inner, less cellular of thymus gland
- ▶ the lymphoid cells are relatively fewer in number
- ▶ From the medulla mature T lymphocytes enter the circulation.
- ▶ The medulla contains
 - ❖ epithelioreticular cells
 - ❖ loosely packed T lymphocytes
 - ❖ Hassall's corpuscles



- ▶ BV = Blood Vessel
- C = Cortex
- Cap = Capsule
- Ep = Epithelioreticular cell
- HC = Hassall's corpuscles
- M = Medulla
- T = Trabeculae

- Because of Lymphocytes are densely packed medulla area is lightly stained.
- Medulla is a network of medullary cords and medullary sinuses.



- ▶ Medullary sinus: they are lymphatic sinus.
Trabecular sinuses at their deeper end break to form a network of medullary sinus which at the other end leave the lymph node as efferent lymph vessel.
- ▶ Medullary cords: a network of cellular cords between the medullary sinuses area.

Thymus gland through ages

- Present from birth
 - Grows in size until puberty
 - Then, shrink in size. Replaced by fats and connective tissue
 - as we grow older, our body are less able to produce antibodies
- greater risk for infections.



Functions of thymus gland

- ▶ Responsible for development on lymphatic system
- ▶ Maturity of t-cell
- ▶ Produce hormone thymosin
- ▶ Prevent the abnormal growth of cell (cancer)

DISEASES

Thymoma in Dogs

- ▶ A thymoma is a tumor originating from the epithelium (layer of tissue covering the thymus) of the thymus.
- ▶ rare tumors in both cats and dogs and they are associated with myasthenia gravis.
- ▶ Myasthenia gravis is a severe autoimmune disease which causes certain muscle groups to tire easily.

Symptoms and Types

- ▶ **Coughing**
- ▶ **Increased breathing rate**
- ▶ **Trouble breathing**
- ▶ **Cranial caval syndrome** -- a side effect of heartworm infestation, which often leads to swelling of the head, neck, or forelimbs
- ▶ **Myasthenia gravis**, a neuromuscular disease that leads to muscle weakness, enlarged esophagus, and frequent regurgitation

