Biology 30
CELL DIVISION – MITOSIS & MEIOSIS

Mitosis:

Cell cycle:
- Divided into two phases:
  - Interphase:
    - Mitotic phases:
      - Karyokinesis:
        4 Phases involved:
        1) 
        2) 
        3) 
        4) 
      - Cytokinesis:

“The Process” of Cell Division:

Interphase:

3 phases of Interphase:
1. G1 (Gap) phase:
2. S phase:
3. G2 (Gap) phase:

Mitotic Phases:
- Karyokinesis:
- Cytokinesis:
1) **Prophase:**
- Longest of the Mitotic phases. Why?
  - **Chromatin:**
    - Chromosomes:
  - **Sister chromatids** (duplicated chromosome):
    - Centromere:
  - Nuclear envelope & nucleolus:

2) **Metaphase:**
   - What occurs?
   - Metaphase plate:

3) **Anaphase:**
   - What separates?
   - Where does the separation occur?
4) **Telophase:**

What occurs?

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**Cleavage Furrow:**

![Cleavage Furrow Diagram]

**Cytokinesis:**

Results in:

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**Control of Cell Division**

Why do you undergo asexual cell division?

1)  
2)  
3)  

Types of cells that can undergo cell division:

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Are there cells that cannot undergo asexual cell division after maturity?
Factors that Influence Cell Division:

1. Growth factors:

2. Cell density:
   Density dependent inhibition:

3. Restriction points:

4. Cell size:

5. Regulatory proteins (cyclical changes):

Cell division and Cancer cells:

How cancer cells develop:

Tumor:

Benign tumor:
Malignant tumor:
Metastasis:

Tumor suppressor genes:
p53 gene:
p21 gene:

normal BRAC1 & BRAC2:

The role of telomeres & telomerases in cell division:
Telomere:
  Function:

  Limits:

Telomerases:
  Absent in:

  Function:

Which types of human cells “normally” possess telomerase?

Causes of cancers & possible cause(s):
Carcinogen:

How do we detect cancers? Treatments for cancers?
SEXUAL REPRODUCTION - Meiosis:

Homologous chromosomes:

Diploid:

Haploid:

Gamete:

Zygote:

Meiosis – The Process:

Two phases:

1) Meiosis I

   Reduction division:

2) Meiosis II

Interphase:
**MEIOSIS I:**

**Prophase I:**

- Synapsis:

**Crossing over:**
  - Chiasmata (chiasma):

  Results in:

**Metaphase I:**

- Metaphase plate:

- Independent assortment:

  \[ 2^n \rightarrow 2^{23} = \]

**Anaphase I:**

- What separates?

- Sister chromatids are?

**Telophase I & Cytokinesis:**

- Results in:

- Are these cells diploid or haploid?
**MEIOSIS II:**
No interphase → No DNA replication

**Prophase II:**

**Metaphase II:**
What lines up on the metaphase plate?

**Anaphase II:**
What separates?

**Telophase II & Cytokinesis:**
Results in:
Are these cells diploid or haploid?

**Spermatogenesis:**

**Oogenesis:**
Before birth till puberty:
Puberty:
Fertilization:
**Karyotype:**

- Allows:

  **Accidents during meiosis:**

**Nondisjunction:**

If nondisjunction occurs, gametes result in either:

\[ n + 1 = \]
\[ n - 1 = \]

If a \((n + 1)\) or \((n - 1)\) gamete unites with a normal gamete, the resulting zygote:

- **Trisomy \((2n + 1)\):**
  - **Monosomic \((2n - 1)\):**

During which meiotic phase would nondisjunction occur?

- What is trisomy 21?

- Why is it believed that females tend to contribute more to chromosomal abnormalities than males?

- Why is there a greater incidence of Downs babies with older females than younger ones?

- Birth defects & cancer are the result of?

  **Chromosomal alterations include:**
  - Deletions:
  - Duplications:
  - Inversions:
  - Translocations:

If nondisjunction occurs on the sex chromosomes, it can lead to:

- XXY = Klinefelter’s syndrome => 1:2000
- XYY = Normal male => 1:2000
- XXX = Metafemale => 1:1000
- XO = Turner syndrome => 1:5000