The cell cycle

Science, Biology

The Cell Cycle

The cells grow and divide by sequence of events that are referred as the cell cycle. The cell cycle has two main phases. The interphase is the first phase that takes about 90-95 percent of division time where the cell grows and prepares for cell division. The other phase is mitosis that involves the separation of chromosomes before cytokinesis (Morgan, 2007)

During interphase, the cell synthesizes DNA and doubles the cytoplasm. The phase is divided into G1 phase, S phase, and G2 phase. The G1 phase occurs before the synthesis of DNA where it increases the number of organelles, and its mass to prepare for cell division. S phase follows the G1 phase where DNA is synthesized, and there is doubling of chromosome content (Morgan, 2007). The last phase of interphase is G2 phase; the cell increases in size and more proteins are synthesized.

Mitosis, on the other hand, involves division of nuclear chromosomes. It has four phases namely the prophase, metaphase, anaphase, and telophase. In prophase, chromatin material is condensed into distinct chromosomes that migrate to the center of the cell. At the opposite poles of the cell, there is formation of spindle fibers. During metaphase, there is the disappearance of the nuclear membrane and chromosomes lines up at the metaphase plane after formation of spindle fibers. In anaphase, the sister chromatin separates and moves to the opposite poles. The last phase is telophase where chromosomes move to different nuclei while cytokinesis divide the cytoplasm to form two daughter cells (Morgan, 2007).

Asexual reproduction in bacteria, protists, and most plants is advantageous.

First, only one parent is required eliminating energy cost during mating, and all genes are passed to the offspring.

Meiosis is a form of cell division that results in the formation of haploid gametes. In meiosis I, the homologous chromosomes are separated (Morgan, 2007). The first phase is prophase I where the chromosome condenses and pairs to recombine. The second is metaphase I that involves attachment of chromosomes to the spindle fibers and aligns with the cell center. At anaphase I, the chromosomes migrate to opposite poles while spindle fibers shorten. Last phase is telophase I where there is formation of the nuclear membrane.

However, meiosis II involves separation of the chromosomes to form two chromatids. The phases in meiosis II include prophase II, where there is dissolving of the nuclear membrane, condensing of chromosomes and the formation of spindle fibers. In Metaphase II, chromosomes align at the center of attachment of spindle fibers. Anaphase II follows; chromatids migrate to opposite poles while spindle fibers shorten. The last phase is telophase II where there is formation of the nuclear membrane. Finally, the cytokinesis occurs resulting in the formation of four haploid cells.

In prophase I, anaphase I and anaphase II there is crossing over that lead to the formation of four unique chromatids hence increasing genetic variation (Morgan, 2007). Crossing over is vital in the evolution since it brings emergence of species that are more adapted and resistant in the environment. The two-fold cost of sexual reproduction refers to where members must produce both male and female sexes during reproduction, but only half can give birth to the offspring. Sexual reproduction helps to

maintain diversity among species. It also allows mixing of genes that can bring about the transfer of resistance genes.

Monohybrid crosses for: (a) complete dominance

P1TT (tall) Xtt (short)

F1 Tt (tall)

F2 1TT(tall) : 2Tt (tall) : 1tt(short)

The phenotypic ratio is 3: 1 while genotypic ratio is 1: 2: 1

(b)Incomplete dominance

P1TT (tall) X tt (short)

F1Tt (medium)

F21TT (tall) : 2Tt (medium) : 1tt (short)

The phonotypic ratio is 1: 2: 1 while genotypic ratio is 1: 2: 1

(c) Co-dominance

P1TT (tall) X tt (short)

F1Tt (medium)

F21TT (tall) : 2Tt (medium) : 1tt (short)

The phonotypic ratio is 1: 2: 1 while genotypic ratio is 1: 2: 1

(d) Sex-linkage

Female who is a carrier for hemophilia

P1XXhXXh Y

F21Xh X h : 1XhX : 1XhY : 1 XY

Dihybridcross

Use of a homozygous tall female carrier (XhXTT) and a short male XYtt

P1XhXTTXXYtt

F2XhXTt : XhXTt : XXTt : XXTt : XhXTt : XhXTt : XXTt : XXTt : XhYTt: XhYTt :

XYTt : XYTt : XhYTt : XhYTt : XYTt : XYTt

The phenotypic ratio is 4: 4: 4: 4 or 1: 1: 1: 1 while genotypic ratio is 4: 4: 4: 4 or 1: 1: 1: 1

Reference

Morgan, O. (2007). The Cell Cycle: Principles of Control: Primers in Biology, New Yolk: New Science Press.