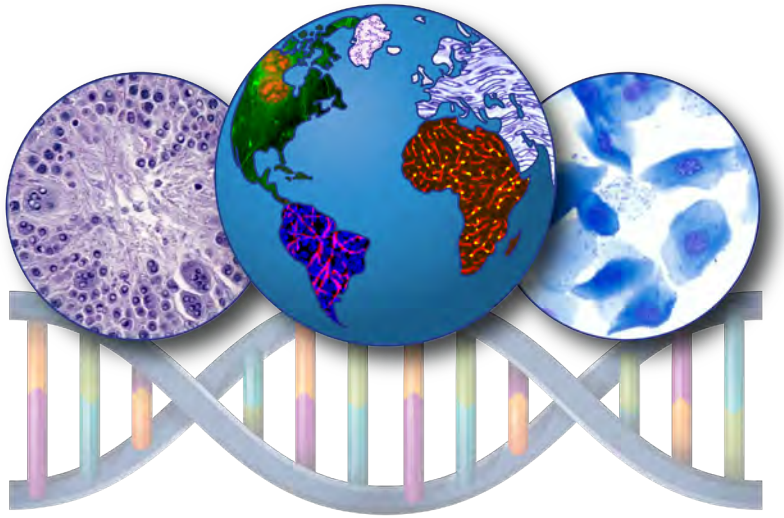
National Institute of
Environmental Health Sciences
Division of Translational Toxicology

Anatomy and Histology of the Normal Rodent Parathyroid Gland



Division of Translational Toxicology Global Toxicologic Pathology Training Program

National Institutes of Health • U.S. Department of Health and Human Services

Overview

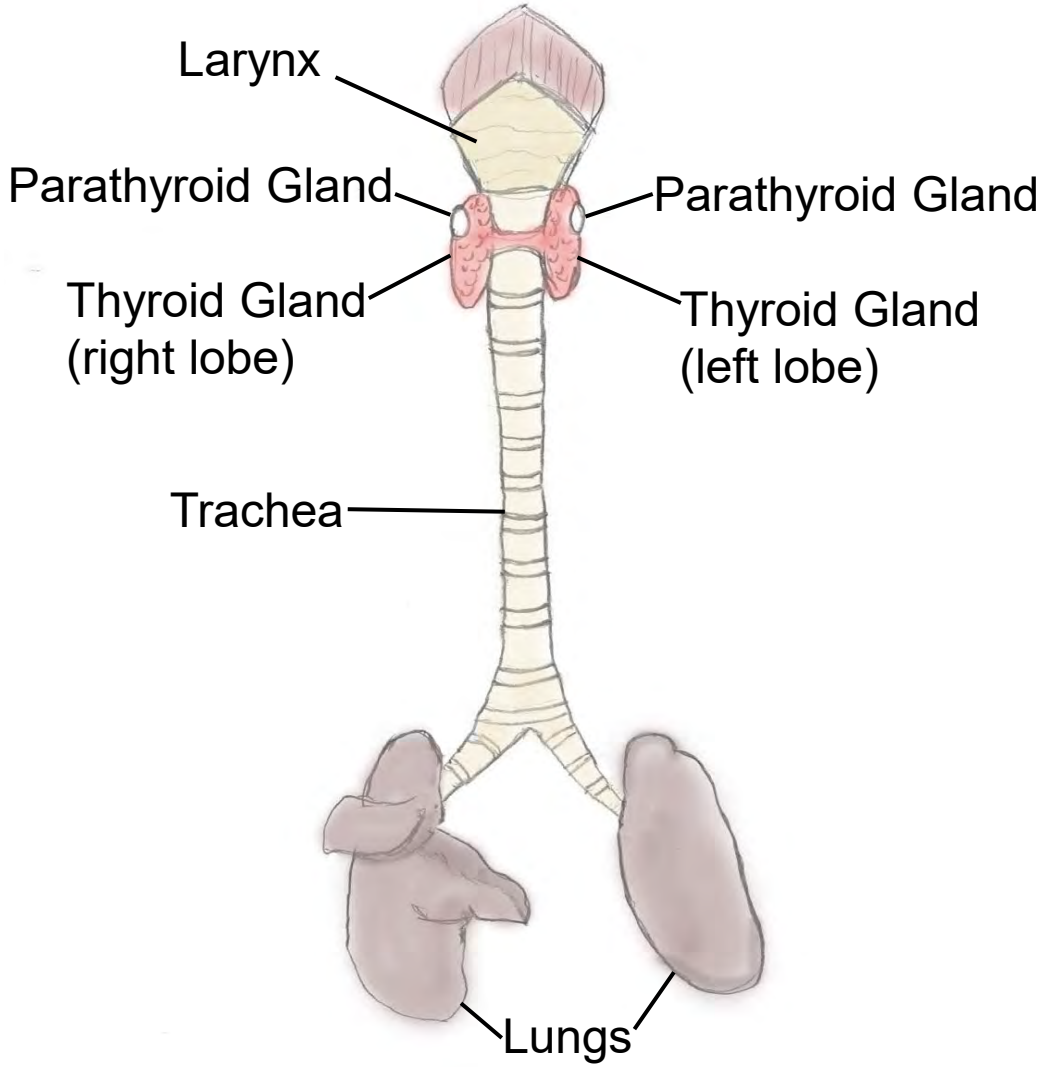
- Embryology and Development
- Gross Anatomy
- Cutting and Trimming
- Histology
- Common Congenital Lesions

Parathyroid Gland: Embryology and Development

- Usually only one pair of parathyroid glands in mice and rats, unlike many other mammals with two pairs
- Derived from the endoderm of the third pharyngeal pouch in mice and rats
- The parathyroids and thymus are both derived from the third pharyngeal pouch
- Gestation day 11.5 in mice and day 13 in rats – the parathyroid glands appear along the dorsal surface of the third pharyngeal pouch
- Gestation day 15 in mice and rats – the parathyroid glands come into contact with the thyroid gland and migrate to their definitive position by day 15.5 in mice and day 16 in rats

