Glencoe Science

Biology

Interactive Classroom

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Mc Graw Hill Glencoe

Chapter 10 Sexual Reproduction and Genetics

EXIT

Click on a lesson name to select.

10.1 Meiosis

Chromosomes and Chromosome Number

- Human body cells have 46 chromosomes
- Each parent contributes 23 chromosomes
- Homologous chromosomes—one of two paired chromosomes, one from each parent

10.1 Meiosis

Chromosomes and Chromosome Number

- Same length
- Same centromere position
- Carry genes that control the same inherited traits

A pair of homologous chromosomes

10.1 Meiosis

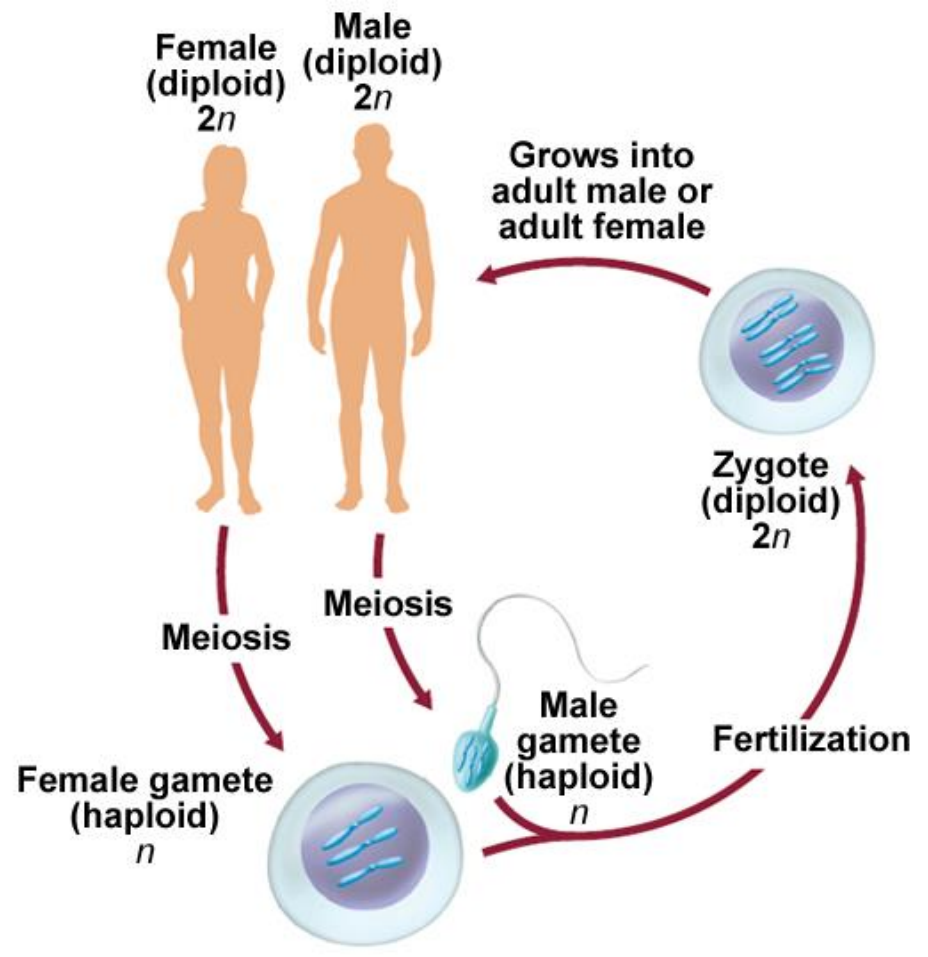
Haploid and Diploid Cells

- An organism produces gametes to maintain the same number of chromosomes from generation to generation.
- Human gametes contain 23 chromosomes.
- A cell with *n* chromosomes is called a haploid cell.
- A cell that contains 2*n* chromosomes is called a diploid cell.

10.1 Meiosis

Meiosis I

- The sexual life cycle in animals involves meiosis.
- Meiosis produces gametes.
- When gametes combine in fertilization, the number of chromosomes is restored.



10.1 Meiosis

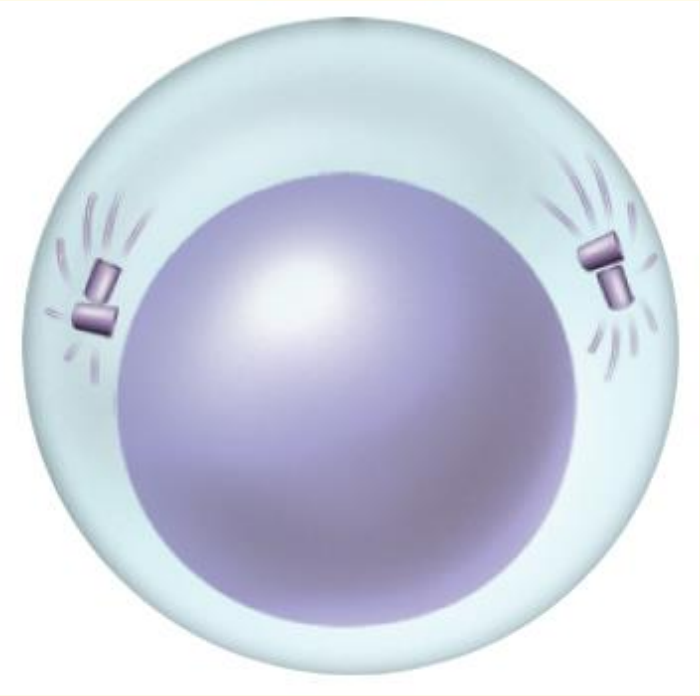
Stages of Meiosis I

- Reduces the chromosome number by half through the separation of homologous chromosomes
- Involves two consecutive cell divisions called meiosis I and meiosis II

10.1 Meiosis

Meiosis I

- Interphase
  - Chromosomes replicate.
  - Chromatin condenses.

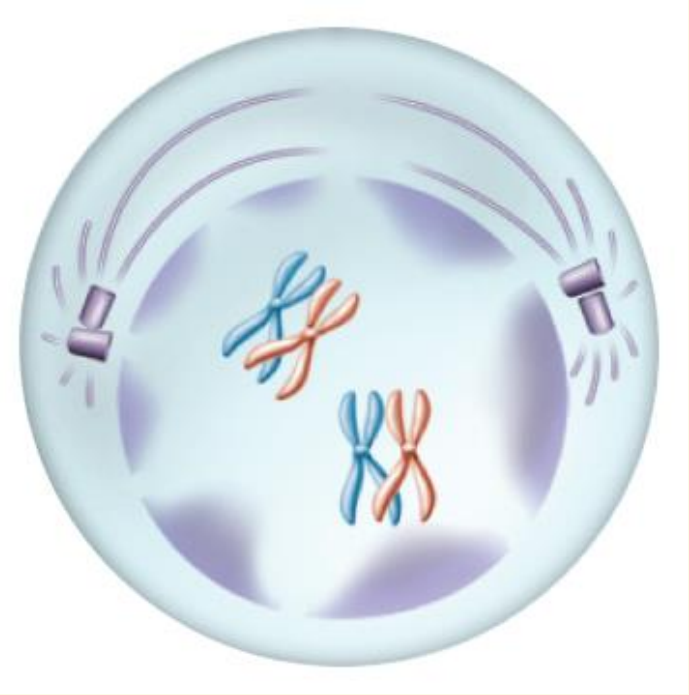


Interphase

10.1 Meiosis

Meiosis I

- Prophase I
  - Pairing of homologous chromosomes occurs.
  - Each chromosome consists of two chromatids.
  - The nuclear envelope breaks down.
  - Spindles form.

