Neoplasia
Lecture 1

NEOPLASIA

- **Cancer is the second leading cause of death in the United States**

Characteristics of cancers:

1. **Cancer is a genetic disorder caused by DNA mutations.**

- **Most pathogenic mutations are either induced by exposure to mutagens or occur spontaneously as part of aging**

- **Cancers frequently show epigenetic changes, such as focal increases in DNA methylation and alterations in histone modifications which may themselves stem from acquired mutations in genes that regulate such modifications.**
- **These genetic and epigenetic changes alter the expression or function of key genes that regulate fundamental cellular processes such as growth, survival, and senescence.**

2. Genetic alterations in cancer cells are heritable

Cells bearing mutations that provide a growth or survival advantage outcompete their neighbors and thus come to dominate the population.

Emergence of genetically distinct subclones with more aggressive characteristics is an important concept referred to as tumor progression

3. Mutations and epigenetic alterations impart to cancer cells a set of properties that are referred to collectively as *cancer hallmarks.*

These properties produce the cellular phenotypes that dictate the natural history of cancers as well as their response to various therapies.

NOMENCLATURE

- ***Neoplasia*** **literally means "new growth."**

- Neoplastic cells are said to be transformed because they continue to replicate,apparently oblivious to the regulatory influences that control normal cells.

- Neoplasms enjoy a degree of autonomy and tend to increase in size regardless of their local environment.

- All neoplasms depend on the host for their nutrition and blood supply.
- Neoplasms derived from hormone responsive tissues often also require endocrine support.

- **In common medical usage a neoplasm often is referred to as a *tumor.***
- **The study of tumors is called *oncology* (from *oncos,* "tumor," and *logos,* "study of")**
- **Neoplasms are divided into benign and malignant depending on a tumor's potential clinical behavior.**

Benign tumors

- A tumor is said to be *benign* when its microscopic and gross characteristics are considered to be relatively innocent implying that it will remain localized and is amenable to local surgical removal.

Malignant tumors

- **Lesion can invade and destroy adjacent structures and spread to distant sites (metastasize) to cause death.**

- **Malignant tumors are collectively referred to as *cancers*, derived from the Latin word for “crab”**

All tumors, benign and malignant, have two basic components:

(1) The *parenchyma* made up of transformed or neoplastic cells

(2) The supporting *stroma* which host-derived, made up of connective tissue, blood vessels, and host-derived inflammatory cells

Benign Tumors

- **Benign tumors are designated by attaching the suffix -*oma* to the cell type from which the tumor arises.**
- **A benign tumor arising in fibrous tissue is a *fibroma***
- **A benign cartilaginous tumor is a *chondroma***

- ***Adenoma*** is generally applied not only to benign epithelial neoplasms that produce gland-like structures but also to benign epithelial neoplasms that are derived from glands but lack a glandular growth pattern.
- Examples