Parathyroid Gland: Gross Anatomy

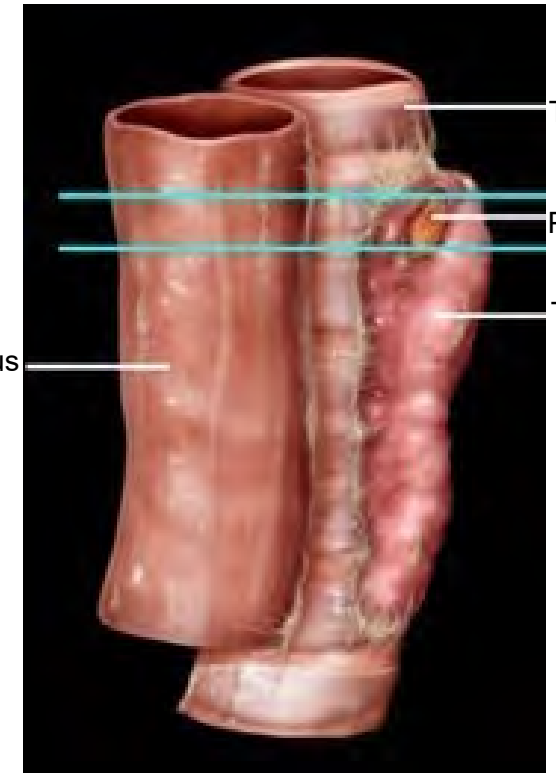
- Paired organs located within the right and left lobes of the thyroid gland in lower neck along the sides of the trachea just caudal to (below) the larynx
  - Each lobe of the thyroid gland contains one parathyroid gland in rats and mice
- Location:
  - Usually on the anterior and lateral aspect of thyroid lobes in rats, but the position may vary
  - Usually on the dorsal and lateral aspect of thyroid lobes in mice, but the position may vary and may be embedded in thyroid
- May be difficult to locate, especially in mice
- Sexual dimorphism in rats:
  - Parathyroid glands are larger in females than males

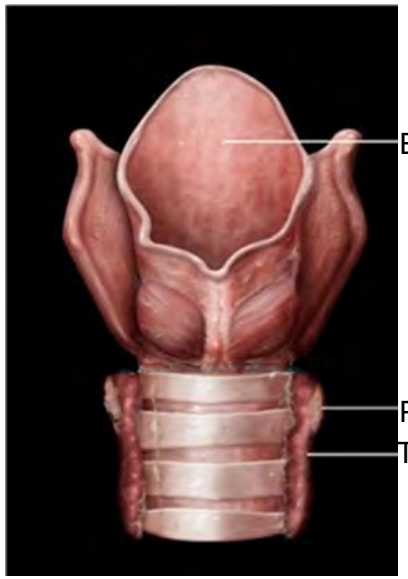


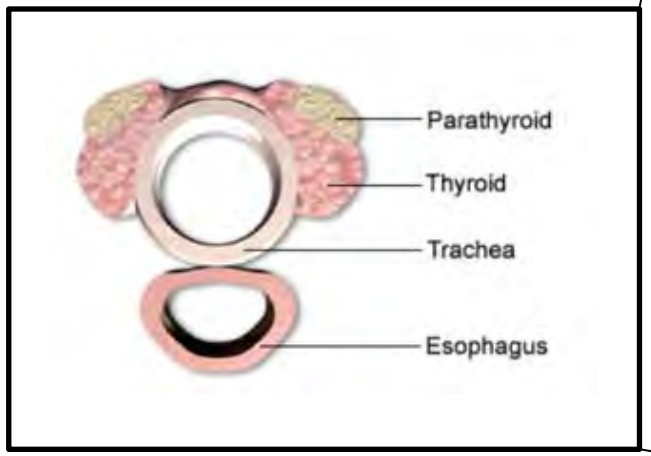
Parathyroid Gland: Cutting and Trimming

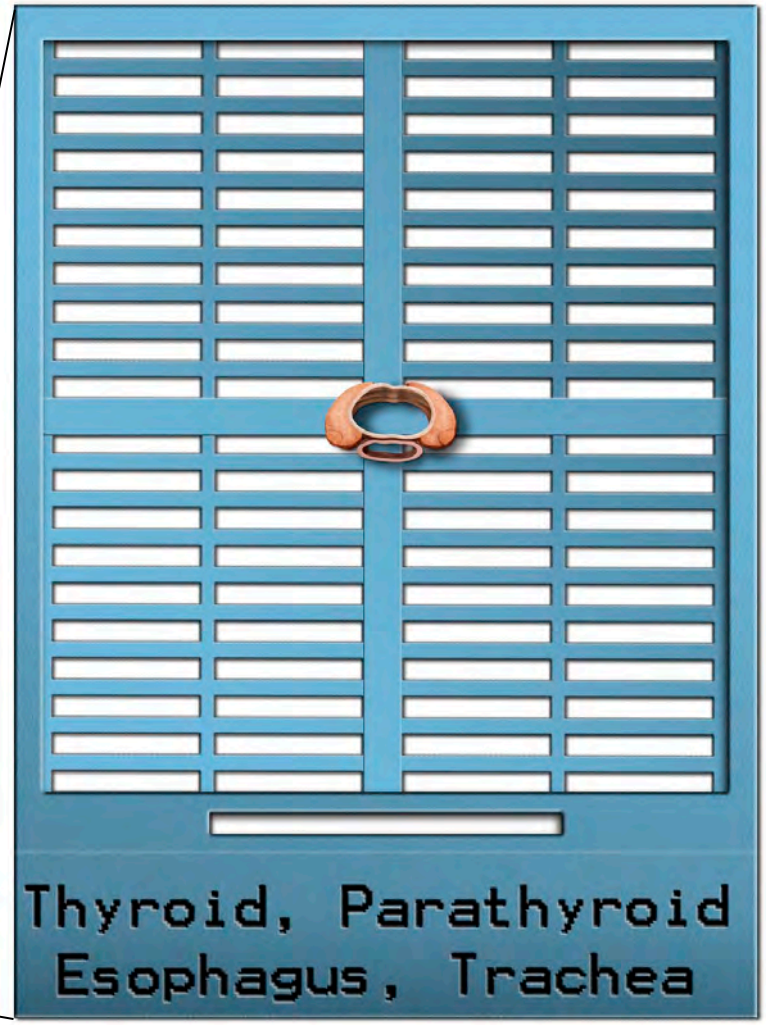
Transverse Sectioning

- Section is taken through the trachea, esophagus, thyroid gland, and parathyroid glands



