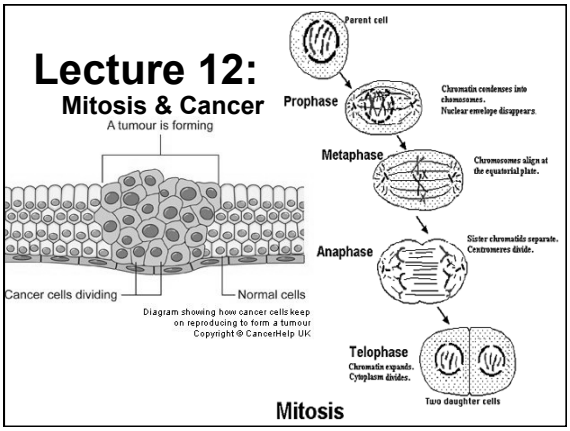
Lecture 12:
Mitosis & Cancer



Important Latin Roots

Mitos	Osis			
• Wrapped • Thread • (greek)	• Process/condition • Disease/Abmormal condition • Increase/Formation			

Onco	Carcin	ology	Oma	Blast	Genic
• Mass or tumor	• Cancer	• Study of	• Tumor	• Relates to immature Cells	• Creating/ Causing

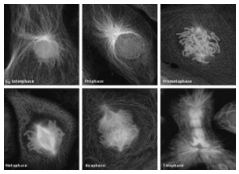
Recap from Last Time:

Places Mutations get passed on:
Cell Reproduction:

- 2 types of cell reproduction:

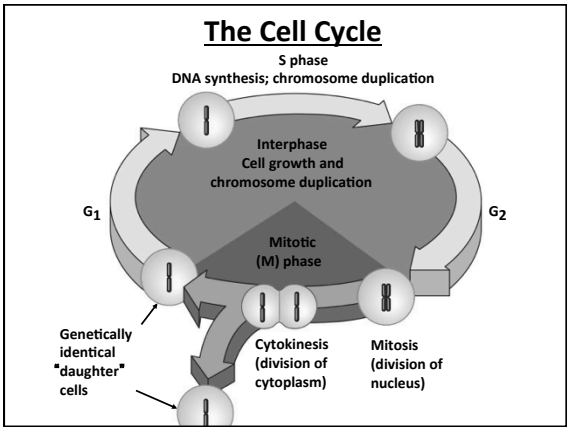
Focus of this Week:

1. Mitosis = growth, repair, asexual reproduction
   - Photocopy machine
   - Growth/Repair
   - Passed on in the same body



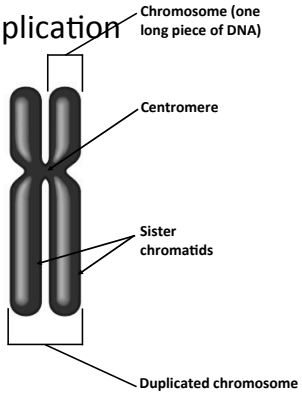
2. Meiosis = sexual reproduction
   - ½ of your genetics
   - Gametes (egg and sperm)
   - Passed on to offspring

The Cell Cycle



Chromosome Duplication

- When a chromosome duplicates the result is two copies of the DNA molecule called **sister chromatids**.



