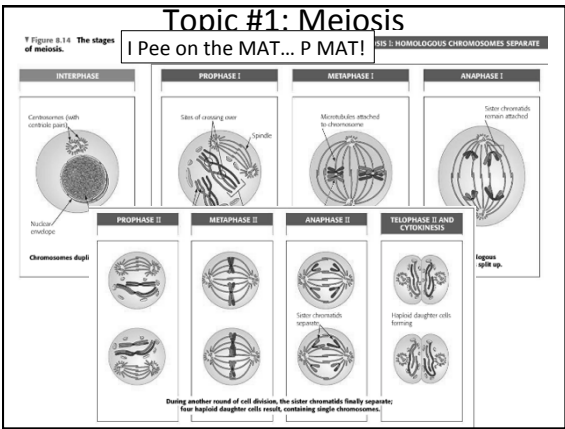


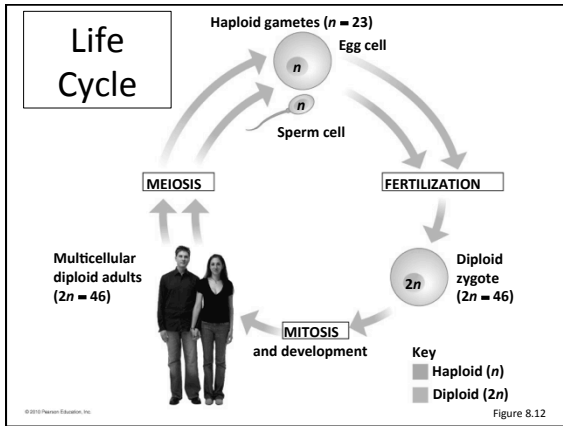
Lecture 14:
2 Parts:

1. Meiosis Chapter 8
2. Inheritance Chapter 9

- *Leading into Lecture 15:*
 1. *Evolution and Inheritance Chapter 13*



Important Latin Roots					
Meioun	Mei	Tosis	Haplo	Di	Oid
• Lessen	• Small	• Process	• Single	• 2	<ul style="list-style-type: none"> • "resembling," "like" • Greek: Eides – "Having the form of"



Some Vocabulary:

- **Homologous chromosomes** are matching pairs of chromosomes that can possess different versions of the same genes.
- **Diploid Cells** have **homologous pairs of chromosomes** (all your body cells except sperm and egg)
- **Haploid Cells** do not have **homologous pairs of chromosomes** (sperm and egg)

Pair of homologous chromosomes

Centromere

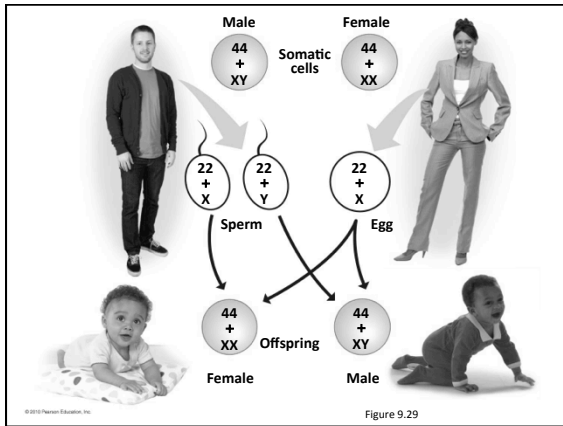
Sister chromatids

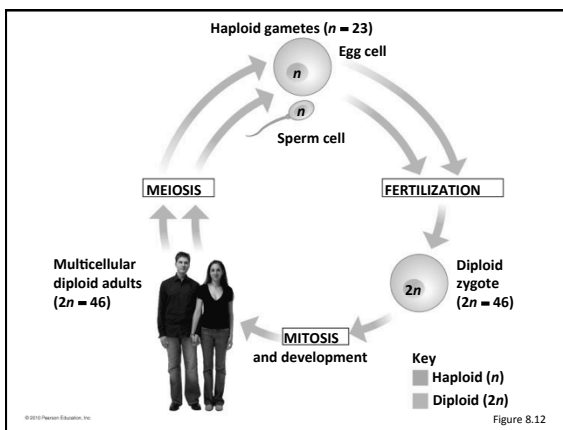
One duplicated chromosome

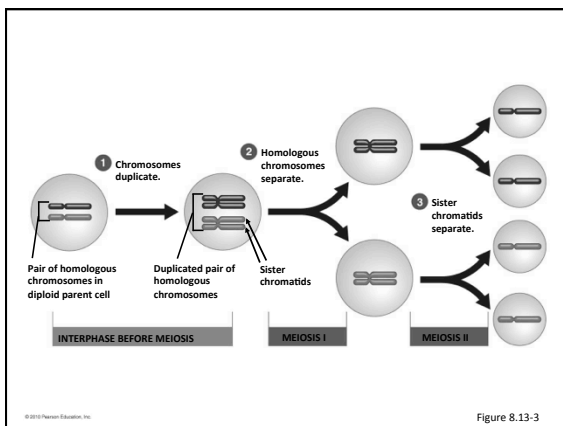
- Humans have **46 chromosomes, 23 pairs**
 - One pair of **sex chromosomes** (XX or XY)
 - 22 pairs of non-sex chromosomes, called **autosomes**