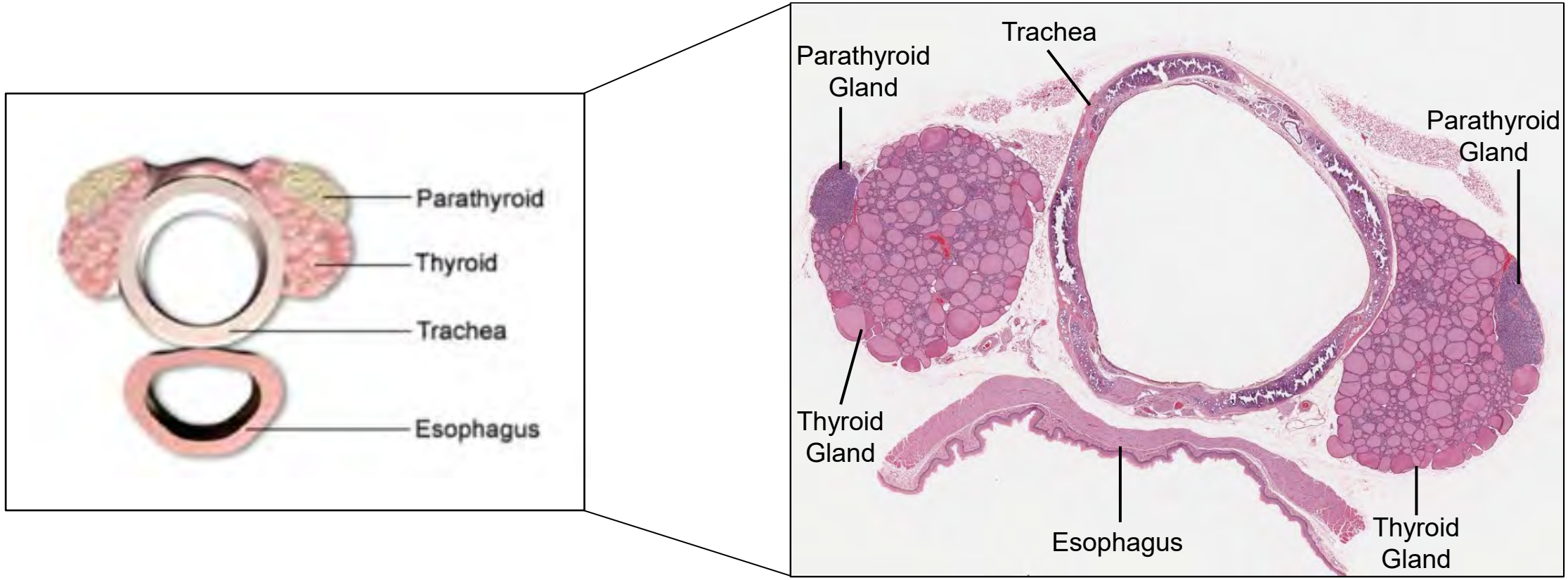






Parathyroid Gland: Cutting and Trimming

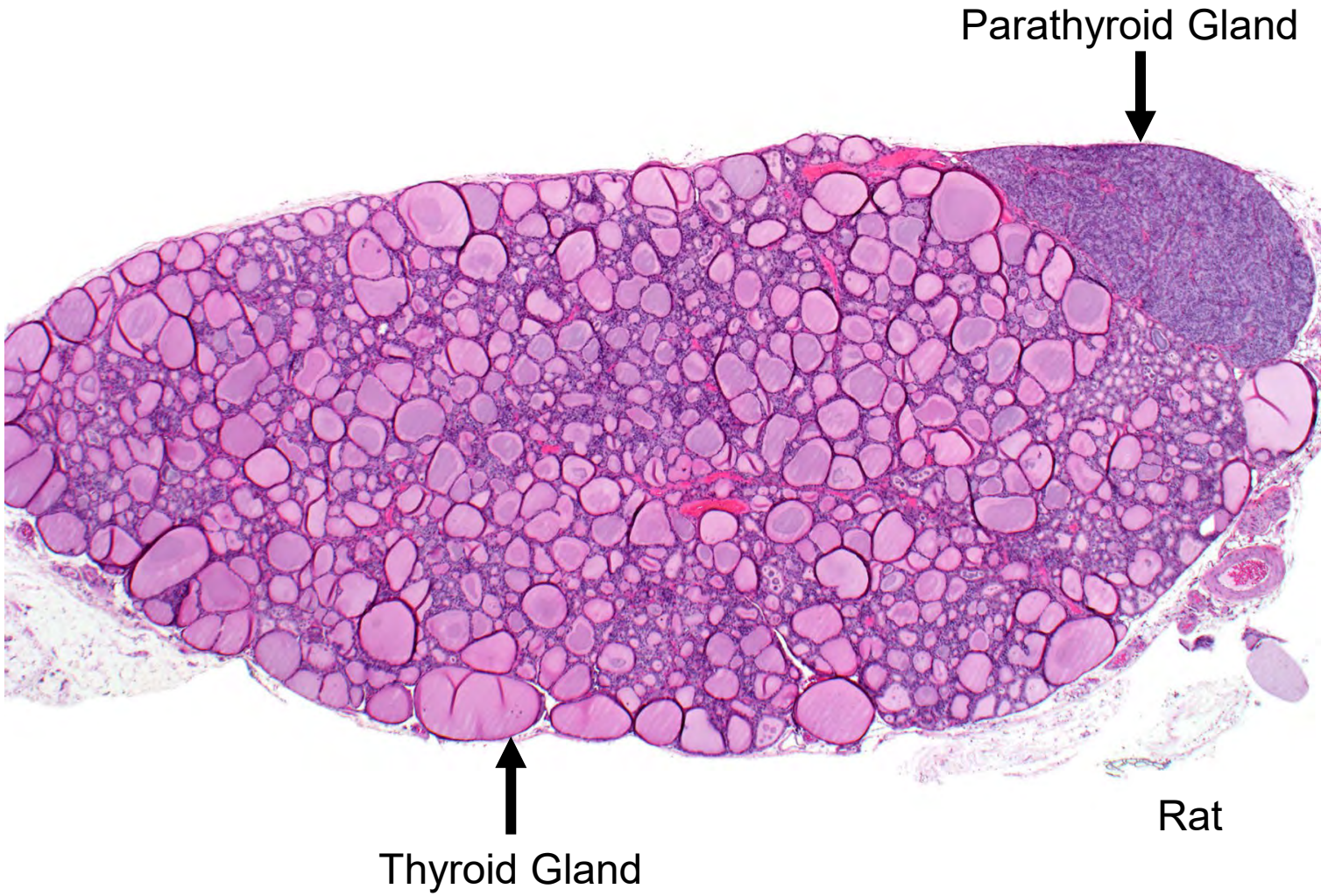
Transverse Sectioning



Parathyroid Gland: Trimming and Histology

Longitudinal Sectioning

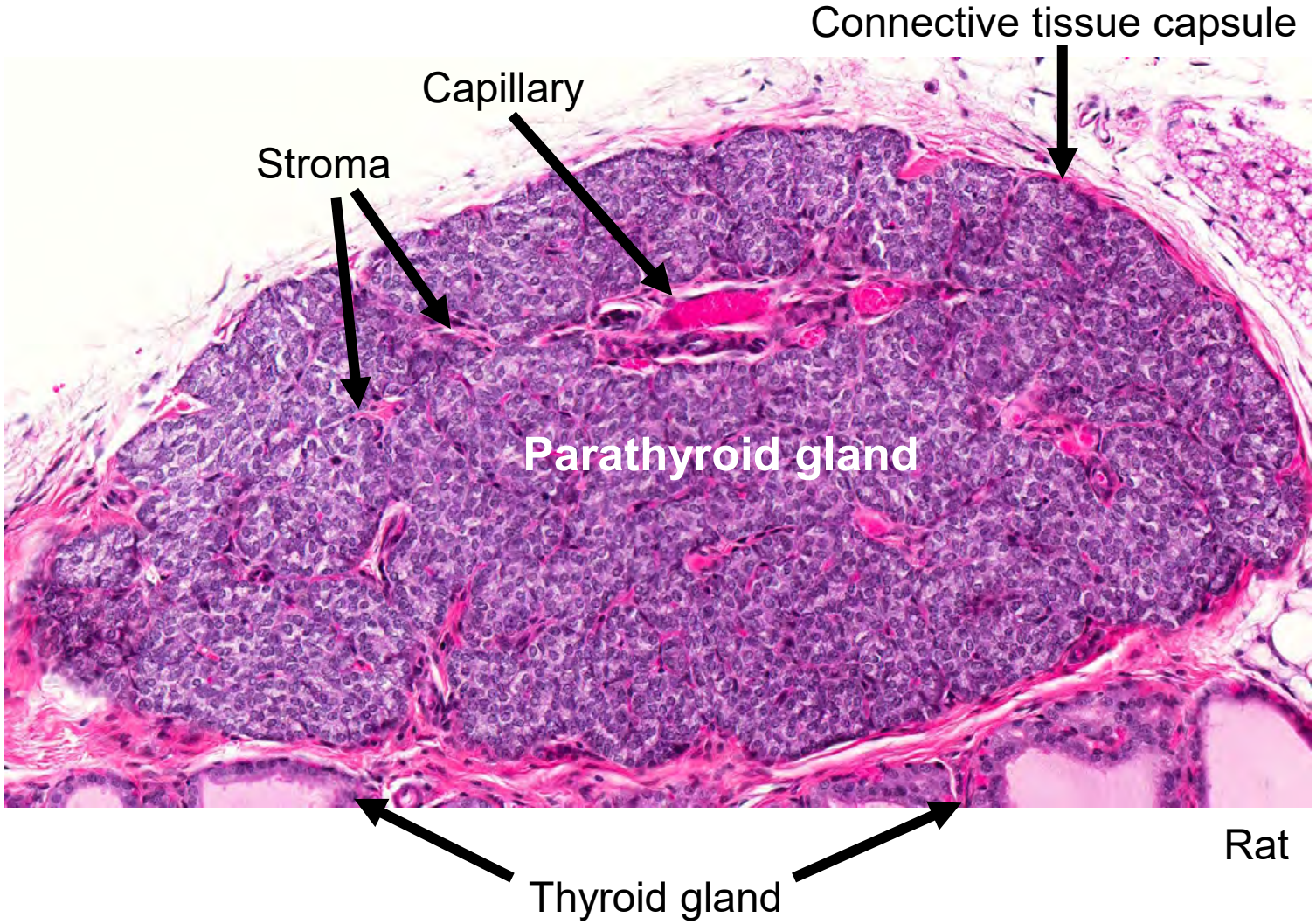
- Longitudinal sections may be necessary when thyroid gland weights are required
- Both lobes of thyroid gland (with parathyroids) are removed and weighed together
