University of Mosul
Lecture No.: 1
College of Veterinary Medicine
Date: second term/2025
Unit of Scientific Affairs
Website: https://uomosul.edu.iq/veterinarymedicine/

Lecture title: **Why is Meiosis Important?:**

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Summary:

Why is Meiosis Important?

Meiosis is essential for the sexual reproduction of eukaryotic organisms, the enabling of genetic diversity through recombination, and the repair of genetic defects.

The crossing over or recombination of genes occurring in prophase I of meiosis I is vital to the genetic diversity of a species. This provides a buffer against genetic defects, susceptibility to disease and survival of possible extinction events, as there will always be certain individuals in a population better able to survive changes in environmental condition. Recombination further allows genetic defects to be masked or even replaced by healthy alleles in offspring of diseased parents.

Meiosis and Mutations

The gametes of older people are more likely to have new mutations (that is, not inherited mutations) than the gametes of younger people. Older women are at higher risk of producing oocytes that have an extra or missing chromosome. If fertilized, such oocytes lead to offspring with the chromosomal abnormalities like trisomy 21 Down syndrome. Older men are also more likely to produce gametes that have genetic errors, but sperm tend to have single-gene mutations rather than chromosome-level changes. The "paternal age effect" usually causes dominant single-gene diseases. That is, only one copy of the mutant gene causes the condition.

Autosomes and sex chromosomes:

In a diploid cell, there are two of each kind of chromosome (termed homologus chromosomes) except the sex chromosomes. In humans one of the sex has two of the same kind of sex chromosomes and the other has one of each kind. In humans there are 23 pairs of homologous chromosomes (2n=46). The human female has 44 non sex chromosomes, termed autosomes and one pair of homomorphic sex chromosomes given the designation XX. The human male has 44 autosomes and one pair of heteromorphic sex chromosomes, one X and one Y chromosome.

Chromatin:

Chemical composition of chromatin: Chromatin consists of DNA, RNA and protein. The protein of chromatin could be of two types: histones and non-histones.

1-Heterochromatin: is a form of chromatin that is densely packed—as opposed to euchromatin, and is found in the nucleus of eukaryotic cells. heterochromatin is in such a condensed structure that it does not enable DNA and RNA polymerases to access the DNA, therefore preventing DNA replication and transcription

2-Euchromatin: is a form of chromatin that is lightly packed—as opposed to heterochromatin, which is densely packed. The presence of euchromatin usually reflects that cells are transcriptionally active, i.e. they are actively transcribing DNA to mRNA.

Chromosome proteins types:-

Histones:

Histones are basic proteins as they are enriched with basic amino acids arginine and lysine. The histones are of five types called H1, H2A H2B, H3, and H4-which are very similar among different species of eukaryotes and have been highly conserved during evolution. H1 is the least conserved among all and is also loosely bound with DNA.

Non-histones:

In addition to histones the chromatin comprises of many different types of non-histone proteins, which are involved in a range of activities, including DNA replication and gene expression.

Genetic interaction: occurs when ever two or more genes of different locus determined specific trait , protein , enzyme or hormone.

The phenotypic ratios obtained by Mendel in garden peas demonstrate that one gene controls one character; of the two alleles of a gene, one allele is completely dominant over the other. Due to this the heterozygote has a phenotype identical to the homozygous parent. Soon after Mendel's work was rediscovered, instances came to light where a gene was not producing an individual effect. On the contrary, genes were interacting with each other to produce phenotypes which did not exhibit dominance relationships observed in Mendel's experiments.