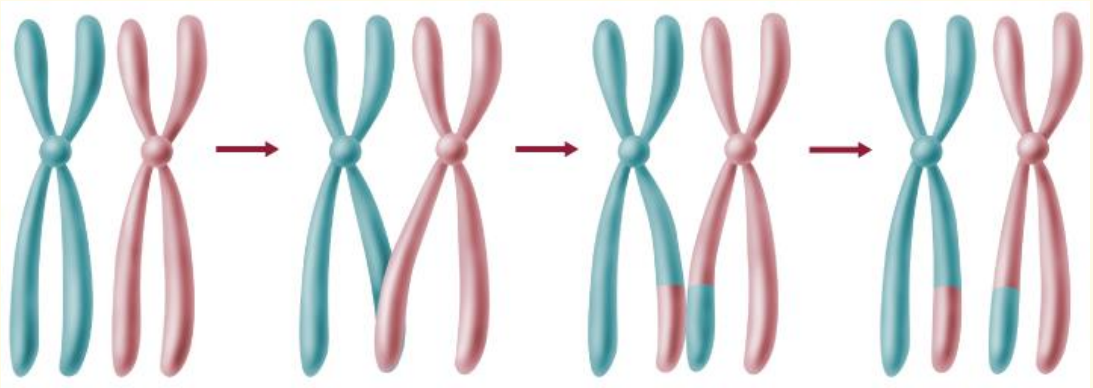


Prophase I

10.1 Meiosis

Meiosis I

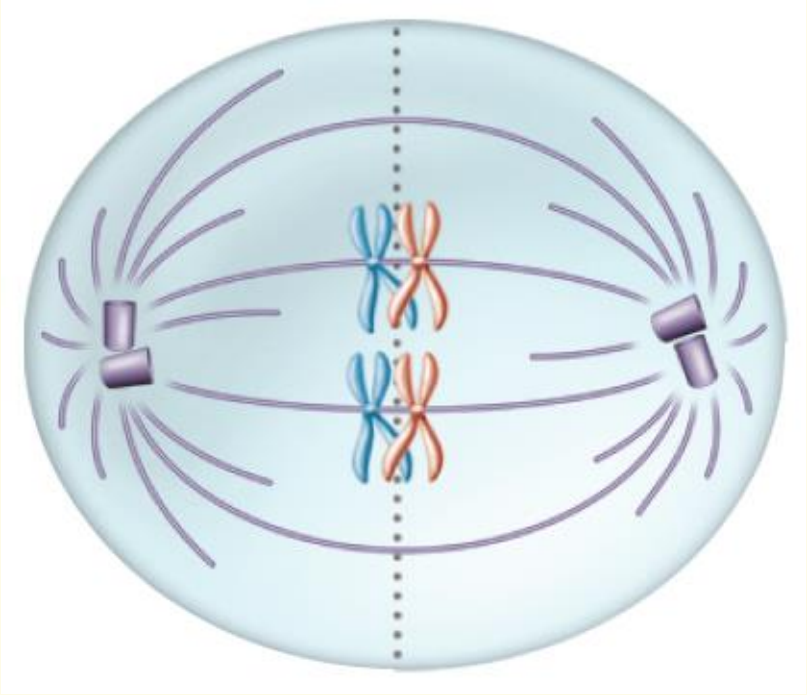
- Prophase I
  - Crossing over produces exchange of genetic information.
  - Crossing over—chromosomal segments are exchanged between a pair of homologous chromosomes.



10.1 Meiosis

Meiosis I

- Metaphase I
  - Chromosome centromeres attach to spindle fibers.
  - Homologous chromosomes line up at the equator.

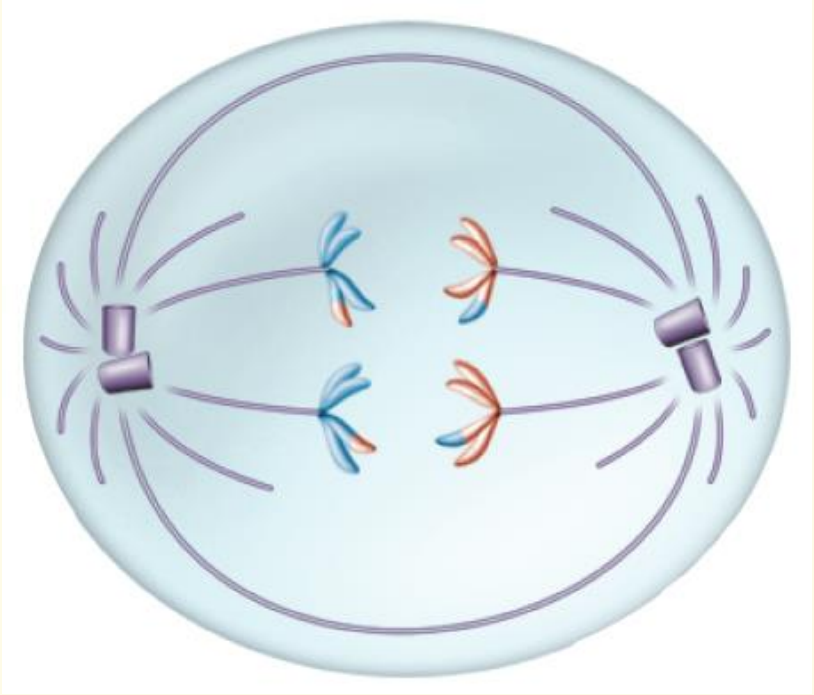


Metaphase I

10.1 Meiosis

Meiosis I

- Anaphase I
  - Homologous chromosomes separate and move to opposite poles of the cell.

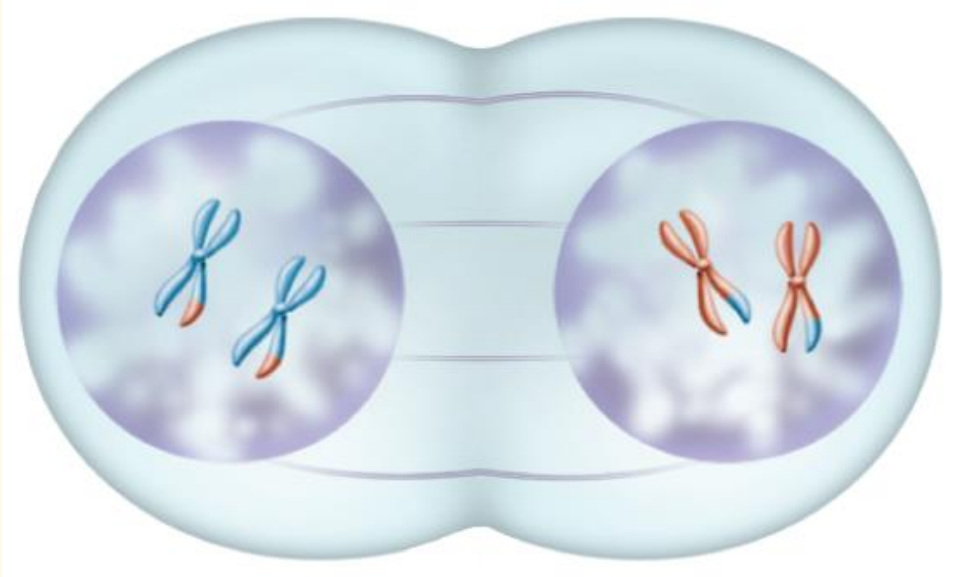


Anaphase I

10.1 Meiosis

Meiosis I

- Telophase I
  - The spindles break down.
  - Chromosomes uncoil and form two nuclei.
  - The cell divides.

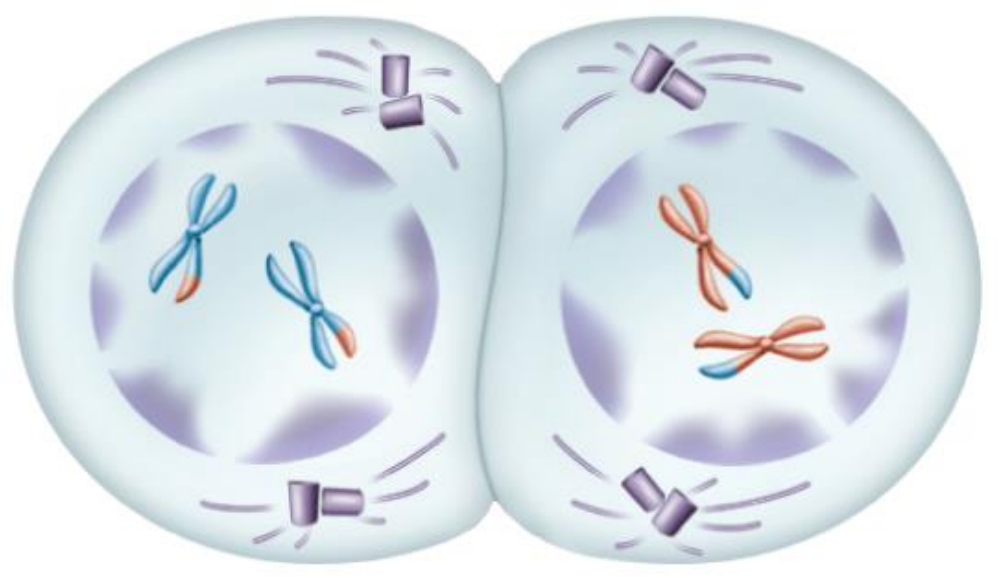


Telophase I

10.1 Meiosis

Meiosis II

- Prophase II
  - A second set of phases begins as the spindle apparatus forms and the chromosomes condense.