- Section is taken through the largest area of thyroid lobe to include the parathyroid gland



Parathyroid Gland: Normal Histology

Normal Rodent Parathyroid

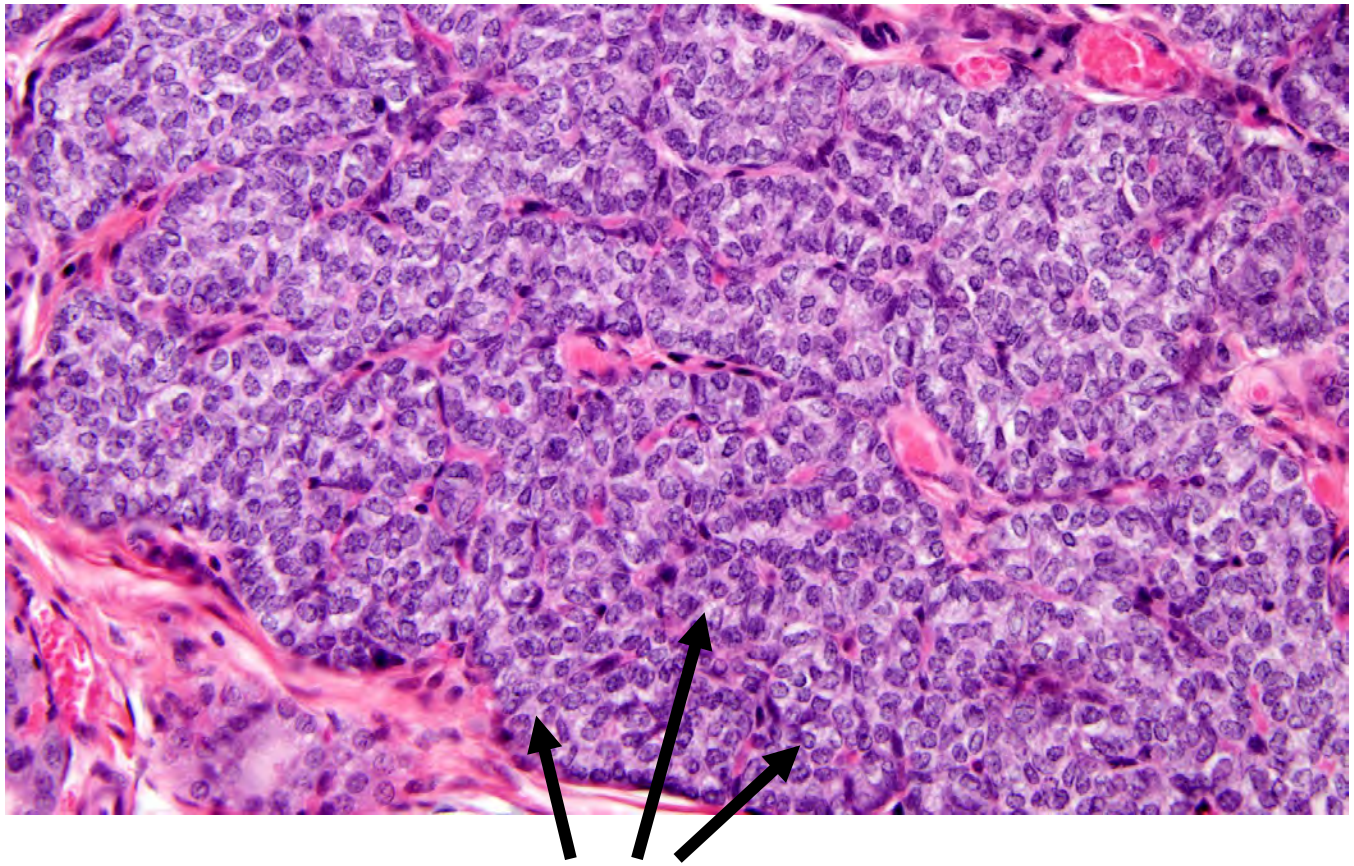
- Parathyroid gland is thinly encapsulated and usually located on the edge of the thyroid gland
- Composed of densely packed clusters and cords of cells separated by stroma of reticular and collagen fibers
- The stroma contains capillaries, lymphatics, and nerves