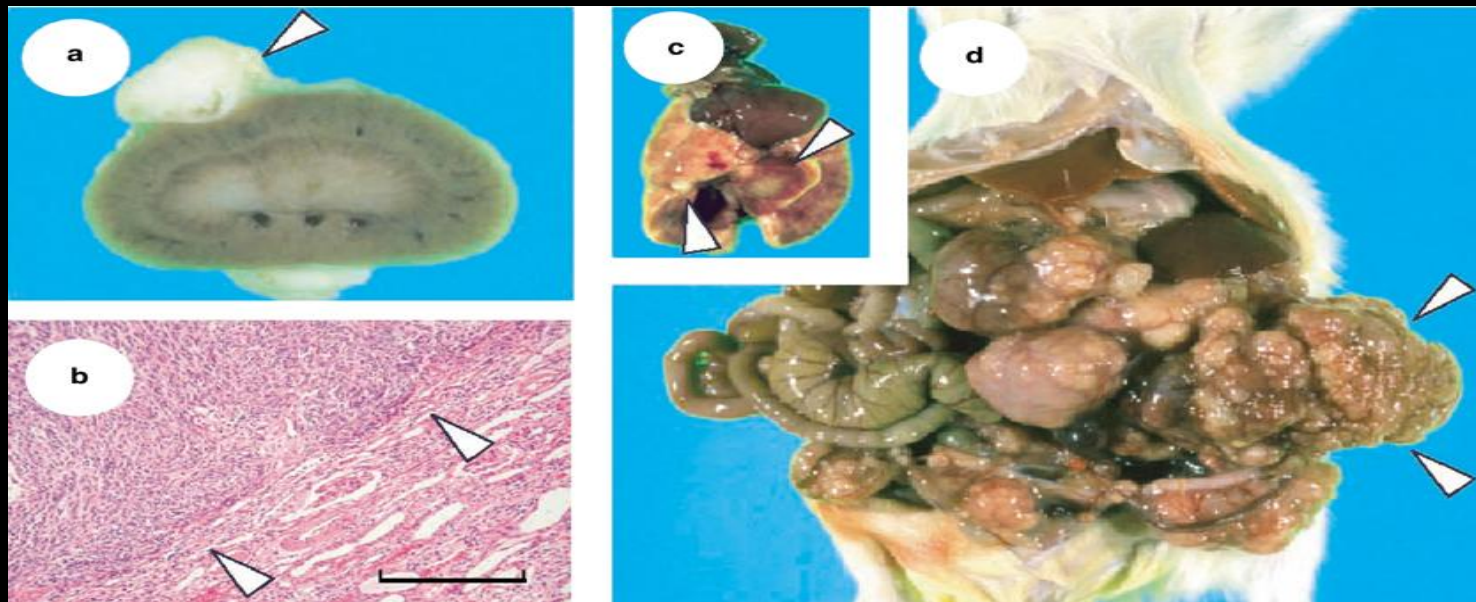
Causes : Unknown



- ▶ A fine-needle aspirate of the mass will show mature lymphocytes (white blood cells) and epithelial cells (cells forming the outside layer of the thymus gland).

Treatment

- ▶ surgery to remove the thymoma. They are highly invasive and
- ▶ difficult to remove in dogs
- ▶ easier to remove in cats
- ▶ Twenty to thirty percent of thymomas are malignant and spread throughout the chest and/or abdomen.



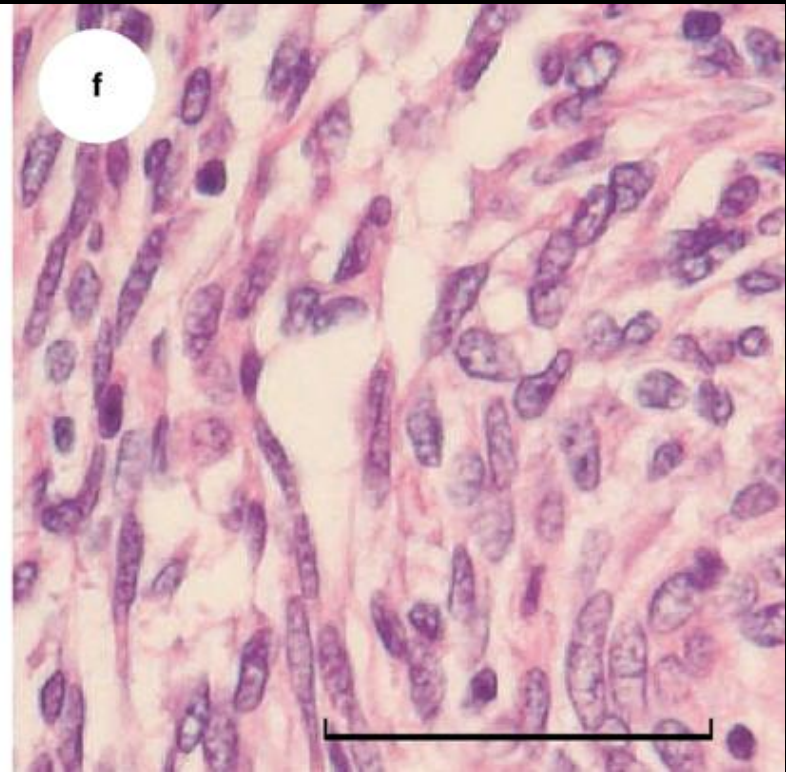
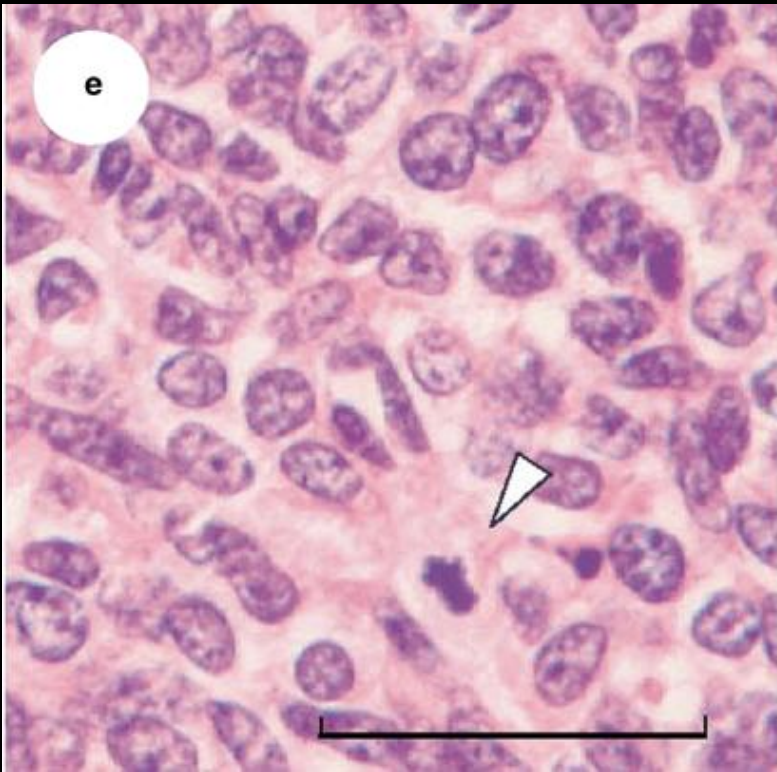
Development of thymomas in the thymuses transplanted into the subcapsular space of the recipient kidney, and the malignant transformation.