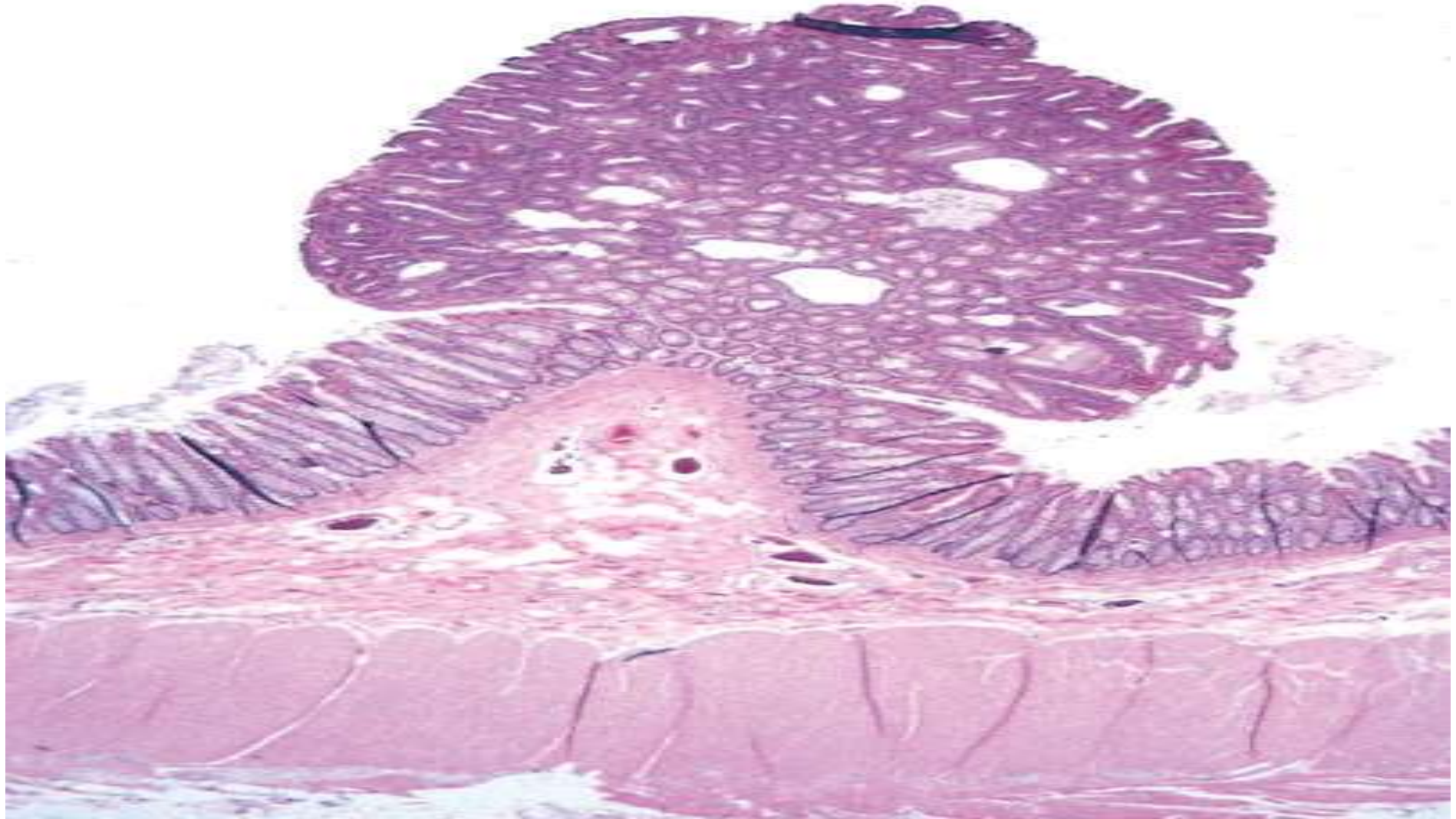
Colonic adenoma

Thyroid adenoma

- **Papillomas** are benign epithelial neoplasms growing on any surface, that produce microscopic or macroscopic fingerlike fronds.
- A **polyp** is a mass that projects above a mucosal surface, as in the gut, to form a macroscopically visible structure
- Polyps can be:

1. Benign
2. Malignant
3. Non-neoplastic as inflammatory polyps

Colonic polyp



- **Cystadenomas** are hollow cystic masses that typically arise in the ovary

Malignant Tumors

- **Malignant neoplasms arising in “solid” mesenchymal tissues or its derivatives are called *sarcomas***
- **Malignant neoplasms arising from the mesenchymal cells of the blood are called leukemias or lymphomas**
- **Sarcomas are designated based on their cell-type composition presumably reflects their cell of origin.**

- **Examples**

Liposarcoma

Chondrosarcoma

Fibrosarcoma

- **Malignant neoplasms of epithelial cells are called carcinomas regardless of the tissue of origin.**
- **Examples**
- **Carcinomas that grow in a glandular pattern are called adenocarcinomas**
- **Carcinoma that produce squamous cells are called squamous cell carcinomas**
- **Carcinomas arising from renal tubules Renal cell adenocarcinoma**