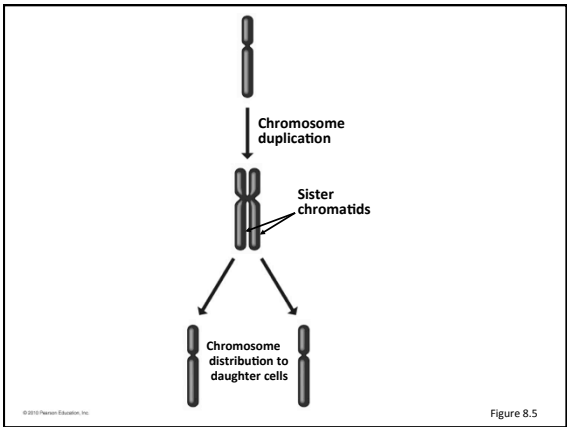


Figure 8.5

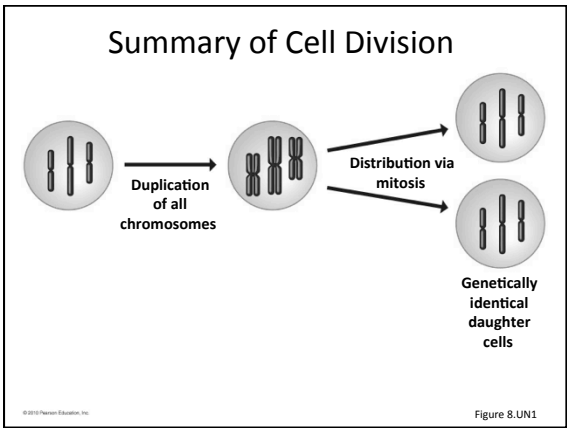

Summary of Cell Division
Duplication of all chromosomes
Distribution via mitosis
Genetically identical daughter cells
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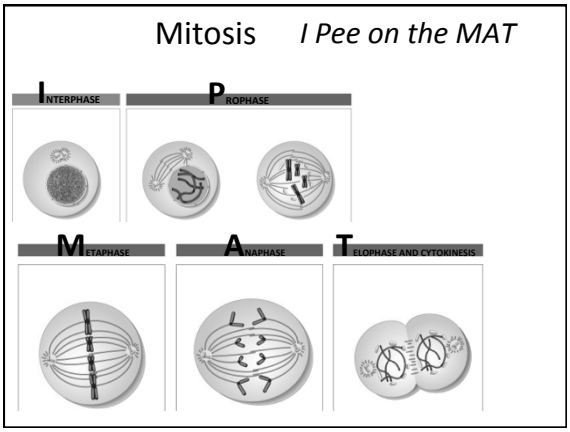
Figure 8.UN1


Mitosis I Pee on the MAT
INTERPHASE
PROPHASE
METAPHASE
ANAPHASE
TELOPHASE AND CYTOKINESIS

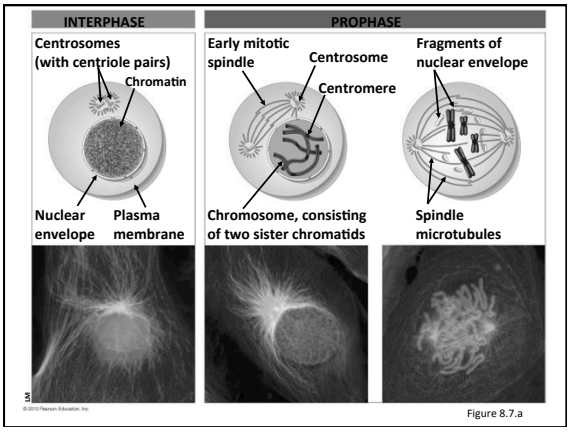

INTERPHASE
PROPHASE
Centrosomes (with centriole pairs)
Chromatin
Nuclear envelope
Plasma membrane
Early mitotic spindle
Centrosome
Centromere
Chromosome, consisting of two sister chromatids
Fragments of nuclear envelope
Spindle microtubules
LM
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Figure 8.7.a

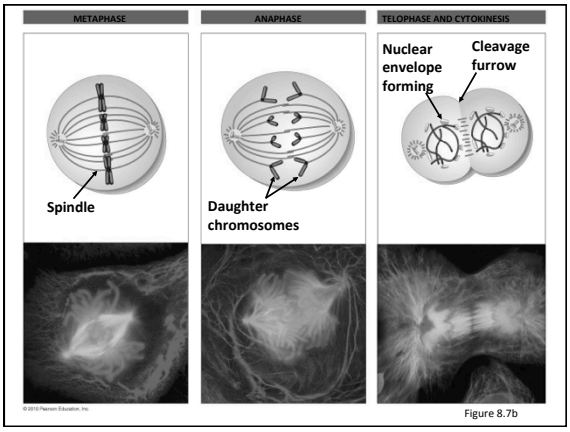


Figure 8.7b

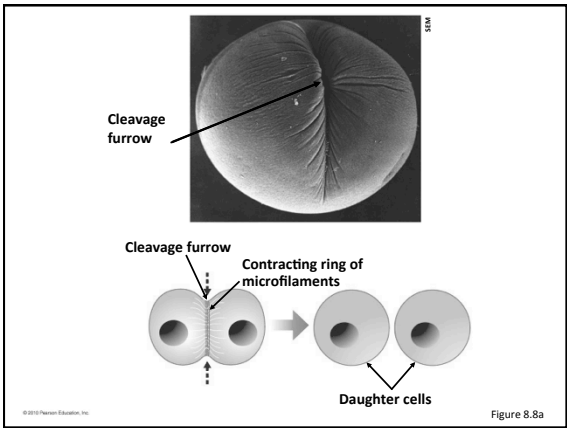


Figure 8.8a

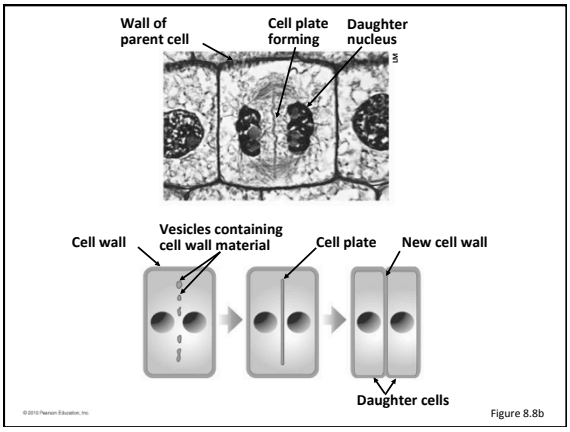


Figure 8.8b

Section #2: Cancer

Cancer

What Is Cancer?