(a) At 3 months after the transplantation, a tumor (arrowhead) developed in the transplanted thymus.

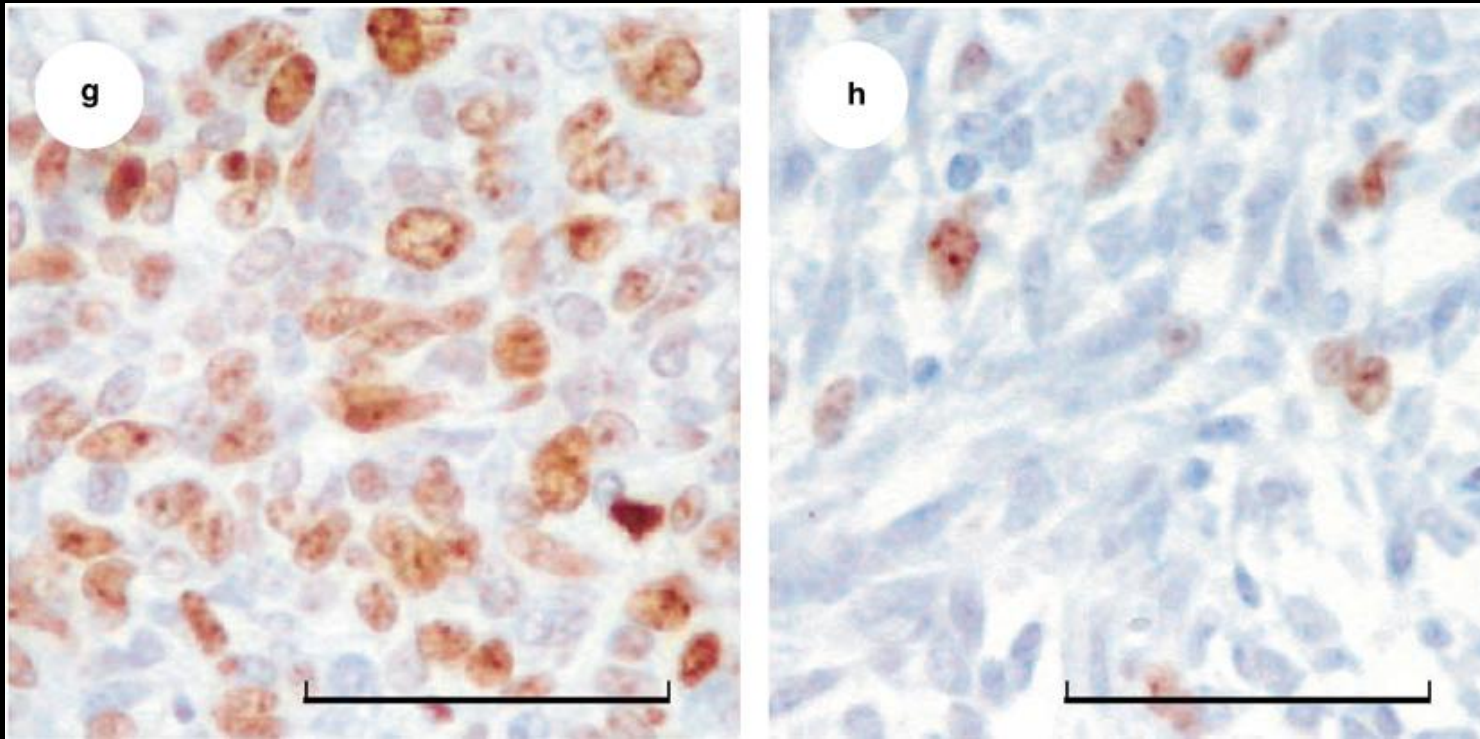
(b) Microscopically, the tumor (arrowheads) showed the same histological features as original thymomas in rats.