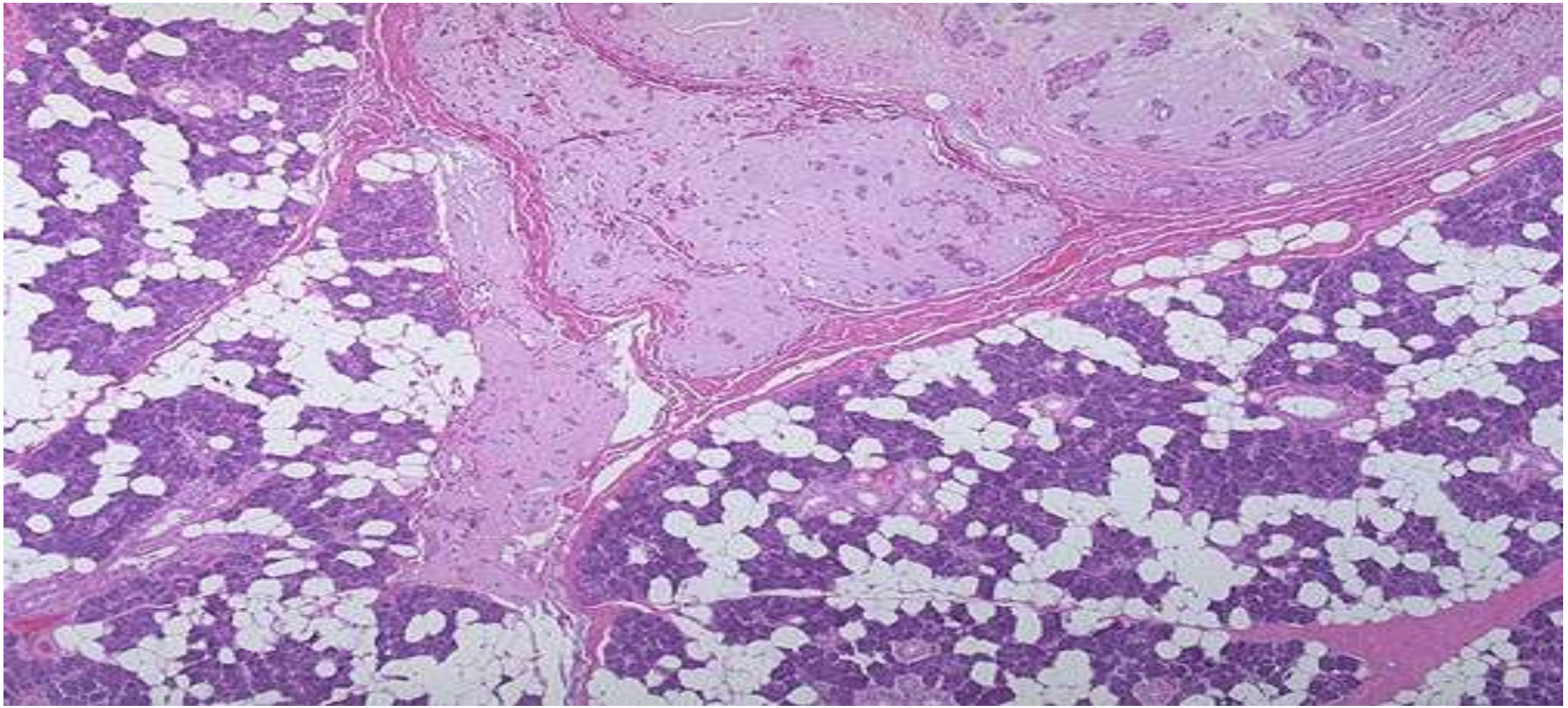
Mixed tumors

- **Mixed tumors are still of monoclonal origin but the progenitor cell in such tumors has the capacity to differentiate down more than one lineage.**
- **Examples**