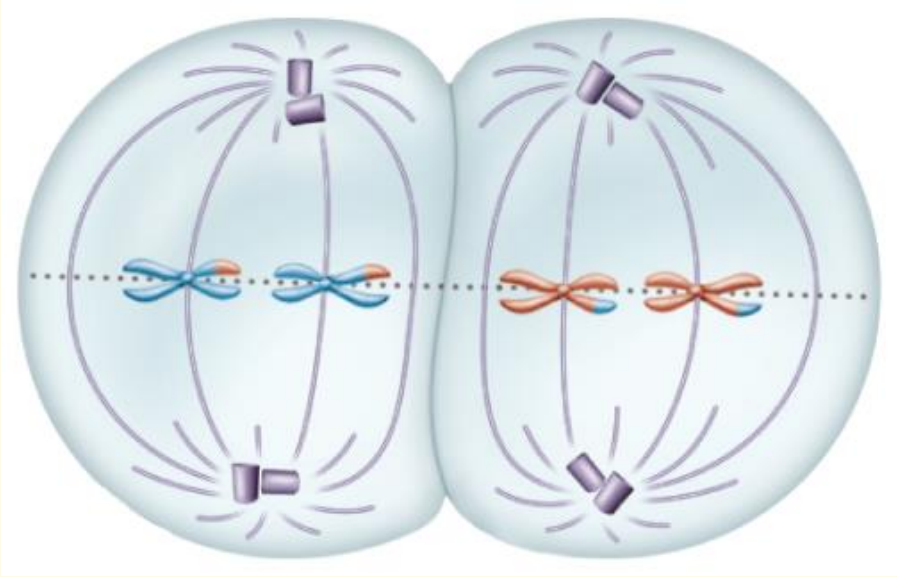


Prophase II

10.1 Meiosis

Meiosis II

- Metaphase II
  - A haploid number of chromosomes line up at the equator.

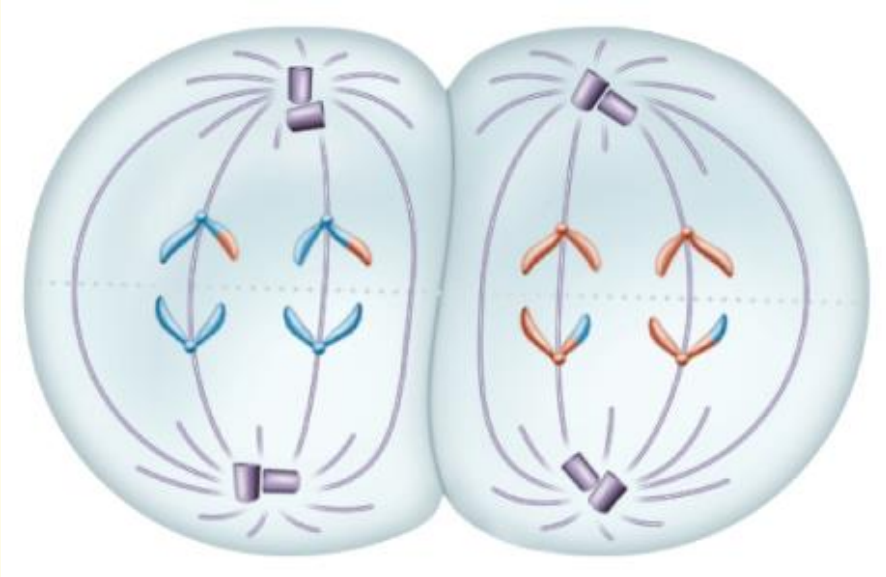


Metaphase II

10.1 Meiosis

Meiosis II

- Anaphase II
  - The sister chromatids are pulled apart at the centromere by spindle fibers and move toward the opposite poles of the cell.

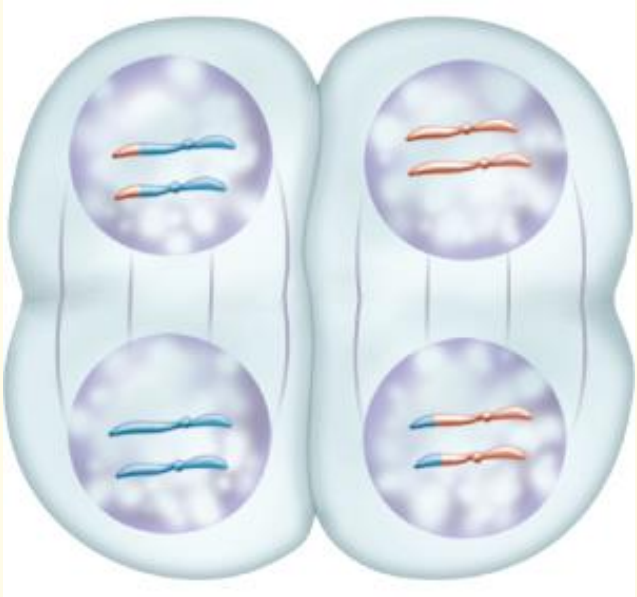


Anaphase II

10.1 Meiosis

Meiosis II

- Telophase II
  - The chromosomes reach the poles, and the nuclear membrane and nuclei reform.

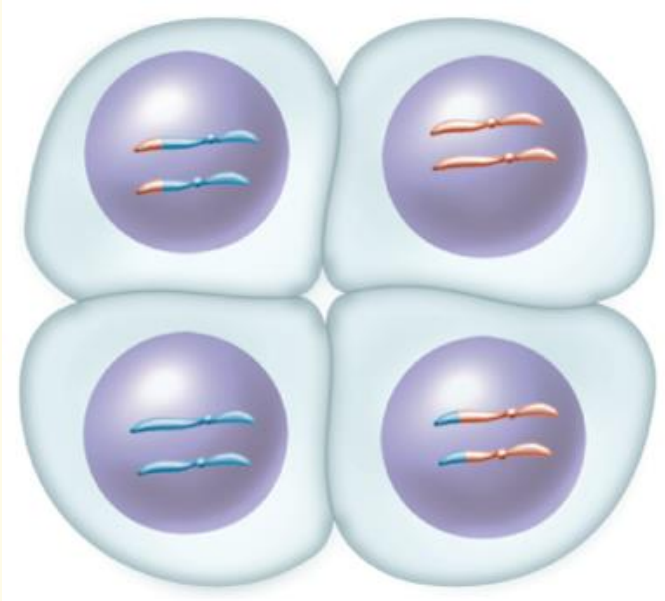


Telophase II

10.1 Meiosis

Meiosis II

- Cytokinesis results in four haploid cells, each with *n* number of chromosomes.



Cytokinesis

Concepts In Motion Animation

Visualizing Meiosis I and Meiosis II

Click here to proceed!

10.1 Meiosis

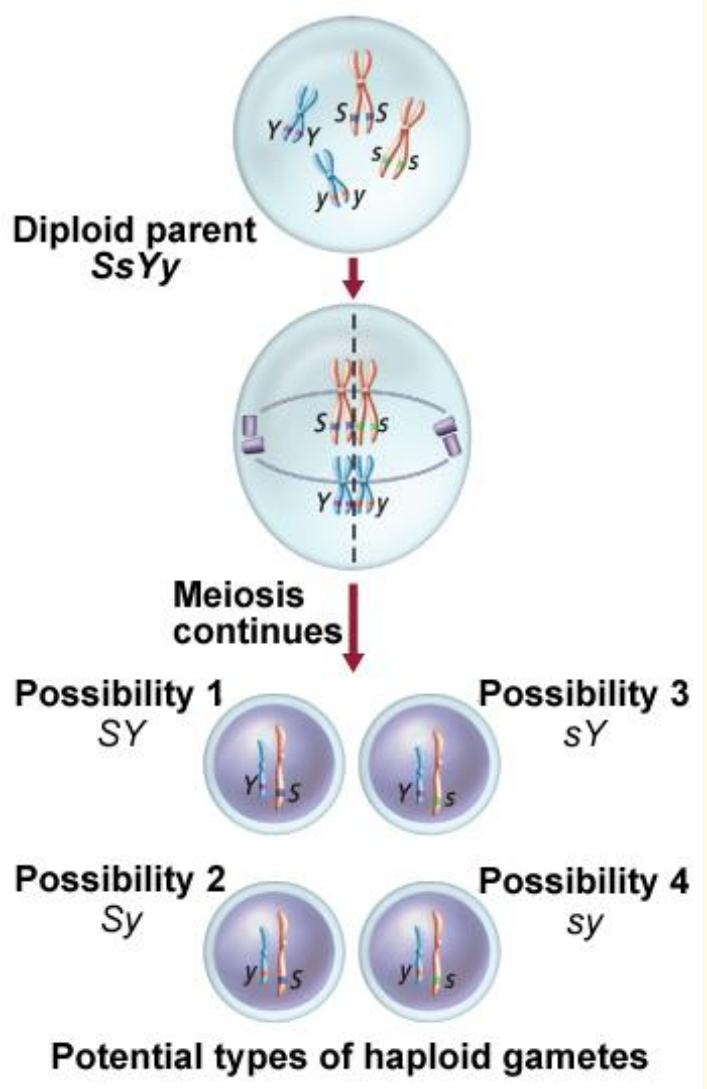
The Importance of Meiosis

- Meiosis consists of two sets of divisions
- Produces four haploid daughter cells that are not identical
- Results in genetic variation

10.1 Meiosis

Meiosis Provides Variation

- Depending on how the chromosomes line up at the equator, four gametes with four different combinations of chromosomes can result.
- Genetic variation also is produced during crossing over and during fertilization, when gametes randomly combine.