Parathyroid Gland: Normal Histology

Normal Rodent Parathyroid

- Chief cells are the main cell type in the mouse and rat parathyroid gland
  - Synthesize and secrete parathyroid hormone (PTH) in response to decreased ionized calcium in the blood
- Chief cells are round to polygonal cells with cytoplasm that varies from faintly eosinophilic (pink) to amphophilic (pink to purple) to clear, depending on the functional state
  - These functional variants are sometimes referred to as dark or light (or clear) cells
- Oxyphil cells in parathyroid glands of humans and other species are not observed in the mouse and rat

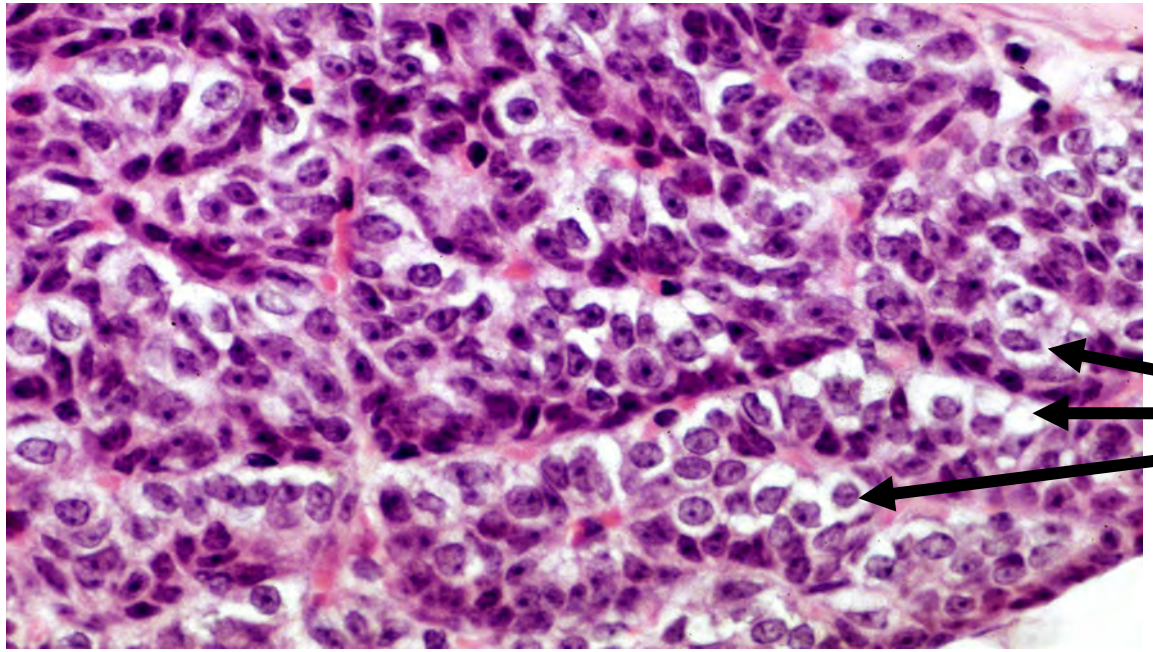


Chief cells in a normal parathyroid gland from a male F344/N rat from a chronic study