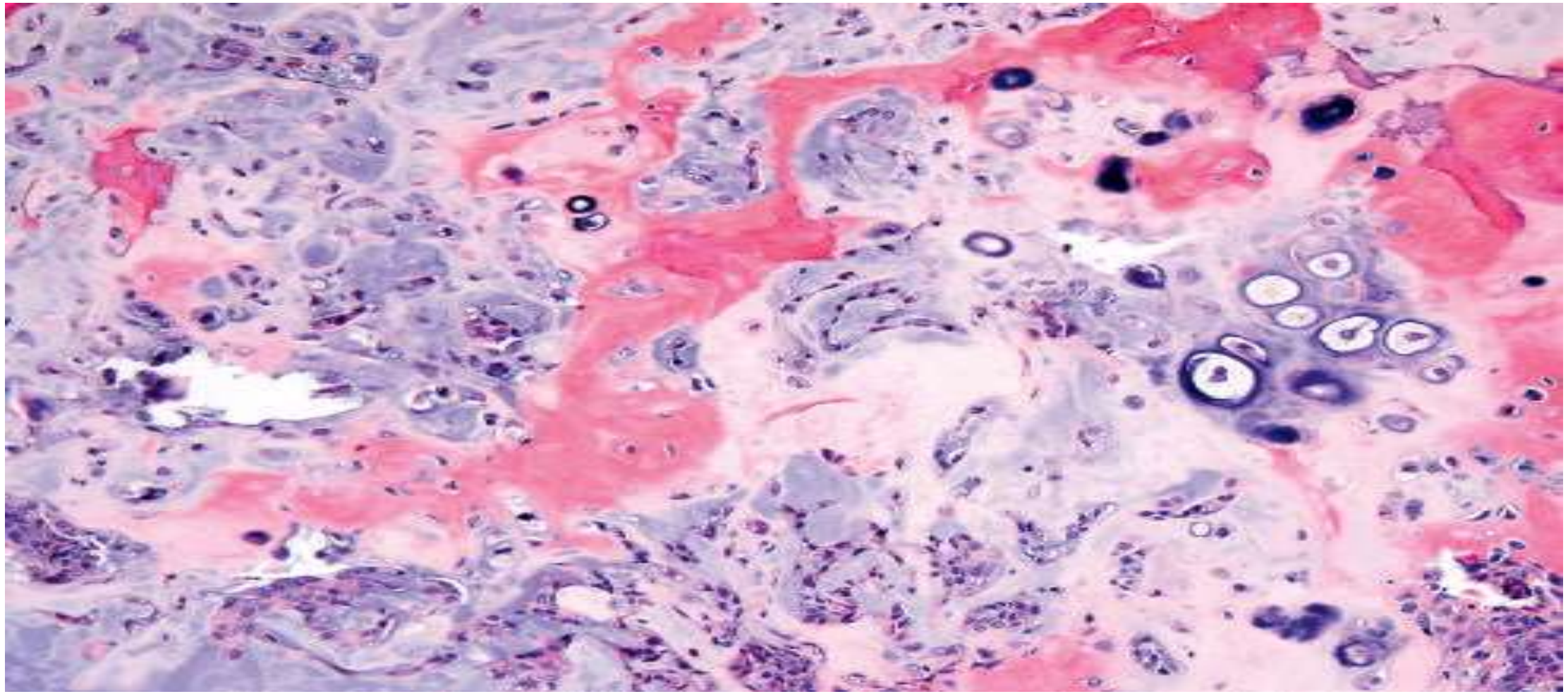
1. mixed tumor of salivary gland (pleomorphic adenoma).

These tumors have obvious epithelial components dispersed throughout a fibromyxoid stroma with islands of cartilage or bone