10.1 Meiosis

Sexual Reproduction v. Asexual Reproduction

- Asexual reproduction
  - The organism inherits all of its chromosomes from a single parent.
  - The new individual is genetically identical to its parent.
- Sexual reproduction
  - Beneficial genes multiply faster over time.

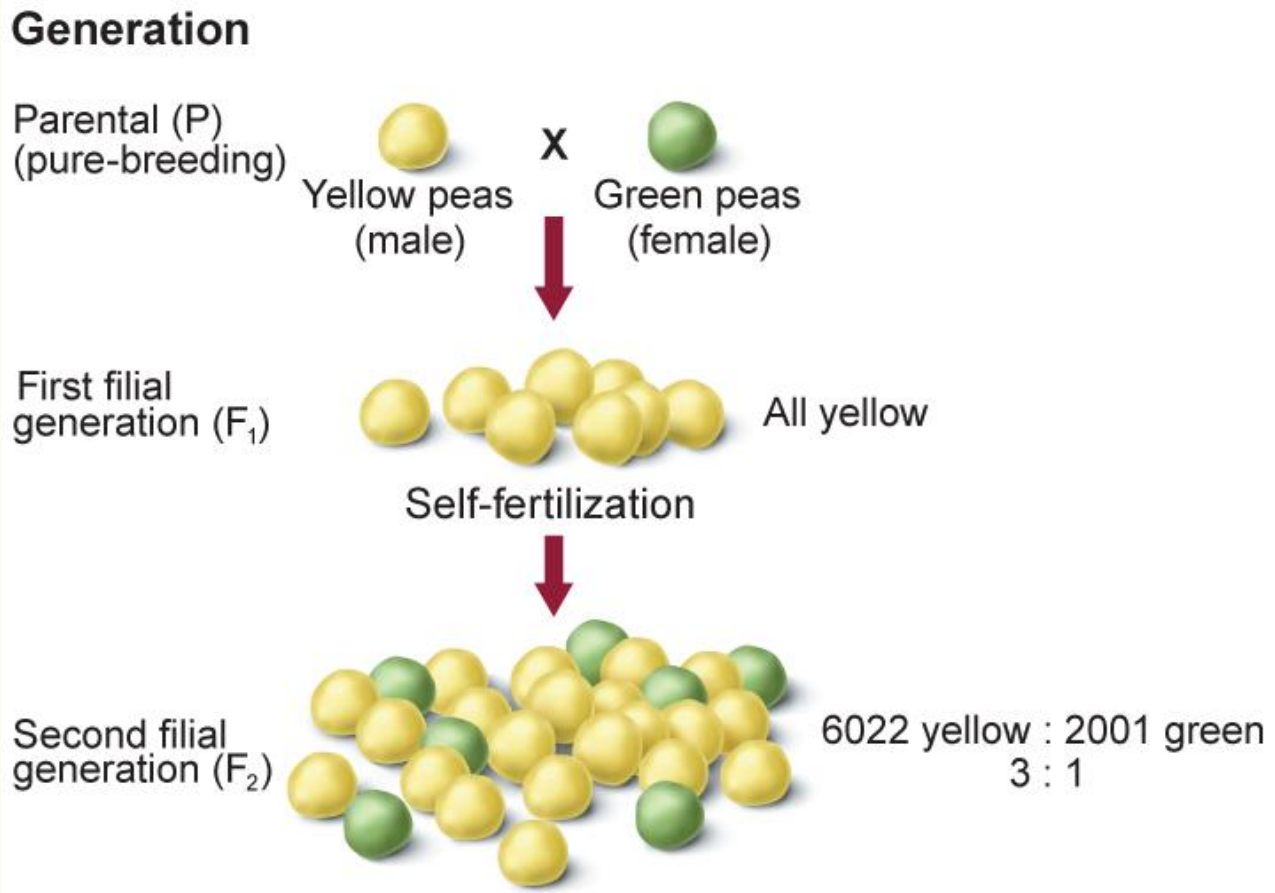
10.2 Mendelian Genetics

How Genetics Began

- The passing of traits to the next generation is called inheritance, or heredity.
- Mendel performed cross-pollination in pea plants.
- Mendel followed various traits in the pea plants he bred.

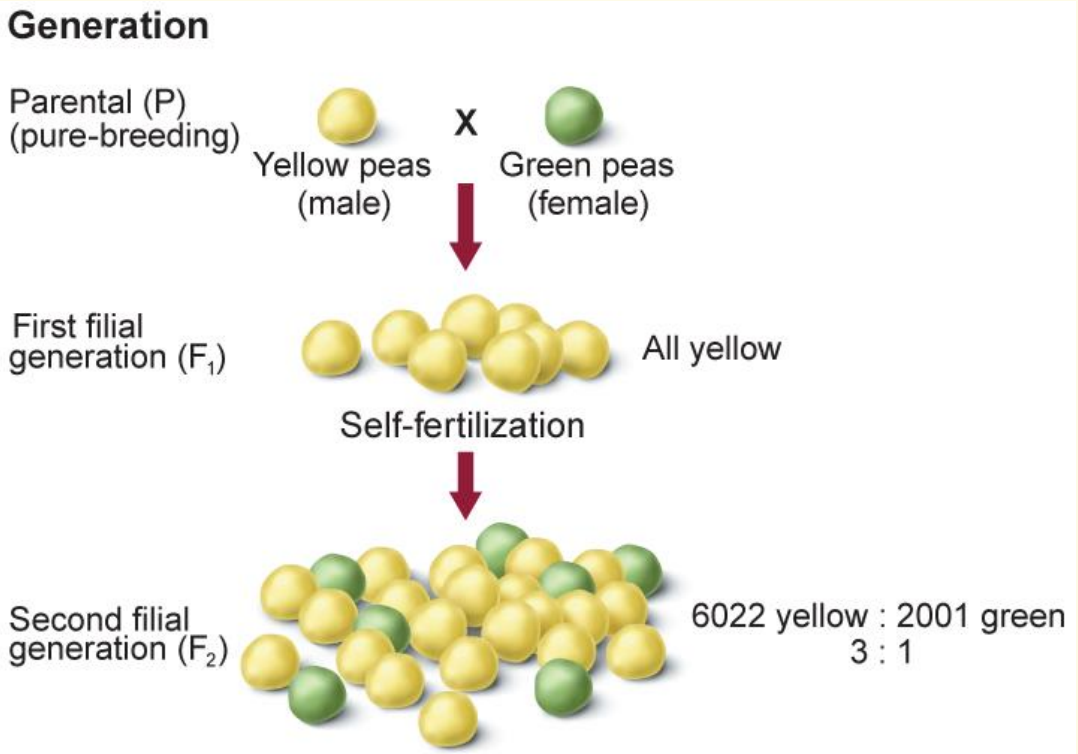
10.2 Mendelian Genetics

- The parent generation is also known as the P generation.



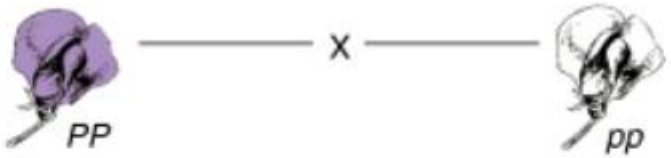
10.2 Mendelian Genetics

- The offspring of this P cross are called the first filial (F_1) generation.
- The second filial (F_2) generation is the offspring from the F_1 cross.



