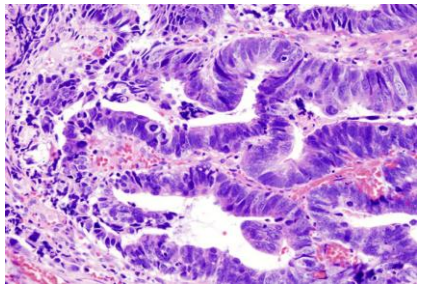
	BIOS 2015 … CHAPTER 20- Neoplasms and Cancer	
Page	**Note**	
	Terminology:	
	Tumor: a swelling (not necessarily a growth).	
	Neoplasm: a new growth.	
	Benign Neoplasm: a neoplasm that will not kill the host except in limited circumstances like being in a confined space like he bain,	
	Malignant Neoplasm: is cancer. It will the host if untreated. Malignant features include local invasion and spreading to other parts of the body (metastasis).	
	Nomenclature:	

	Benign	Malignant
Suffix	-oma	-carcinoma - sarcoma
Gland Tumor	Adenoma	Adenocarcinoma
Fat Cell Tumor	Lipoma	Liposarcoma

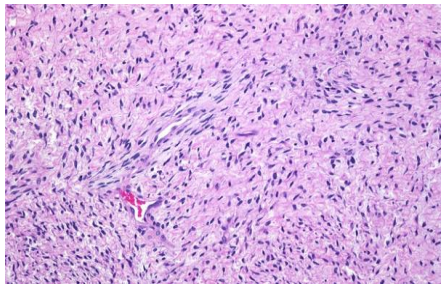
Some malignant tumors have unique names:
- Hodgkin's disease: a type of lymphoma.
- Wilms' tumor: a type of malignant kidney tumor in Children.
- Leukemia: a general term for malignancies of white blood cells.

	Two Main Categories of Cancer:	
	1. Carcinoma - arises from epithelial tissues (tissues that embryologically arise from endoderm and ectoderm). Epithelial cells line cavities and hollow organs like the oral cavity, esophagus, stomach, intestines, trachea, and airways. They also cover you in the form of skin. Solid organs like the lungs, liver, pancreas, kidneys, and glandular tissues are epithelial in origin.	

2. Sarcoma - arises from "soft tissues" and "connective tissue" (tissues that embryologically arise from mesoderm). This includes tissues like fibous tissue, muscle, nerve and fat (also known as adipose tissue and lipid tissue). This includes muscular organs like the heart.