Pleomorphic adenoma



Pleomorphic adenoma of salivary gland



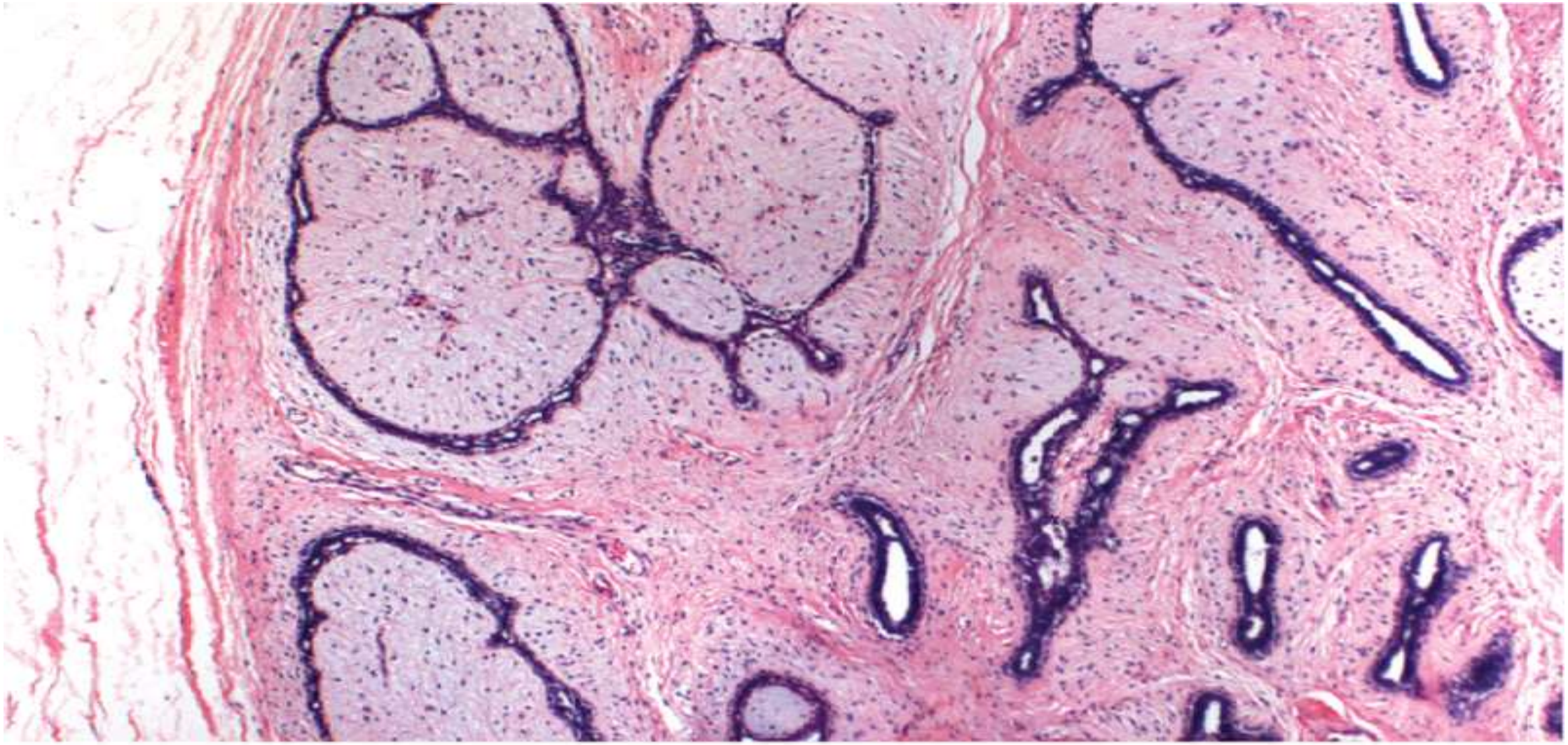
2. Fibroadenoma of the female breast

Benign mixed tumor

It consists of a mixture of proliferating ductal elements and fibrous tissue

Only the fibrous component is neoplastic

Fibroadenoma



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Teratoma

- **Teratoma is a special type of mixed tumor that contains recognizable mature or immature cells or tissues derived from more than one germ cell layer and sometimes all three**
- **Teratomas originate from totipotential germ cells**
- **Ovaries, testis, mid line embryonic rests are common sites**

- **<u>One Parenchymal Cell Type</u>**
- **Connective tissue and derivatives**
- Fibroma - Fibrosarcoma
- Lipoma - Liposarcoma
- Chondroma -Chondrosarcoma
- Osteoma - Osteogenic sarcoma

- **Endothelium and related cell types**
- Blood vessels : Hemangioma- Angiosarcoma
- Lymph vessels :Lymphangioma - Lymphangiosarcoma
- Mesothelium : X - Mesothelioma
- Brain coverings : Meningioma - Invasive meningioma

- **Blood cells and related cell types**
- **No benign tumors**
- Hematopoietic cells : Leukemias
- Lymphoid tissue : Lymphomas

- **Muscle**
- Smooth : Leiomyoma - Leiomyosarcoma
- Striated : Rhabdomyoma - Rhabdomyosarcoma

- **Skin**
- **Stratified squamous : Squamous cell papilloma - Squamous cell or epidermoid carcinoma**
- **Basal cells of skin or adnexa : Basal cell carcinoma**
- **Tumors of melanocytes : Nevus - Malignant melanoma**

- **Epithelial lining of glands or ducts**
- **Adenoma - Adenocarcinoma**
- **Papilloma - Papillary carcinomas**
- **Cystadenoma - Cystadenocarcinoma**

- **Lung :** Bronchial adenoma - Bronchogenic carcinoma
- **Kidney :** Renal tubular adenoma - Renal cell carcinoma
- **Liver :** Liver cell adenoma - Hepatocellular carcinoma
- **Bladder :** Urothelial papilloma - Urothelial carcinoma
- **Placenta :**Hydatidiform mole - Choriocarcinoma
- **Testicle :** No benign - Seminoma , Embryonal carcinoma

Mixed tumors

- **Salivary glands : Pleomorphic adenoma (benign)**
- **Renal anlage : Wilms tumor (malignant)**

Totipotential cells in gonads or in embryonic rests

- **Mature teratoma, Immature teratoma, teratocarcinoma**