Concepts In Motion

P



reset

10.2 Mendelian Genetics

- Mendel studied seven different traits.
  - Seed or pea color
  - Flower color
  - Seed pod color
  - Seed shape or texture
  - Seed pod shape
  - Stem length
  - Flower position

10.2 Mendelian Genetics

Genes in Pairs

- Allele
  - An alternative form of a single gene passed from generation to generation
- Dominant
- Recessive

10.2 Mendelian Genetics

Dominance

- An organism with two of the same alleles for a particular trait is homozygous.
- An organism with two different alleles for a particular trait is heterozygous.

10.2 Mendelian Genetics

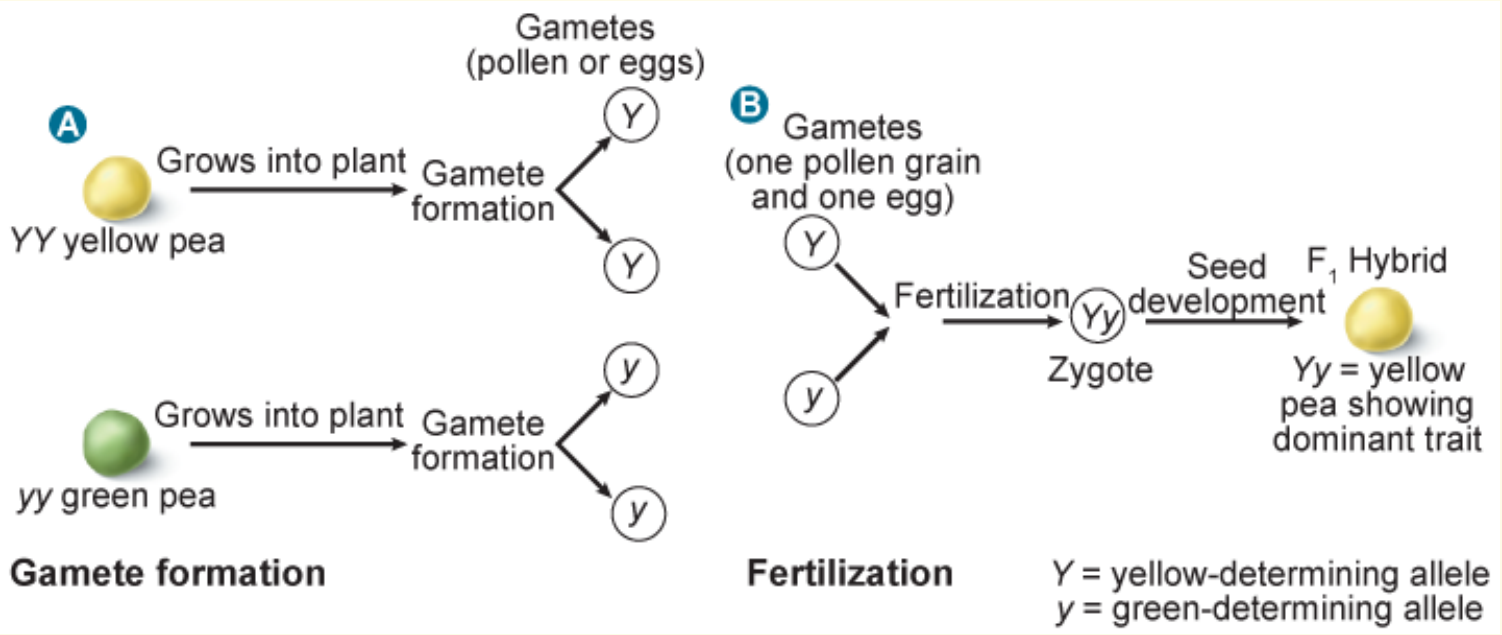
Genotype and Phenotype

- An organism's allele pairs are called its genotype.
- The observable characteristic or outward expression of an allele pair is called the phenotype.

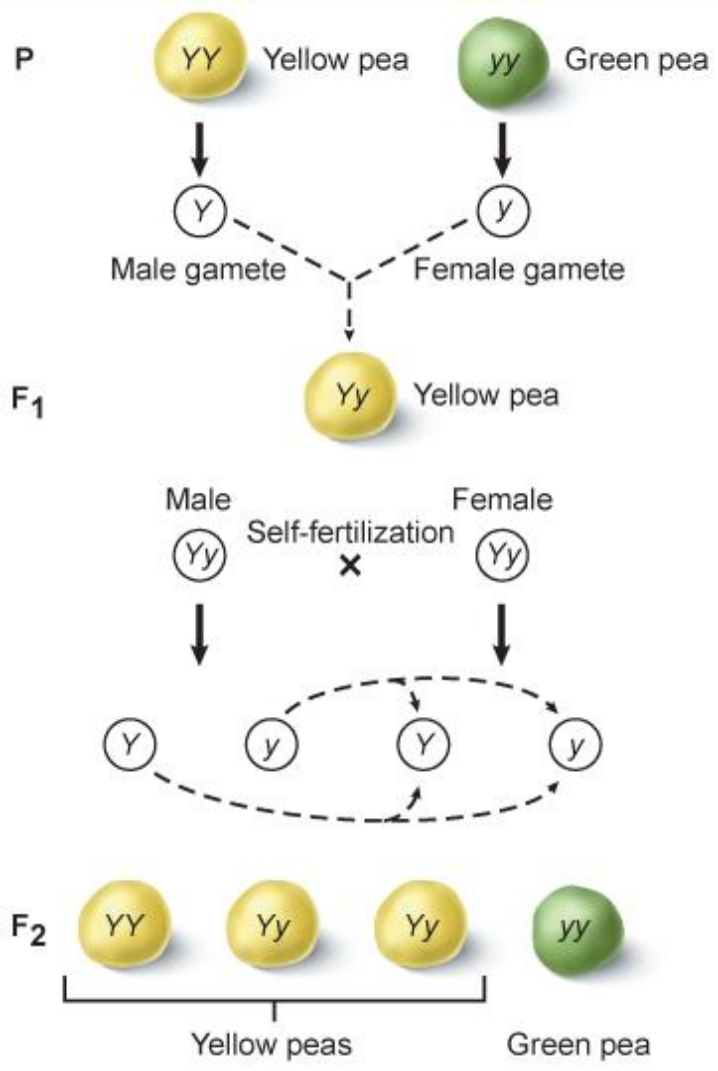
10.2 Mendelian Genetics

Mendel's Law of Segregation

- Two alleles for each trait separate during meiosis.
- During fertilization, two alleles for that trait unite.
- Heterozygous organisms are called hybrids.



10.2 Mendelian Genetics



Monohybrid Cross

- A cross that involves hybrids for a single trait is called a monohybrid cross.

10.2 Mendelian Genetics

Dihybrid Cross

- The simultaneous inheritance of two or more traits in the same plant is a dihybrid cross.
- Dihybrids are heterozygous for both traits.

10.2 Mendelian Genetics

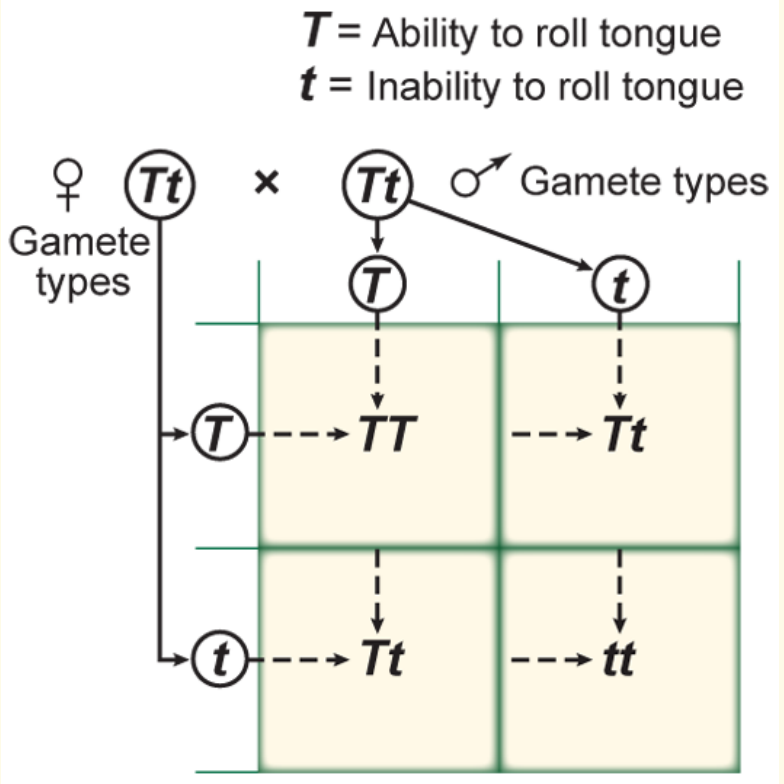
Law of Independent Assortment

- Random distribution of alleles occurs during gamete formation
- Genes on separate chromosomes sort independently during meiosis.
- Each allele combination is equally likely to occur.