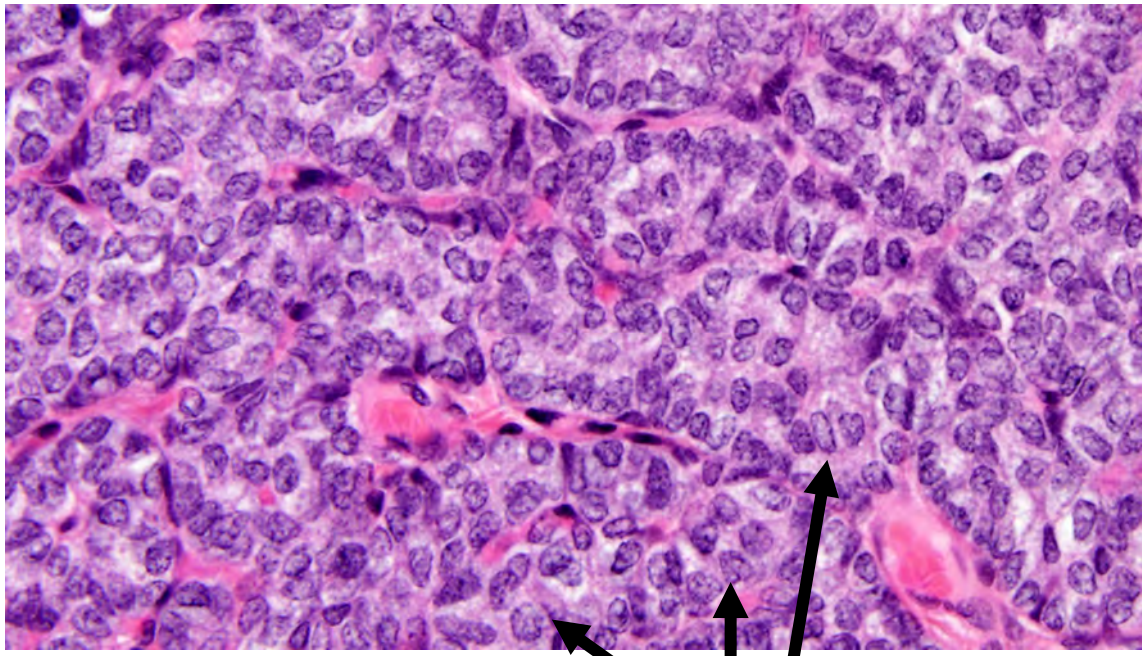
Parathyroid Gland: Normal Histology

Normal Rodent Parathyroid

- Active cells have granular eosinophilic to amphophilic cytoplasm
- Inactive cells have abundant clear cytoplasm and may increase with age



Inactive chief cells with abundant clear cytoplasm in a B6C3F1 mouse from a chronic study



Active chief cells with amphophilic cytoplasm in an F344/N rat

Parathyroid Gland: Congenital Lesions

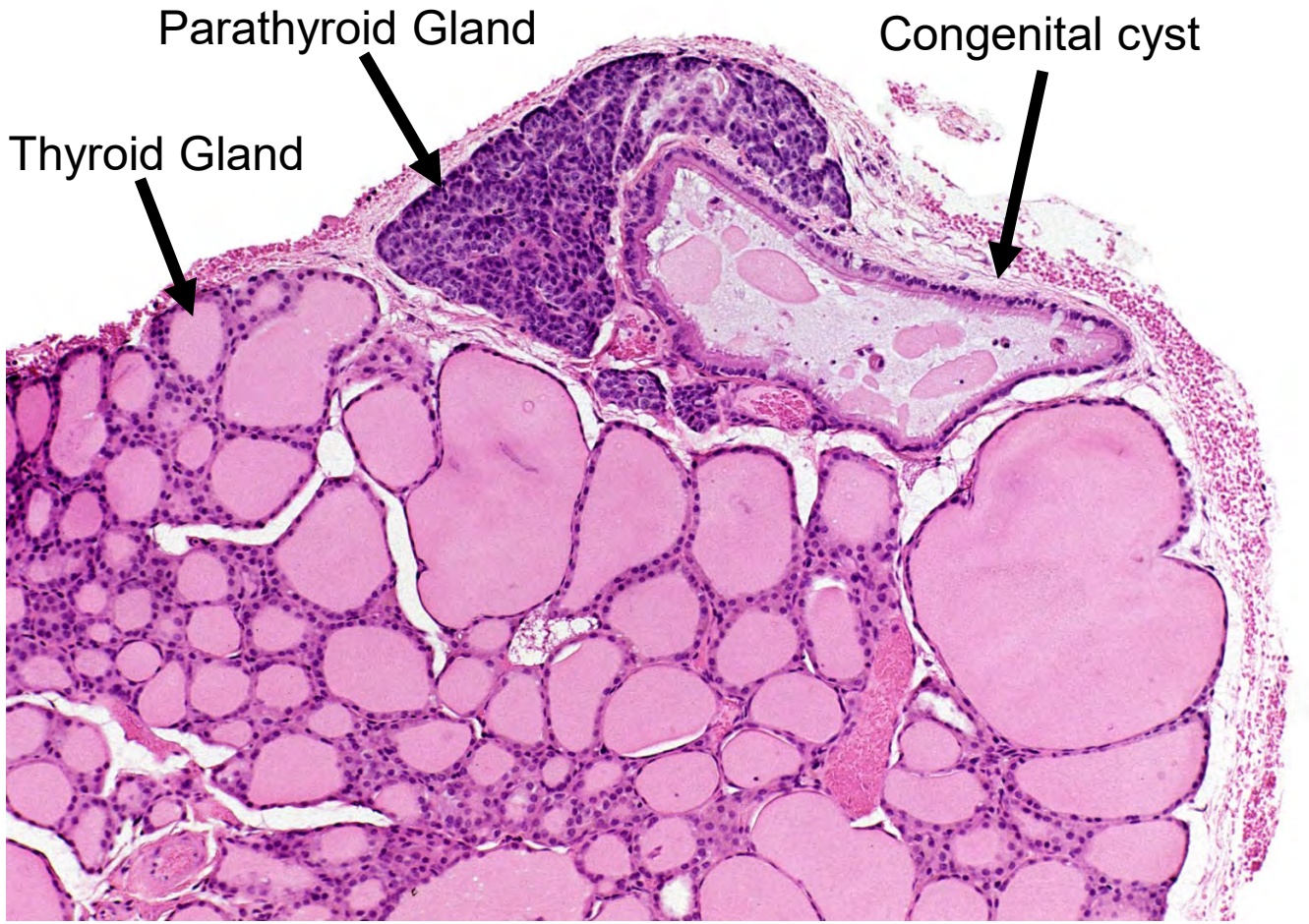
Congenital/Developmental Lesions

- Cyst
- Parathyroid Gland – Ectopic Tissue, Thymus
- Thymus – Ectopic Tissue, Parathyroid Gland