(c) Metastases to the lungs (arrowheads).

(d) Peritoneal disseminations and a large tumor formation adjacent to the kidney (arrowheads) were observed when the tumor was incubated for another 3 months. Figures are from representative rats at 3 and 6 months after the transplantation



(e, f) Histopathologically, nuclear atypia and mitosis (e, arrowhead) were prominent in the transformed thymomas compared with those in the originals (f) (HE staining).



g, h) Many nuclei of cells positively stained with anti-Ki-67 antibody were found in the transformed thymomas (**g**, brown staining in nuclei) but few in the originals (**h**)

What is lymphoma?

- ❑ also referred to as malignant lymphoma or lymphosarcoma)
- ❑ defined as the malignant proliferation of lymphoid cells, originating from outside of the bone marrow
- ❑ in solid organs such as lymph nodes, liver, or spleen. It is the origin of this malignancy from outside of the bone marrow that differentiates lymphoma from lymphoid leukemias.
- ❑ Lymphoma is the most common hematopoietic malignancy in dogs.
- ❑ Canine lymphoma can be classified by anatomic site, histologic or cytologic phenotype, and immunophenotype

Factor and causes

- ❑ Most dogs with lymphoma are middle-age or older (6 years or older).
- ❑ An increased incidence of this disease in certain breeds such as Boxers, Scottish Terriers, Basset Hounds, Airedale Terriers, Chow Chows, German Shepherds, Poodles, Saint Bernards, English Bulldogs, Beagles, and Golden Retrievers has been reported.
- ❑ No sex predilection has been reported.
- ❑ The cause of lymphoma in dogs is unknown and suspected to be multifactorial in nature.
- ❑ Although some studies have shown
 - an association between pesticide use and magnetic field exposure
 - an increased incidence of this disease in middle-age, related purebred dogs,
 - the significance of these associations is controversial.

The WHO clinical staging for domestic animals with lymphoma guidelines are as follows:

- ❑ Stage I: Single lymph node involvement
- ❑ Stage II: Multiple lymph node involvement in a regional area
- ❑ Stage III: Generalized lymphadenopathy
- ❑ Stage IV: Hepatic or splenic involvement (with or without stage III)
- ❑ Stage V: Bone marrow or blood involvement or any non-lymphoid organ (with or without stage I to IV)

Clinical stage can be established based on the World Health Organization

(WHO) clinical staging guidelines for domestic animals with lymphoma.

The four anatomic classification sites include the following:

- 1. Multicentric: generalized lymph node, hepatic, splenic, or bone marrow involvement.**
- 2. Alimentary: solitary, diffuse, or multifocal gastrointestinal tract infiltration, hepatic, splenic, or mesenteric lymph node involvement.**
- 3. Extranodal: renal, central nervous system, cutaneous, any organ tissue.**
- 4. Mediastinal (thymic): mediastinal lymphadenopathy or bone marrow involvement.**