10.2 Mendelian Genetics

Punnett Squares

- Predict the possible offspring of a cross between two known genotypes



Online Virtual Lab

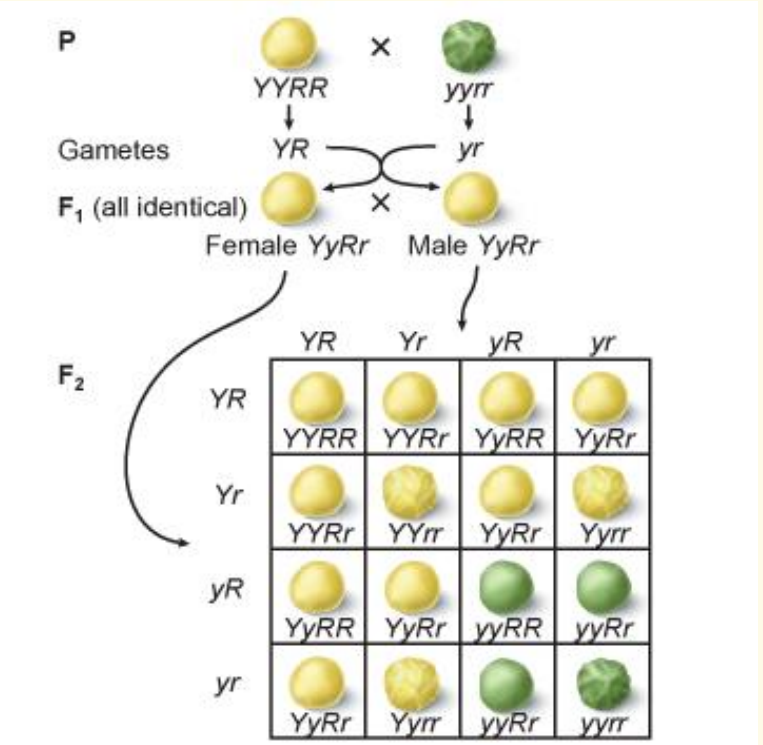
Punnett Squares

Click here to proceed!

10.2 Mendelian Genetics

Punnett Square— Dihybrid Cross

- Four types of alleles from the male gametes and four types of alleles from the female gametes can be produced.
- The resulting phenotypic ratio is 9:3:3:1.



Type	Genotype	Phenotype	Number	Phenotypic Ratio
Parental	Y_R_	yellow round	315	9/16
Recombinant	yyR_	green round	108	3/16
Recombinant	Y_rr	yellow wrinkled	101	3/16
Parental	yyrr	green wrinkled	32	1/16

10.3 Gene Linkage and Polyploidy

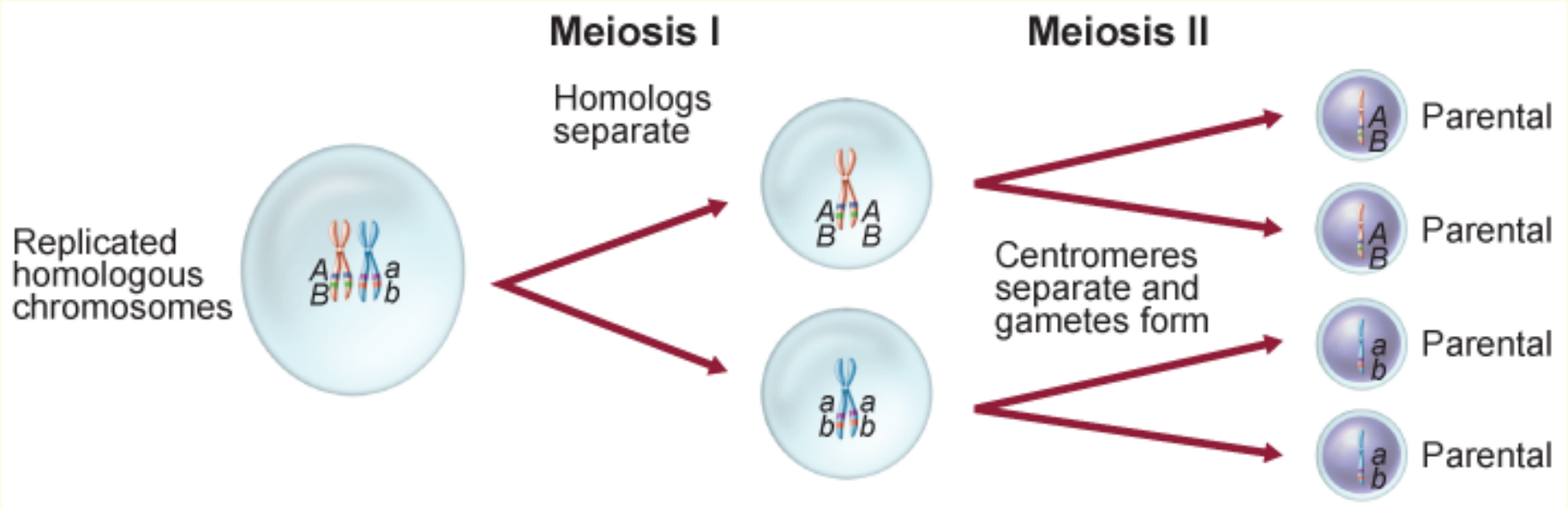
Genetic Recombination

- The new combination of genes produced by crossing over and independent assortment
- Combinations of genes due to independent assortment can be calculated using the formula 2^n, where *n* is the number of chromosome pairs.

10.3 Gene Linkage and Polyploidy

Gene Linkage

- The linkage of genes on a chromosome results in an exception to Mendel's law of independent assortment because linked genes usually do not segregate independently.



10.3 Gene Linkage and Polyploidy

Polyploidy

- Polyploidy is the occurrence of one or more extra sets of all chromosomes in an organism.

- A triploid organism, for instance, would be designated 3*n*, which means that it has three complete sets of chromosomes.

Chapter Resource Menu

Click on a hyperlink to view the corresponding lesson.

Chapter Diagnostic Questions

CheckPoint

Which symbol is used to represent the number of chromosomes in a gamete?

A. #

B. x

C. r

D. n

Chapter Diagnostic Questions

CheckPoint

Name the person known as the father of genetics.

A. Felix Mendelssohn

B. Gregor Mendel

C. Dr. Reginald Punnett

D. Albert Einstein

Chapter Diagnostic Questions

CheckPoint

Which term refers to the outward expression of an allele pair?

A. gamete
B. hybrid
C. phenotype
D. genotype

10.1 Formative Questions

CheckPoint

Segments of DNA that control the production of proteins are called _____.

A. chromatids

B. chromosomes

C. genes

D. traits

10.1 Formative Questions

CheckPoint

What is the term for a pair of chromosomes that have the same length, same centromere position, and carry genes that control the same traits?

A. diploid

B. heterozygous

C. homozygous

D. homologous

10.1 Formative Questions

CheckPoint

How does the number of chromosomes in gametes compare with the number of chromosomes in body cells?

10.1 Formative Questions

CheckPoint

A. Gametes have 1/4 the number of chromosomes.

B. Gametes have 1/2 the number of chromosomes.

C. Gametes have the same number of chromosomes.

D. Gametes have twice as many chromosomes.

10.1 Formative Questions

CheckPoint

What type of organisms only reproduce asexually?

A. bacteria
B. protists
C. plants
D. simple animals

10.2 Formative Questions

CheckPoint

What is the name for different forms of a single gene that are passed from generation to generation?

A. alleles
B. genotypes
C. phenotypes
D. traits

10.2 Formative Questions

CheckPoint

Which pair of alleles is heterozygous?

A. RR

B. Rr

C. rr

D. yR

10.2 Formative Questions

CheckPoint

In rabbits, gray fur (G) is dominant to black fur (g). If a heterozygous male is crossed with a heterozygous female, what is the phenotypic ratio of the possible offspring?

A. 1:1

B. 1:2:1

C. 2:1

D. 3:1

10.3 Formative Questions

CheckPoint

Which explains how the shuffling of genes during meiosis results in billions of possible combinations?

A. crossing over

B. gene linkage

C. genetic recombination

D. independent segregation

10.3 Formative Questions

CheckPoint

True or False

Two genes on the same chromosome may become separated during meiosis.