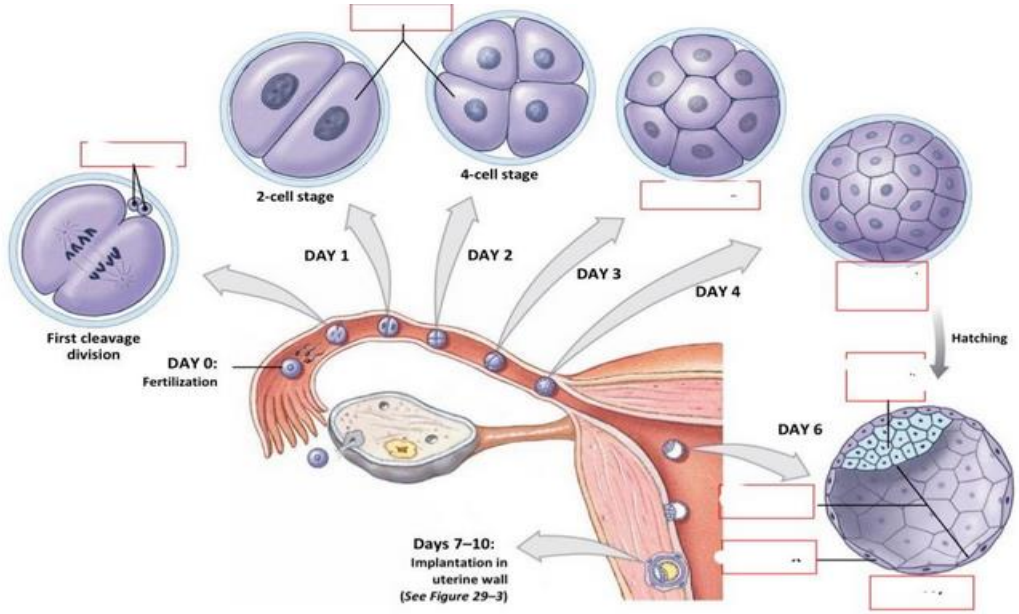
Carcinoma

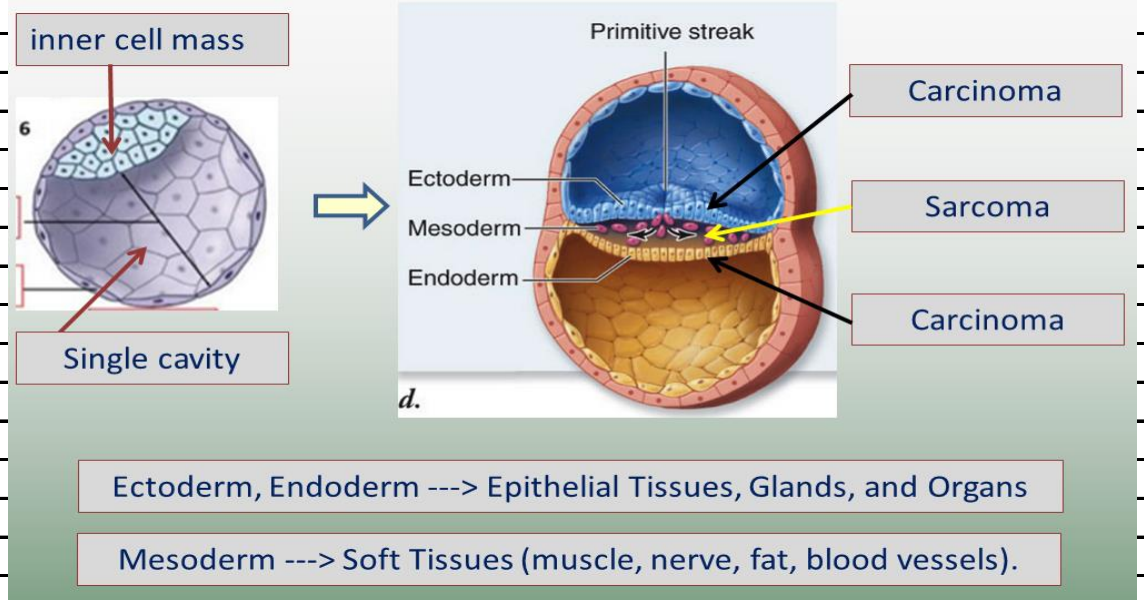


Sarcoma

Review of Embryology:

The ovum is fertilized in the distal end of the fallopian tube and divides as it migrates down the tube to the uterus. At some point it is a ball of cells that grows more and becomes a hollow ball with a collection of cells at one pole. This is called the inner cell mass. A cavity forms in this mass to produce a plate of cells with three layers: Ectoderm, Mesoderm, and Endoderm.





Examples of Cancer:

Sqaumous lining cells in mouth ---> Squamous Carcinoma

Duct cells in breast ---> Ductal Carcinoma

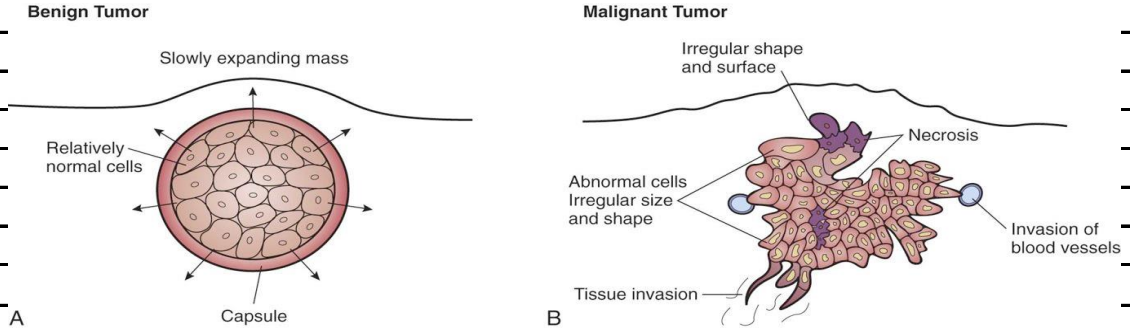
Prostate glands ---> Prostate Carcinoma

Muscle cells ---> Myosarcoma

Fat Cells ---> Liposarcoma

White blood cells ---> Leukemia and Lymphoma

551 **Comparison of Benign and Malignant Neoplasms:**



550

Comparison of Benign and Malignant Neoplasms:

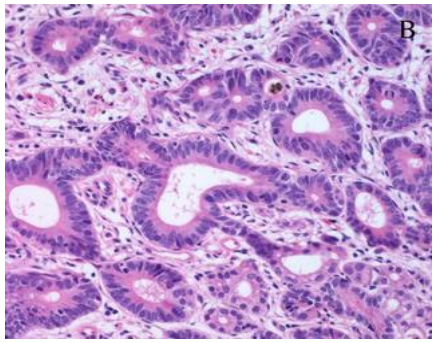
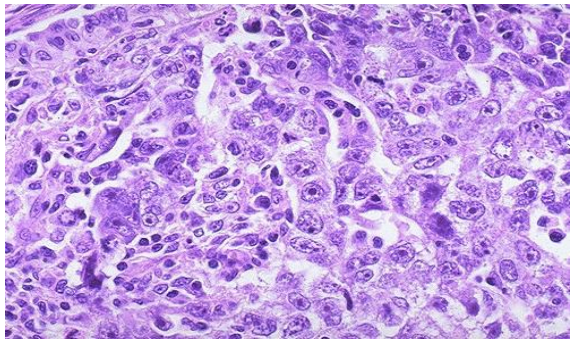
	Benign Tumors	Malignant Tumors
Cells	Similar to normal cells	Varied in size and shape with large nuclei
	Differentiated	Many undifferentiated
	Mitosis fairly normal	Mitosis increased and atypical
Growth	Relatively slow	Rapid growth
	Expanding mass	Cells not adhesive, infiltrate tissue
	Frequently encapsulated	No capsule
Spread	Remains localized	Invades nearby tissues or metastasizes to distant sites through blood and lymph vessels
Systemic effects	Rare	Often present
Life-threatening	Only in certain locations (e.g., brain)	Yes, by tissue destruction and spread of tumors

Growth features ina malignant neoplasm:

Neovascularization (Angiogenesis) - ingrowth of new blood vessels (a target or chemotherapy, drugs that block angiogenesis).

Necrosis - if a tumor gets large it outgrows its blood supply, and the center of the tumor may become necrotic.

Variable time course: some cancers arise quickly; other evolve over a long time period lending themselves to screening and detection that can improve survival.

551	**Gradng and Staging Tumors:**	
	Grading: the tumor is examined using a micoscope, an its histologic appearance is "graded" with respect to its differentiation: Well, Moderately, or Poorly Differentiated. Well differentiated means it resembles the original tissue (you can discern glands as an example). Poorly differentiated means it does not form structures, and it is not clear what kind of tissue it is from.	
	  **Well Differentiated Adenocarcinoma** **Poorly Diffeentiated Carcinoma**	
	Staging: refers to how far the tumor has spread.	
	Remember: GH - Grade Histology SS - Staging Spread	
	Staging formulas often consider the size, lymph node involvement, metastasis.	
	The TNM classification assigns number like T1, T2, T3 etc to corellate to the tumor size. An example could be T1 (less than 0.5 cm), T2 (0.5 - 2 cm), and T3 (> 2 cm). N1, N2, N3 etc may refer to the number or percent positive lymph nodes or compare near and distant nodes in different stages. Metastasis is usually M0 and M1 for absence or presence of distant metastasis. The classification is tailored for each individual tumor type and there are published standards.	
552	**Warning signs of Cancer:**	
	1. Unusual bleeding or discharge anywhere in the body. **2. Change in bowel or bladder habits (e.g., prolonged diarrhea or discomfort).** **3. A change in a wart or mole (i.e., color, size, or shape).** **4. A sore that does not heal (on the skin or in the mouth, anywhere).** **5. Unexplained weight loss.** **6. Anemia or low hemoglobin, and persistent fatigue.** **7. Persistent cough or hoarseness without reason.** **8. A solid lump, often painless, in the breast or testes or anywhere on the body.**	