Parathyroid Gland: Congenital Lesions

Cyst

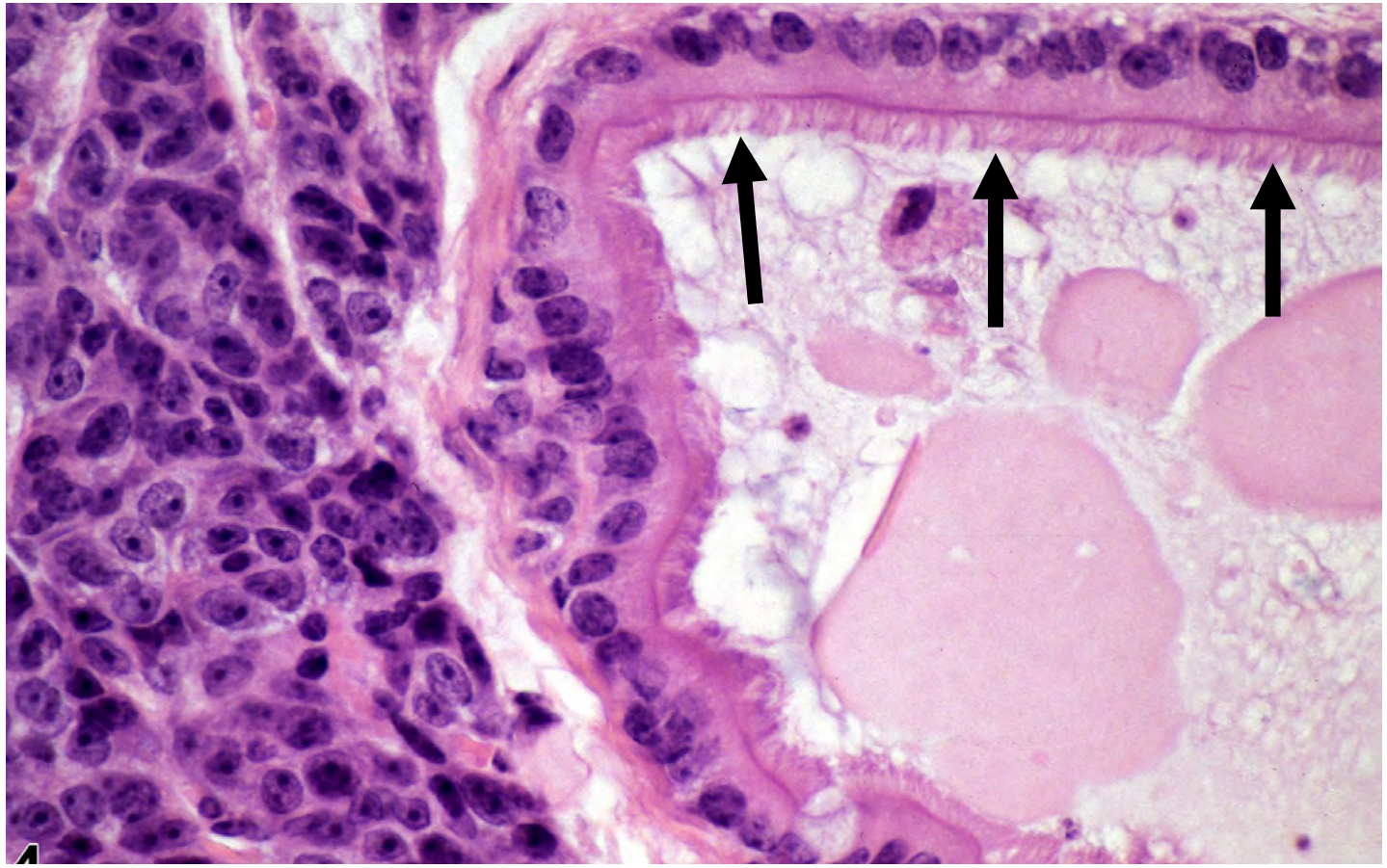
- Usually congenital
- Formed by remnants of embryonal structures
- Lined by simple cuboidal to columnar epithelium that may be ciliated
- May be empty or filled with eosinophilic or mucinous material



Mouse

Parathyroid Gland: Congenital Lesions

Cyst

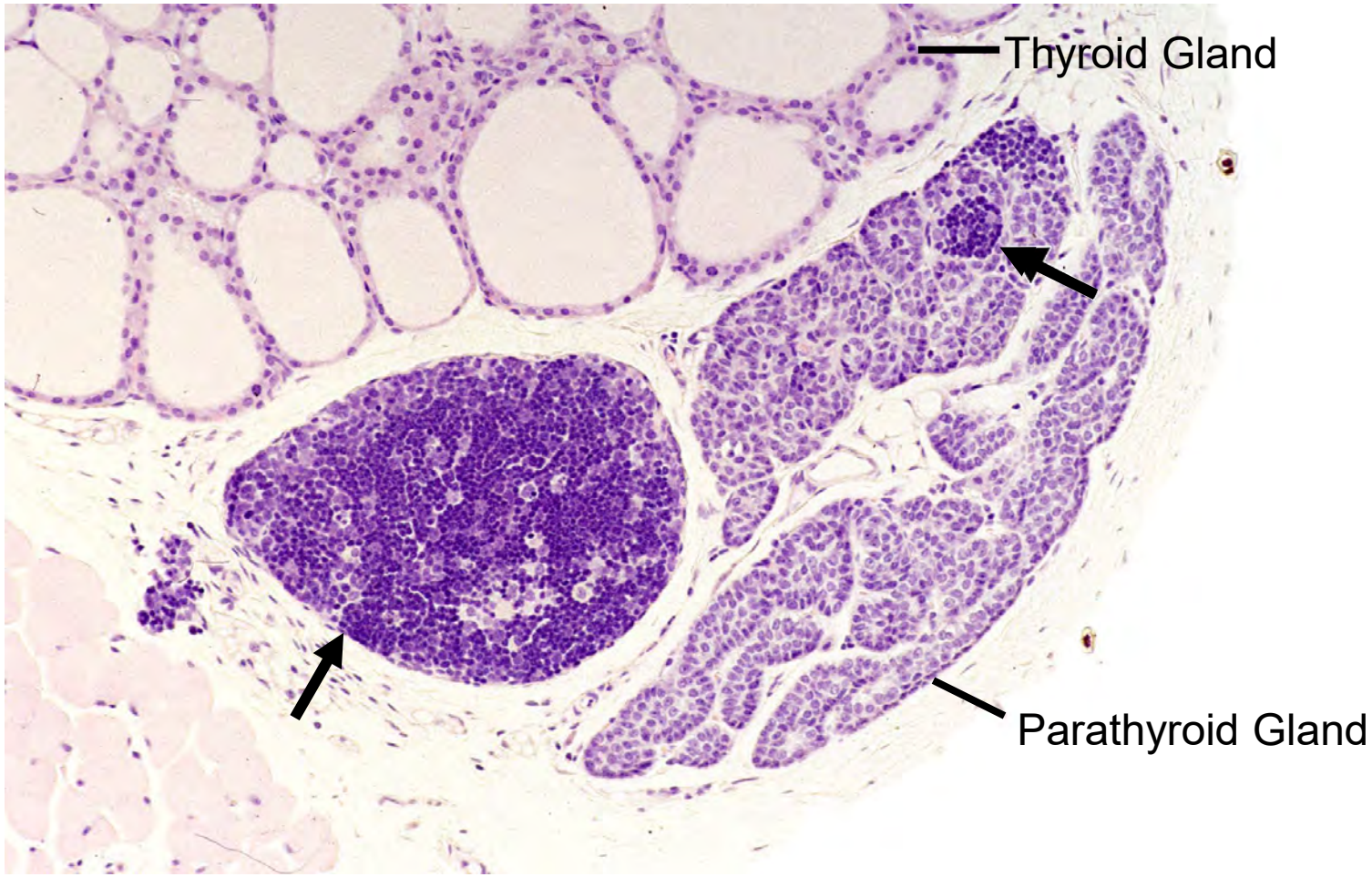


Higher magnification showing ciliated epithelium (arrows), mouse

Parathyroid Gland: Congenital Lesions

Parathyroid Gland – Ectopic Tissue, Thymus

Common congenital lesion that occurs because of the close association of the parathyroid and thymus during embryological development

