

Stages of Meiosis and Meiosis and Genetic Variation

Prophase I

- ☑ Chromosomes become visible
- ☑ Nuclear envelope breaks down
- ☑ Crossing-over occurs

Metaphase I

- ☑ Pairs of homologous chromosomes move to the equator of the cell

Anaphase I

- ☑ Homologous chromosomes move to opposite poles of the cell

Telophase I and cytokinesis

(cytokinesis is the division of the cytoplasm of the cell)

- ☑ Chromosomes gather at the poles of the cell
- ☑ The cytoplasm divides

Prophase II

- ☑ New spindle forms around the chromosomes

Metaphase II

- ☑ Chromosomes line up at the equator

Anaphase II

- ☑ Centromeres divide
- ☑ Chromatids move to opposite poles of the cell

Telophase II and cytokinesis

- ☑ Nuclear envelope forms around each set of chromosomes
- ☑ Cytoplasm divides

Meiosis and Genetic Variation

- ☑ Meiosis is an important process that allows for genetic variation in the following 3 ways:

1. Independent assortment
2. Crossing-over
3. Random fertilization

1. Independent Assortment -The random distribution of homologous chromosomes during meiosis

- ⊛ Each of the 23 pairs of chromosomes separates independently
- ⊛ Thus, 2^{23} (about 8 million) gametes with different gene combinations can be produced from one original cell by this mechanism

2. Crossing-Over – Occurs when parts of a chromatid on one homologous chromosome are broken and exchanged with parts of a chromatid on the other homologous chromosome.

→ The DNA exchange that occurs during crossing-over adds even more genetic variation

3. Random Fertilization – the zygote that forms a new individual is created by the random joining of two gametes

→ Each gamete is produced independently

→ Fertilization of an egg by a sperm is random

→ So the number of possible outcomes is as follows:

$$\begin{array}{c} \downarrow\downarrow\downarrow \\ \underline{2^{23}} \times \underline{2^{23}} = 64 \text{ trillion} \end{array}$$

The Importance of Genetic Variation

Meiosis and the joining of gametes are essential to evolution

No genetic process generates variation more quickly

Meiosis and Gamete Formation

Meiosis is the primary event in the formation of gametes

$\downarrow\downarrow\downarrow$
gametogenesis

☺ The process where sperm cells are produced in male animals is called **spermatogenesis**

☺ The process where egg cells (ovum) are produced in female animals is called **oogenesis**