	Effects of Cancer:	
	Pain: Not a warning sign. It ususally develops late vs early in cancer. It is usually from pressing on nerves but can be related to inflammation or bleeding.	
	Obstruction: A growing tumor can block the trachea causing difficult breathing or it can block the intestines causing bloating, vomiting, and diarrhea.	
	Ulceration: A tumor growing under the skin or adjavent to the intesinal lining can kill the overlying skin or intestinal mucosa and produce an ulcer.	
553	**Infection: Ulcers and necrosis can open a portal to infection around the tumor.**	
	Inflammation: around a tumor can cause complications (treated with glucocorticoids, steroids).	
	Systemic Effects: weight loss, cachexia (severe tissue wasting), anorexia, fatigue, generalized pain, and stress. (systemic is the opposite of localized).	
	Paraneolastic Syndrome: The tumor secretes hormones or hormone like molecules that produce a systemic alteration. An example is a tumor that secretes a parathyroid like hormone that can result in hypercalcemia. Another example is a tumor called a pheochromocytoma that secretes norepineprine that raises the blood pressure.	
	DIAGNOSIS:	
	- includes screening of high risk patients before symptoms occur as well as working on a known mass or symptom.	
	Blood Tests: These are used in diagnosis, to monitor treatment, and to look for recurrance.	
	- direct examination of blood smears may show circulating leukemic cells.	
	- the CBC may show serious deficiencies in a red or white blood cells if a tumor is destroying the bone marrow (where new red and white blood cells are constantly made to replace old ones).	
	- thrombocytopenia (low platelet count) and leucopenia (low white blood cell count) are two important parameters to monitor in chemotherapy because they lead, respectively, to bleeding and infections.	
	- tumor markers circulating in the blood may aid in diagnosis and in monitoring for recurrance.	
	- imaging techniques, X-rays, ultrasound, CT, MRI, nuclear medicine scans, etc… help in diagnosis and following treatment.	
	- cytologic tests like PAP smears and fine needle aspirates to examine cells in a smear.	
	- biopsies, tissue samples can be studied using the microscope and other special techniques.	

554 **Spread of Malignant Neoplasms:**

1. direct extension to adjacent structures. The location determines the severity. Examples: If a cancer occurs in an area surrounded by a lot of soft tissue like fat, there ma be no vital structures nearby and surgical removal may not damage much. Contrast this to the pelvic area where in a narrow geograpic zone, the bladder, uterus, vagina, and rectum are all in close proximity:

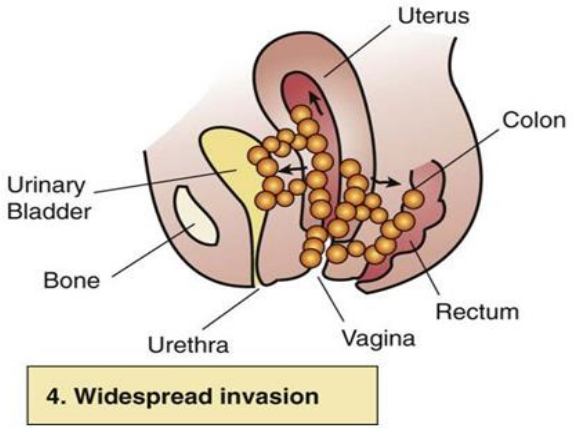
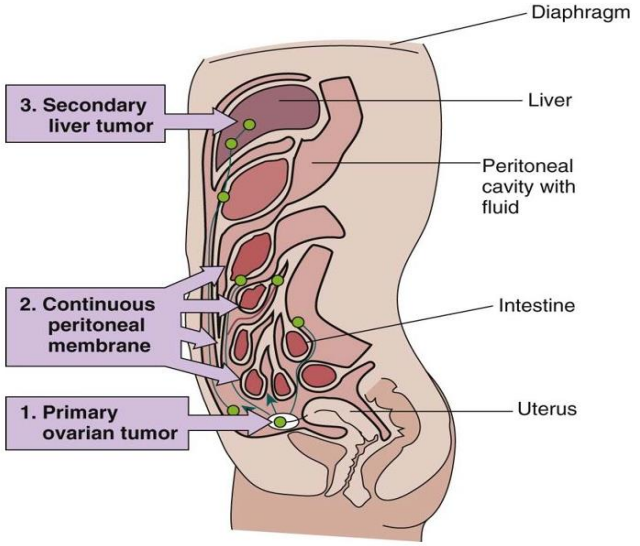


FIGURE 20-7 Ovarian cancer spread by seeding throughout the peritoneal cavity.



555 **Metastasis: spread by lymphaics to lymph nodes and by blood (hematogenous) to distant organs. Sometimes certain cancers have a proclivity to spread to specific organs.**

Seeding: Single cells disperse in a fluid in a cavity like the peritoneal cavity and give rise it numberous tumor implants tha cover abdominal organs and surfaces (ovarian cancer is a classic example). Same can happen in the pleural cavities.

556 **STAGING: Using the principles discussed above for TNM staging. Combinations of T, N, and M status are used to create clinical stages that help guide the type and level of treatment.**

[example on next page]

Example of Staging-Breast Cancer

T = Size of tumor

N = Involvement of lymph nodes

M = Presence of metastasis

557

Stage I: T1—tumor 2 cm or less in diameter;
N0—no lymph nodes involved;
M0—no metastasis .