10.3 Formative Questions

CheckPoint

What is the term for an organism that has one or more sets of extra chromosomes in its cells?

A. diploid
B. gamete
C. hybrid
D. polyploid

Chapter Assessment Questions

CheckPoint

How many chromosomes would a cell have during metaphase I of meiosis if it has 12 chromosomes during interphase?

A. 6

B. 12

C. 24

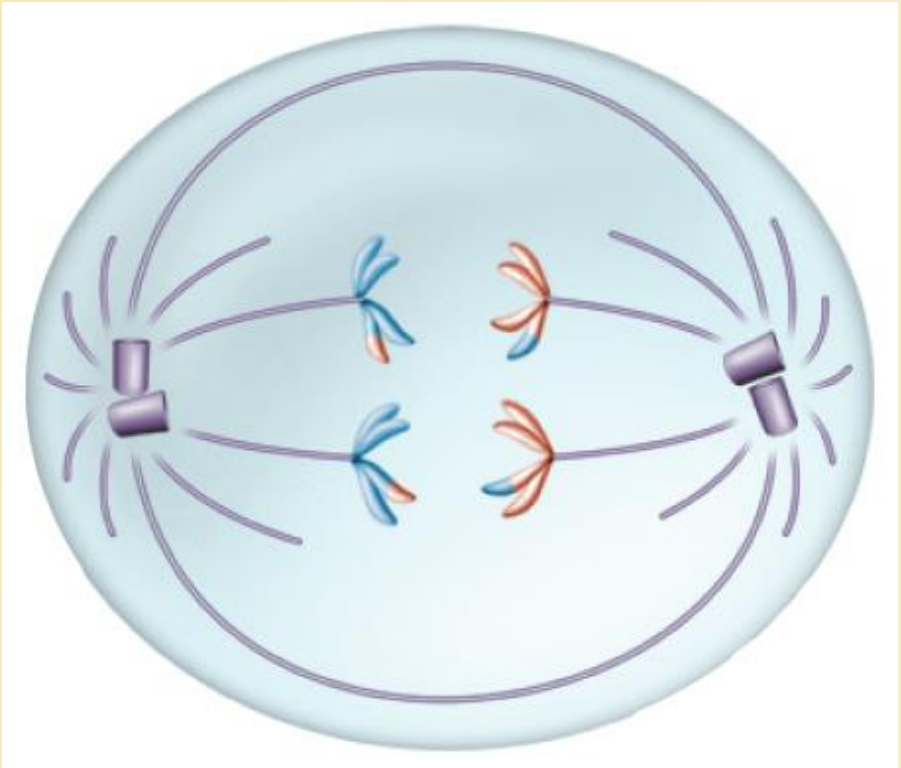
D. 36

Chapter Assessment Questions

CheckPoint

Which stage of meiosis is illustrated?

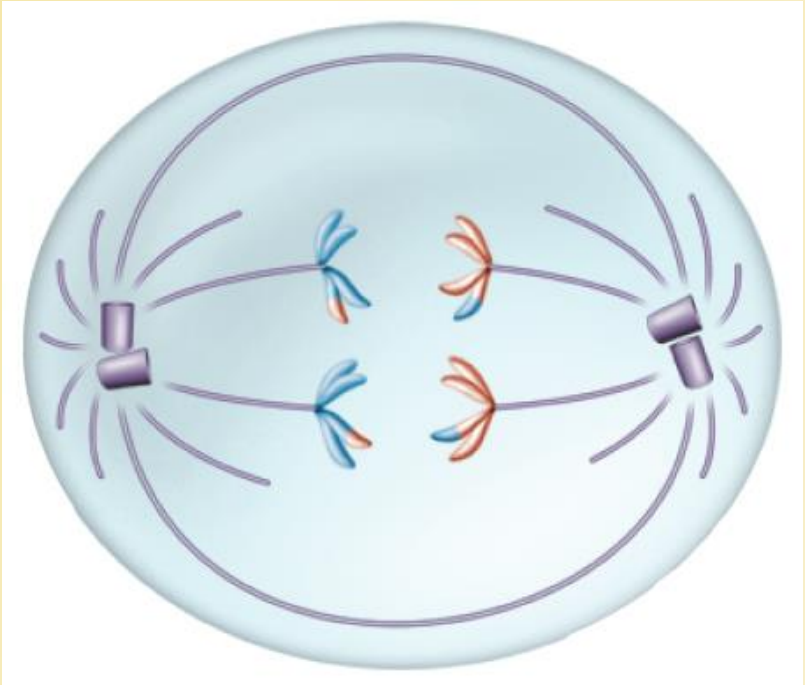
A. prophase I
B. interphase
C. anaphase I
D. anaphase II



Chapter Assessment Questions

CheckPoint

What is the next step for the chromosomes illustrated?



Chapter Assessment Questions

CheckPoint

A. Chromosomes replicate.

B. Chromosomes move to opposite poles.

C. Chromosomes uncoil and form two nuclei.

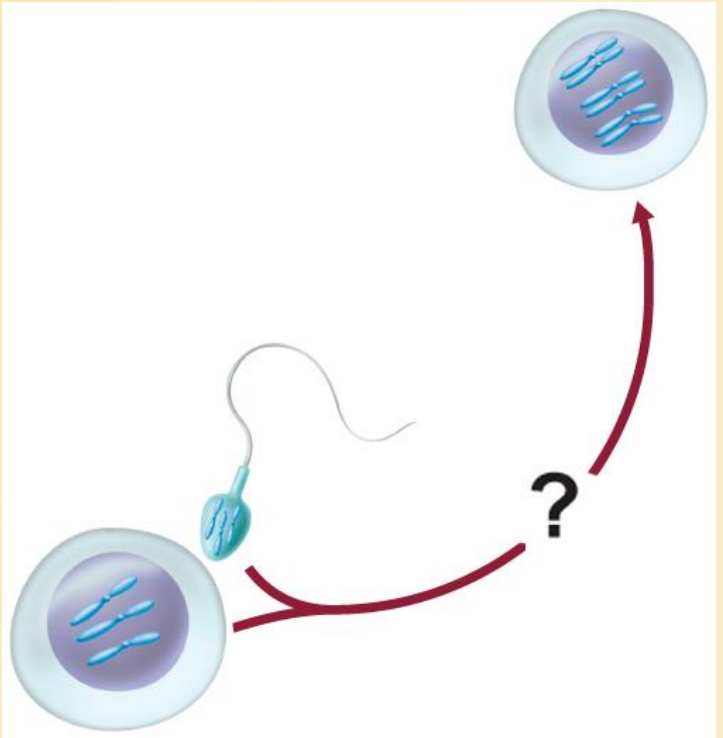
D. Chromosomes line up at the equator.

Standardized Test Practice

CheckPoint

What is this process called?

A. fertilization
B. gamete formation
C. inheritance
D. reproduction



Standardized Test Practice

CheckPoint

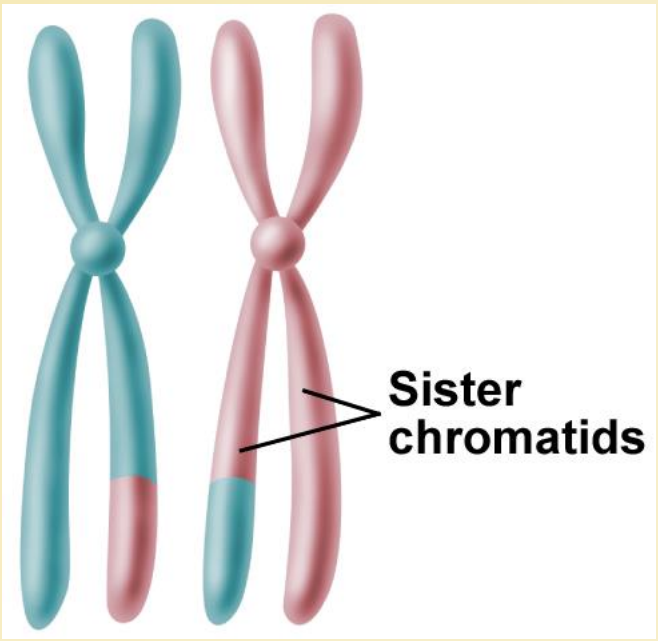
Before meiosis I, the sister chromatids of this chromosome were identical. What process caused a change in a section of one chromatid?