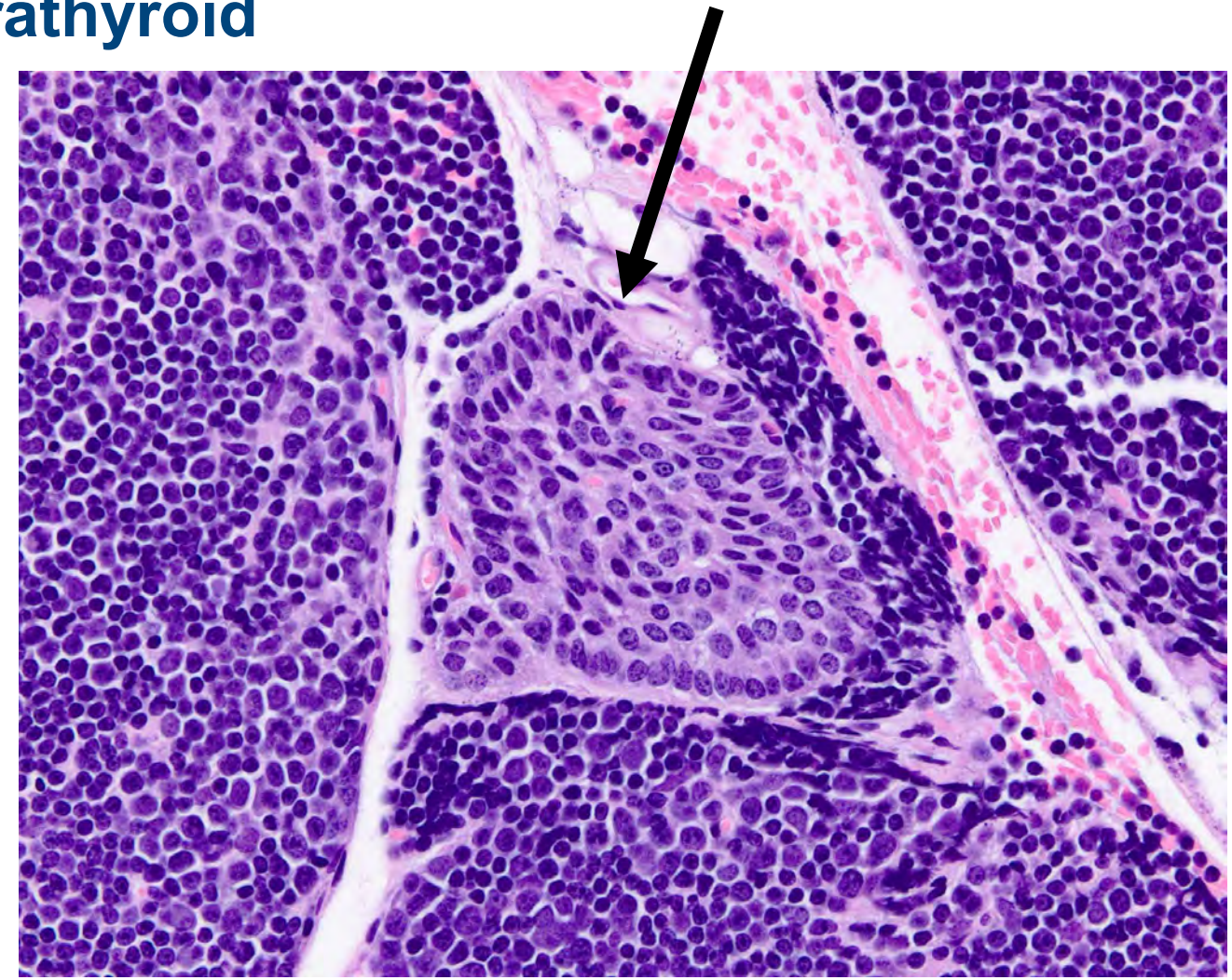


Well-differentiated thymic tissue (arrows) adjacent to and embedded within the parathyroid gland, mouse

Parathyroid Gland: Congenital Lesions

Thymus – Ectopic Tissue, Parathyroid

Ectopic parathyroid tissue often occurs in the thymus because of the close association of the thymus and parathyroid during embryological development



Well-differentiated parathyroid tissue (arrow) is embedded within the thymus, mouse

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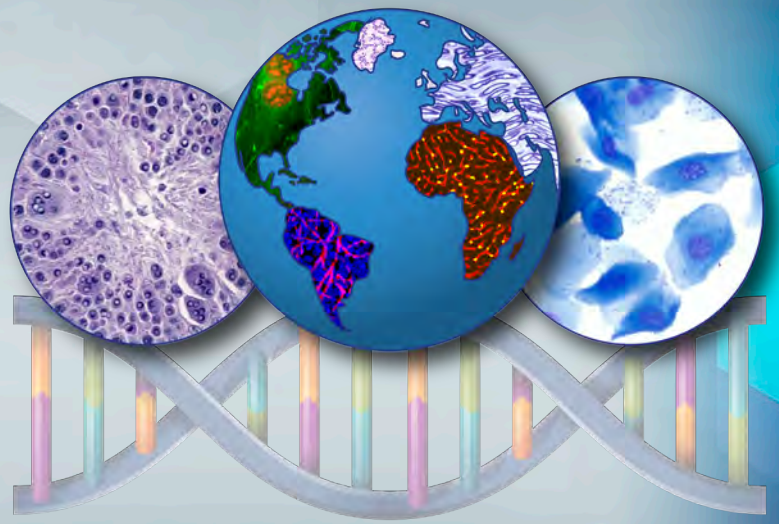

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