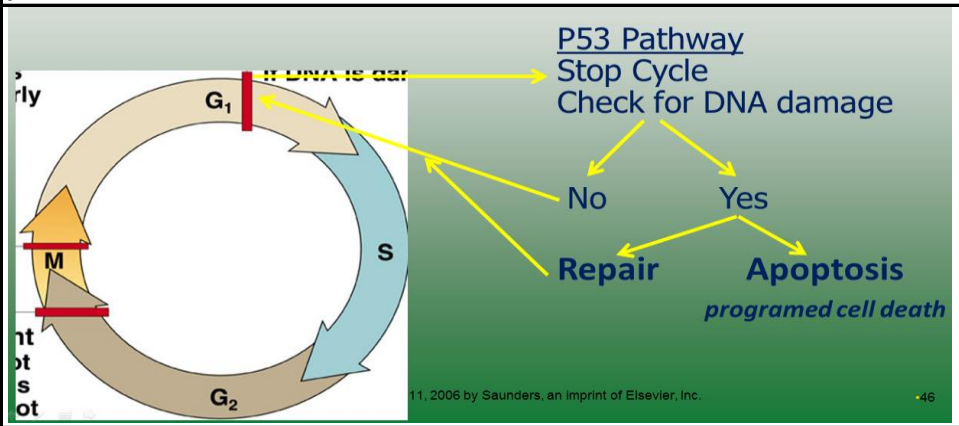
Stage II: T0 to T2—tumor less than 5 cm in diameter;
N1—nodes involved;
M0—no metastasis..

Stage III: T3—tumor larger than 5 cm in diameter; N1 or N2—nodes involved; tumor may be fixed; M0—no metastasis

Stage IV: T4—tumor any size but fixed to chest wall or skin;
N3—clavicular nodes involved (spread); M1—metastasis present

557

Risk Factors:	**Example:**
Genetic:	**Breast cancer, Leukemia**
Virus:	**Hepatitis - Liver, HPV - Cervical Cancer, HIV - Kaposi's Sarcoma**
Ultraviolet:	**Skin cancer**
Radiation:	**Leukemia**
Chemicals:	**Asbestos - Lung, Benzene - Leukemia, Analine Dyes - Bladder**
Inflammation:	**Ulcerative Colitis - Colon**
Diet	**High fat - Colon; Smoked foods - stomach**
Hormones	**Estrogen - Endometrial**
Age	**Many**

	TREATMENT	
	- Depends on specific cancer	
	- Surgery, chemotherapy, immunotherapy, radiation (combinations of these).	
	Surgery	
	Minimally invasive and tissue sparing vs radical surgery: **Use of laproscope, heals quick vs large abdominal incision.** **Lumpectomy and sentinel node vs radical mastectomy.** **Limb salvage vs amputation.** **Radiofrequency ablation (RFA)** **Alternative to surgery: small needle inserted and radiofrequencies generate heat that kills cancer**	
	Radiation: alone or with chemotheapy, damages the cancer's DNA, most efective in rapidly dividing cells, helps to shrink a cancer before surgical removal.	
	Adverse Effects of Radiation:	
	Bone Marrow Depression	
	- Leukopenia (decreased white blood cells) - increases risk of infection	
	- Anemia (decreased red blood cells) - leads to fatigue	
	- Thrombocytopenia (decreased platelets) - excessive bleeding.	
	note: used to wipe out marrow in total body irradiaation for bone marrow transplant.	
	Epithelial damage - hair loss.	
	Infertility - if gonads in field.	
	Chemotherapy: Using 2-4 different drugs is often best. Different agents target different biologc processes.	
		**Cell Cycle:** - target for many chemotherapy agents - p53 pathway facillitates some chemo - mutaed p53 does not work and favors cancer (more of a problem for adults vs kids) - Elephants get no cancer because they have 23 pairs of p53.

	Adverse Effects of Chemotherapy	
	BONE MARROW DEPRESSION: The limiting fator in how much Chemotherapy can be administered.	
	Nausea	
	Vomiting from gastrointesinal irritation and from activation of the vomiting centers in the brain.	
	Epithelial Damage - hair loss, mouth ulcers, skin lesions.	
	Organ Specific Damage: Fibrosis in lungs, Muscle damage in Heart, Kidney damage.	
	Prognosis - expectation (good or bad) for treatment success.	
	Remission - no clinical sign of the cancer.	
	Outcome:	
	Skin - good because you see and treat early (except melanoma).	
	Ovary - not so good, not symptomatic till advanced stage.	
	Brain - dependant on location in brain (some low grade tumors are in places that can not be treated with surgery).	