A. DNA replication

B. crossing over

C. synapsis

D. telophase



Standardized Test Practice

CheckPoint

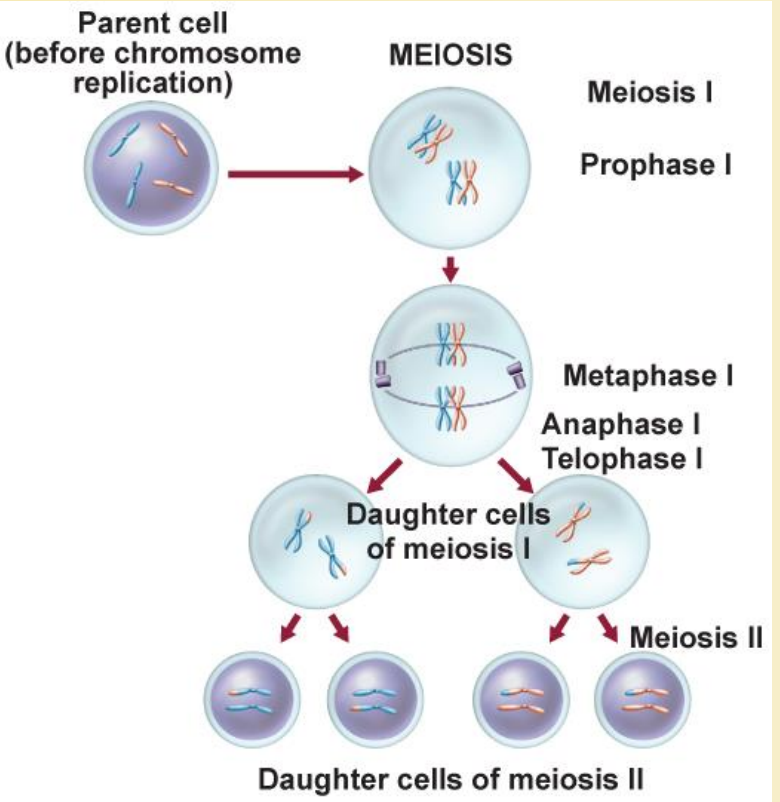
At what stage is the chromosome number reduced from *2n* to *n*?

A. prophase I

B. metaphase I

C. anaphase I

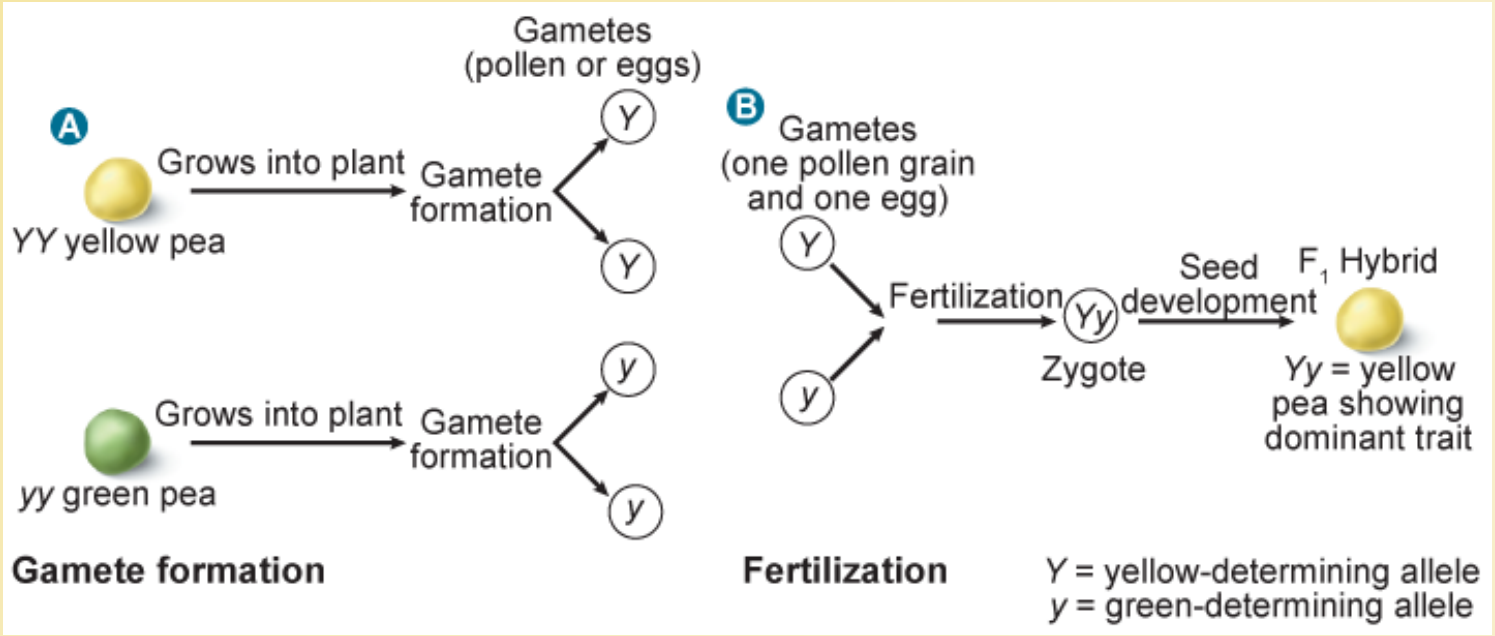
D. meiosis II



Standardized Test Practice

CheckPoint

To which step in this process does the law of segregation apply?



Standardized Test Practice

CheckPoint

A. grows into plant

B. gamete formation

C. fertilization

D. seed development

Standardized Test Practice

CheckPoint

For human eye color, brown is dominant and blue is recessive. If a husband is heterozygous and his wife has blue eyes, what is the probability that their child will have blue eyes?

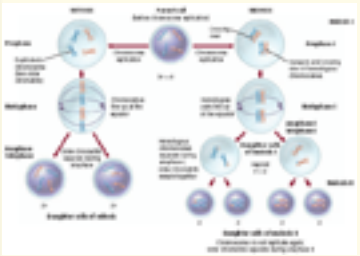
A. 0

B. 1/4

C. 1/2

D. 1

Glencoe Biology Transparencies



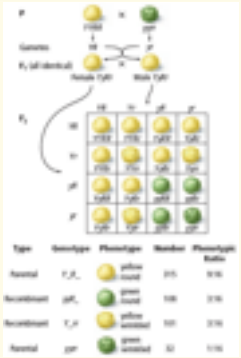
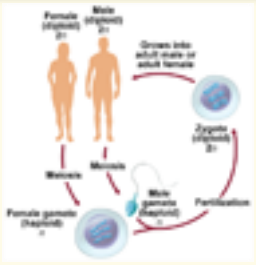
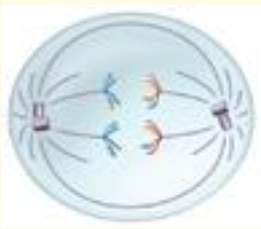
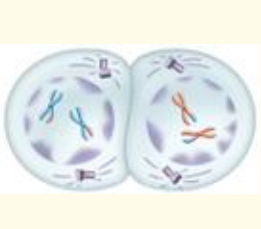
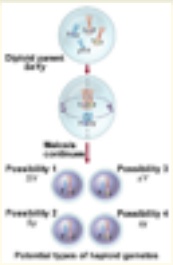


Image Bank









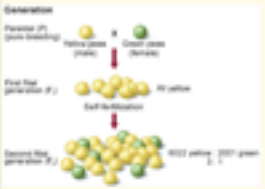
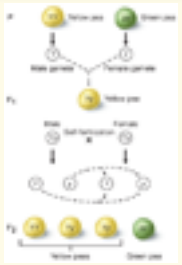
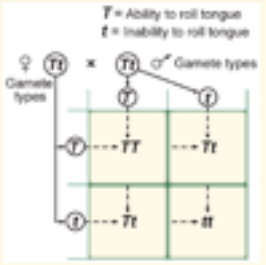


Image Bank




T = Ability to roll tongue
t = Inability to roll tongue
Gamete types
Gamete types
Tt
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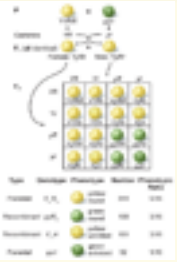

Vocabulary

Section 1

- gene
- homologous chromosome
- gamete
- haploid
- fertilization
- diploid
- meiosis
- crossing over

Vocabulary

Section 2

- genetics
- allele
- dominant
- recessive
- homozygous
- heterozygous
- genotype
- phenotype
- law of segregation
- hybrid
- law of independent assortment

Vocabulary

Section 3

- genetic recombination
- polyploidy

Animation

Concepts In Motion

- Visualizing Meiosis I and Meiosis II
- Generations