Y

X





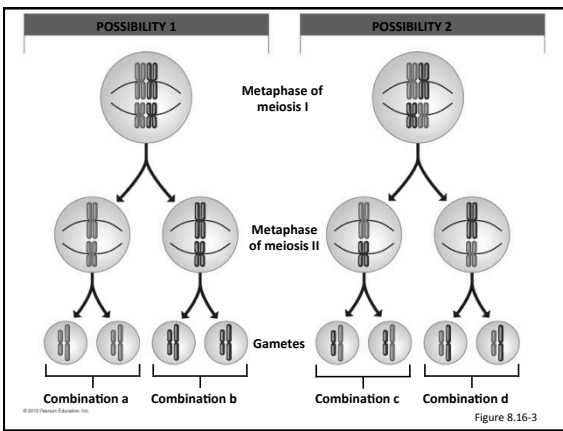


The Origins of Genetic Variation

– You are not exactly like your parents!

Why? (3 reasons)

1. Independent Assortment of Chromosomes
2. Crossing Over
3. Random Fertilization

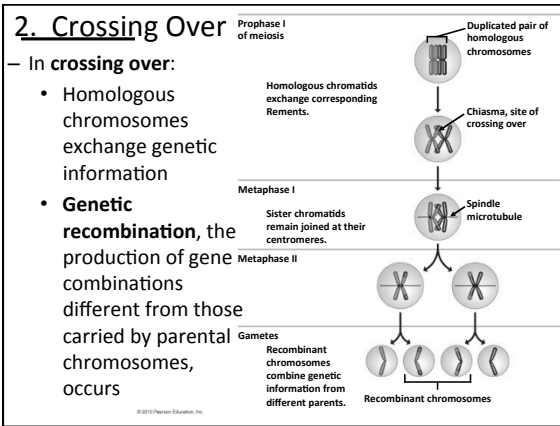


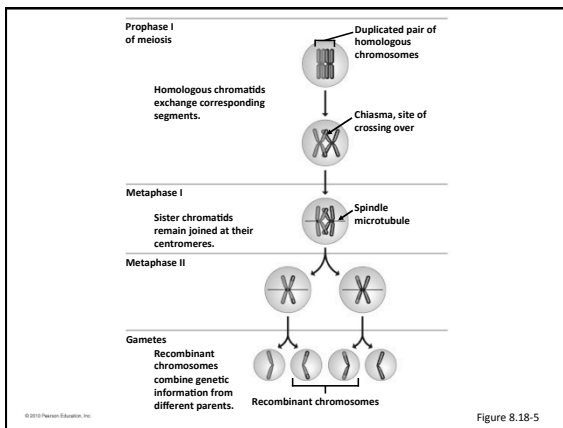
– For any species the total number of chromosome combinations that can appear in the gametes due to independent assortment is:

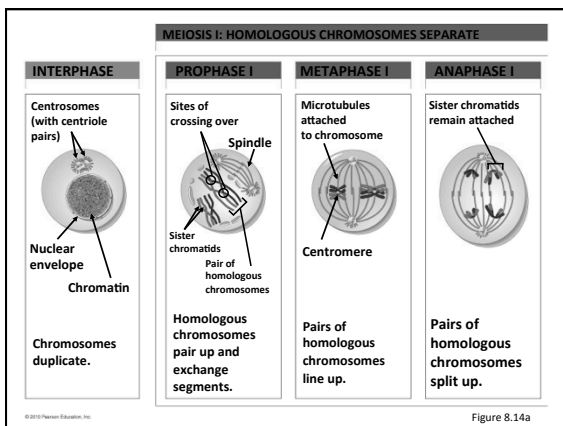
- 2^n where n is the haploid number.

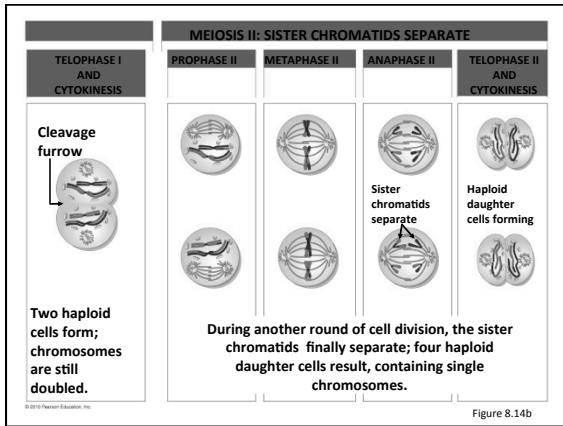
– For a human:

- $n = 23$
- $2^{23} = 8,388,608$ different chromosome combinations possible in a gamete