Physical examination

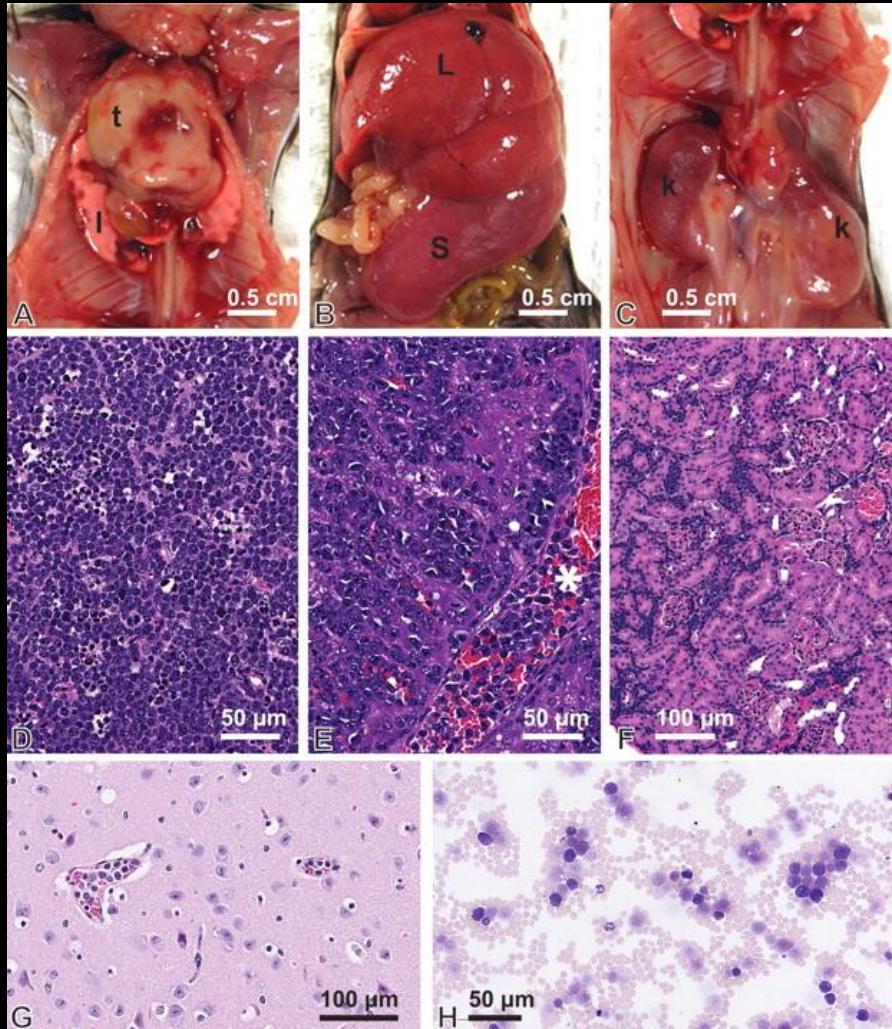
- ❑ All accessible lymph nodes should be carefully palpated for enlargement; this includes performing
 - ❑ a digital rectal examination.
- ❑ Thorough abdominal palpation can help to identify hepatomegaly, splenomegaly, renomegaly, or abnormalities in the gastrointestinal tract, and potential abdominal lymph node enlargement.
- ❑ Conscientious thoracic auscultation may help to identify pulmonary involvement or the presence of a pleural effusion.
- ❑ Mucous membrane evaluation may identify pallor, icterus, or petechiae.
- ❑ An ocular examination, including fundic evaluation, is also essential because as many as 50% of dogs with lymphoma can have ocular changes associated with their disease.

Diagnosis

- ❑ The cornerstone of lymphoma diagnosis in the dog is microscopic confirmation of the disease.
- ❑ The cytologic evaluation of fine-needle aspirates from enlarged lymph nodes by a clinical pathologist may be adequate to make the diagnosis in most cases.
- ❑ It is important to avoid aspirating lymph nodes draining reactive areas (e.g., the submandibular lymph nodes) to prevent confusion between reactive hyperplasia and lymphoma on cytologic assessment.
- ❑ Cytologic analysis of aspirates from affected organs (e.g., liver, spleen, kidneys) or of fluids (pleural, abdominal, cerebrospinal fluid) may also provide the diagnosis.
- ❑ A tissue biopsy for conclusive histologic confirmation of lymphoma will be necessary in some cases of lymphoma.

▶ Treatment

- Chemotherapy (systemic disease—
developed many years)
- Surgery (focal disease)



THANK YOU =)