– Cancer is a disease of the cell cycle.
  • Uncontrolled cell division
– Cancer cells do not respond normally to the cell cycle control system.
  • MUTATIONS in genes for proteins that regulate cell division

Two types of mutations:

1. Oncogenes or (gas pedal stuck down)
2. Tumor suppressor genes (breaks don't work)

Oncogenes (gas pedal stuck down)

- Most **oncogenes** are **mutations of** certain normal genes called ***proto-oncogenes***.
- Proto-oncogenes are the "good" genes that normally control what kind of cell it is and how often it divides.
  – When a proto-oncogene mutates into an oncogene, it can become permanently turned on or activated when it is not supposed to be.
- *Most of these mutations are acquired, a few are inherited.*

Tumor Suppressor Genes (breaks don't work)

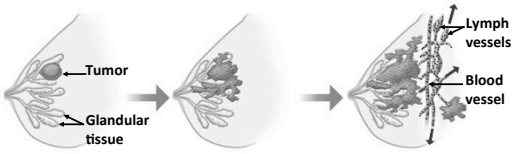
- Tumor suppressor genes:
  1. Slow down cell division
  2. Repair DNA mistakes
  3. Tell cells when to die (a process known as *apoptosis*).
- The "breast cancer genes" (*BRCA1*, *BRCA2*,) are examples of this kind of mutation
- *Most of these mutations are acquired, a few are inherited.*

Tumors

- Cancer cells can form **tumors**, abnormally growing mass of cells.
- **Malignant tumors** can:
  - Spread to other parts of the body
  - Interrupt normal body functions
  - Take a lots of nutrients and blood supply
- A person with a malignant tumor is said to have **cancer**.

Largest Tumor in the World

- What is the main issue with this tumor?
  - Benign (Non-Malignant)



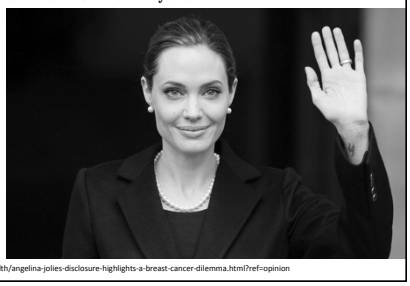
A tumor grows from a single cancer cell.

Cancer cells invade neighboring tissue.

Metastasis: Cancer cells spread through lymph and blood vessels to other parts of the body.

Figure 8.9

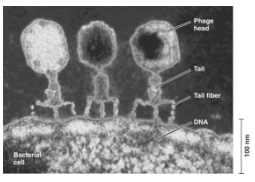
Her condition is rare. Mutations in BRCA1 and another gene called BRCA2 are estimated to cause only 5 percent to 10 percent of breast cancers and 10 percent to 15 percent of ovarian cancers among white women in the United States. The mutations are found in other racial and ethnic groups as well, but it is not known how common they are.



http://www.nytimes.com/2013/05/15/health/angelina-jolies-disclosure-highlights-a-breast-cancer-dilemma.html?ref=opinion

Viruses and Cancer

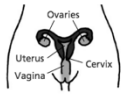
- Viruses inject their genetic material into cells
- If that material damages the regulation of cell division, it causes



- Pap smears for HPV (human papilloma virus)
  - Causes cervical cancer
  - Most women with HPV don't get cancer
- Great resource: http://www.cancer.org/acs/groups/content/@editorial/documents/document/acspc-043803.pdf

What is cervical cancer?

Cervical cancer starts in the cells of the cervix, the part of the womb (or uterus) that opens to the vagina.



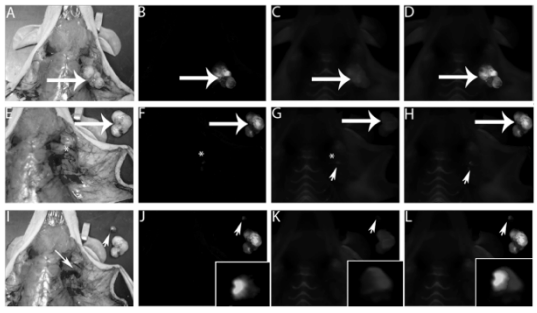
Cancer Treatment

– Cancer treatment can involve:

- **Radiation therapy**, which damages DNA and disrupts cell division
- **Chemotherapy**, which uses drugs that disrupt cell division
- **Tumor removal:**
  - Easier with fluorescent proteins

Next Slide Has Real Tissue (pig)

ACPPs delineate tumor at the margin of resection.



Nguyen Q T et al. PNAS 2010;107:4317-4322