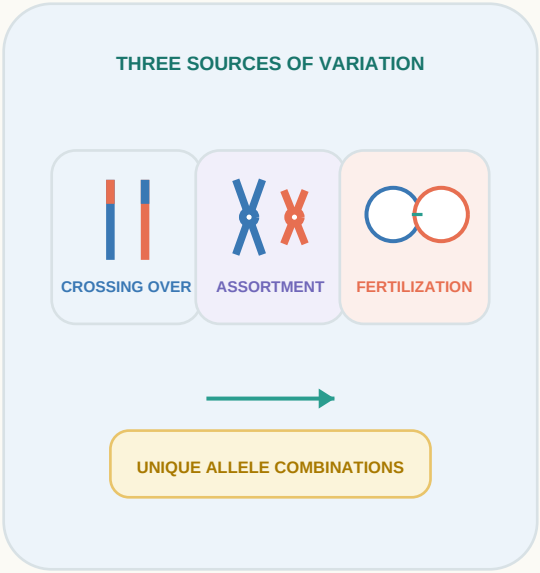
AP BIOLOGY | UNIT 5

TOPIC 5.2

Meiosis and Genetic Diversity

Meiosis and fertilization reshuffle alleles, producing gametes and offspring with new genetic combinations.



THE CORE CAUSAL CHAIN

CROSSING OVER → chromatid segments swap

ASSORTMENT → homologs orient randomly

GAMETES → allele sets differ

FERTILIZATION → two gametes combine

BY THE END, YOU SHOULD BE ABLE TO...

1. Explain how crossing over creates recombinants.
2. Trace random assortment and fertilization.
3. Predict effects of nondisjunction.

CENTRAL IDEA

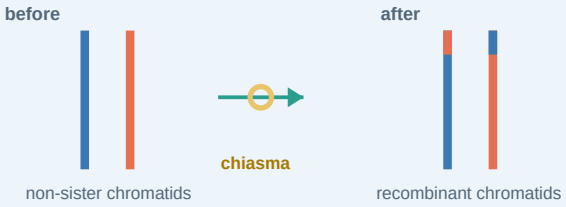
Variation arises when chromosomes exchange DNA, maternal and paternal homologs assort into different gametes, and genetically different gametes unite.

1 Meiosis reshuffles chromosomes and alleles

Crossing over changes allele combinations within chromosomes, while random assortment changes which homologs enter each gamete.

TWO INDEPENDENT SOURCES OF VARIATION

CROSSING OVER - PROPHASE I



RANDOM ASSORTMENT - METAPHASE I



Each homolog pair orients independently.

BOTH PROCESSES CREATE DIFFERENT ALLELE COMBINATIONS

WHAT EACH PROCESS CHANGES

CROSSING OVER

new combinations of alleles along one chromosome

RANDOM ASSORTMENT

new combinations of maternal and paternal chromosomes

KEY DISTINCTION

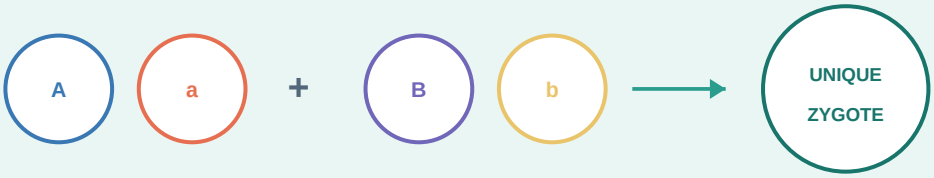
Crossing over exchanges DNA between non-sister chromatids of homologous chromosomes. It does not exchange DNA between sister chromatids or unrelated chromosomes.

2 Fertilization multiplies genetic combinations

Genetically different gametes unite at random, while chromosome-separation errors can produce abnormal chromosome numbers.

GAMETES COMBINE

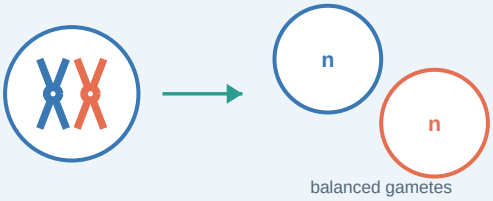
RANDOM FERTILIZATION



Any genetically distinct egg can unite with any genetically distinct sperm.

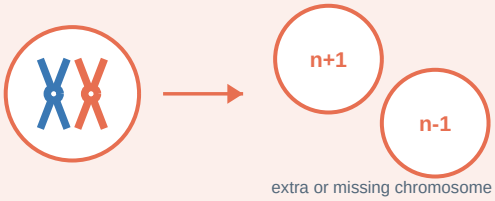
WHEN SEPARATION FAILS: NONDISJUNCTION

NORMAL SEPARATION



balanced gametes

NONDISJUNCTION



extra or missing chromosome

NONDISJUNCTION -> GAMETES WITH TOO MANY OR TOO FEW CHROMOSOMES

AFTER FERTILIZATION, THE ZYGOTE MAY HAVE AN ABNORMAL CHROMOSOME NUMBER

FINAL MAP

Crossing over creates recombinant chromosomes. Random assortment distributes homologs into different gametes. Fertilization combines two gametes. Nondisjunction changes chromosome number rather than simply reshuffling alleles.