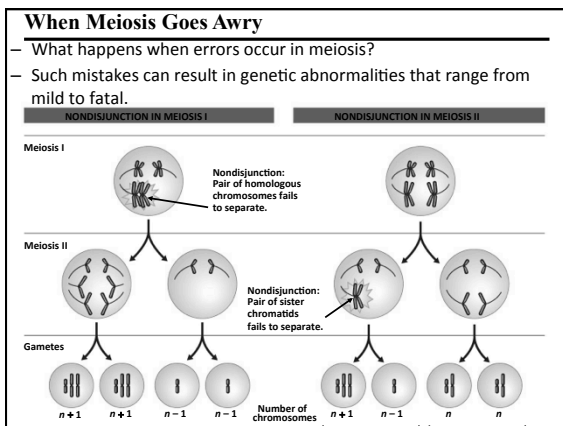


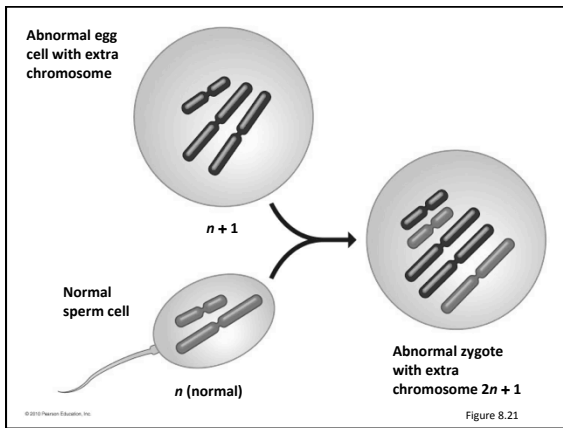


3. Random Fertilization

- A human egg cell is fertilized randomly by one sperm, leading to genetic variety in the zygote.
- If each gamete represents one of 8,388,608 different chromosome combination at fertilization, humans would have $8,388,608 \times 8,388,608$, or more than **7 trillion**, different possible chromosome combination

Figure 8.17





Down Syndrome: An Extra Chromosome 21

– **Down Syndrome:**

- Is also called **trisomy 21**
- Is a condition in which an individual has an extra chromosome 21
- Affects about one out of every 700 children

The image shows a karyotype on the left with a bracket highlighting three copies of chromosome 21, labeled 'Chromosome 21'. To the right is a black and white photograph of a young child with Down syndrome.

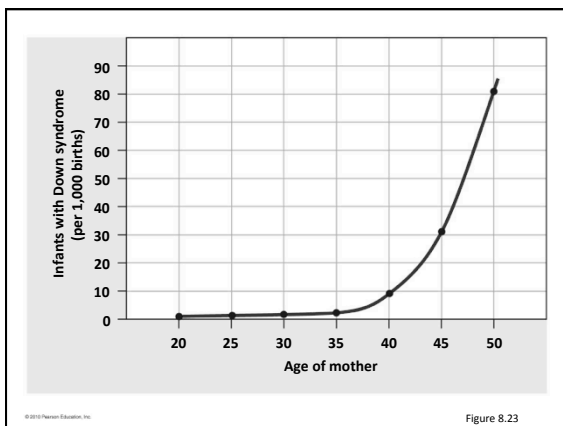



Table 8.1 Abnormalities of Sex Chromosome Number in Humans			
Sex Chromosomes	Syndrome	Origins of Nondisjunction	Frequency in Population
XYY	Klinefelter syndrome (male)	Meiosis in egg or sperm formation	1/2000
XYY	None (normal male)	Meiosis in sperm formation	1/2000
XXX	None (normal female)	Meiosis in egg or sperm formation	1/1000
XO	Turner syndrome (female)	Meiosis in egg or sperm formation	1/5000

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Evolution Connection: The Advantages of Sex

– Asexual reproduction conveys an evolutionary advantage when plants are:

Pros	Cons
1. Sparsely distributed 2. Superbly suited to a stable environment	1. No genetic diversity



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Sexual Reproduction

– Sexual reproduction may convey an evolutionary advantage by:

Pros	Cons
1. Speeding adaptation to a changing environment 2. Allowing a population to more easily rid itself of harmful genes	1. Need a partner 2. STDs

The Process of Science:
Do All Animals Have Sex?

- **Observation:** No scientists have ever found male bdelloid rotifers, a microscopic freshwater invertebrate.
- **Hypothesis:** Bdelloid rotifers have thrived for millions of years using only asexual reproduction.
- **Prediction:** Bdelloid rotifers would display much more variation in their homologous pairs of genes than most organisms.

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- **Experiment:** Researchers compared sequences of a particular gene in bdelloid and non-bdelloid rotifers.
- **Results:**
 - Non-bdelloid sexually reproducing rotifers had nearly identical homologous genes
 - Bdelloid asexually reproducing rotifers had homologous genes that differed by 3.5–54%.
- **Conclusion:** Bdelloid rotifers have evolved for millions of years without any sexual reproduction.

- The DNA in a cell is packed into an elaborate, multilevel system of coiling and folding.
- **Histones** are proteins used to package DNA in eukaryotes.
- **Nucleosomes** consist of DNA wound around histone molecules.

Bio 10 -
Lecture 14:
Macromolecules
