DOWNLOAD PDF GENETICS AND CELL BIOLOGY ON FILE

Chapter 1 : Genetics and Molecular Biology PDF P | Download book

Genetics and Cell Biology On File is divided into seven topics: Techniques, Cell Types and Evolution, Cell Biology, Cell Division, Classical Genetics, Molecular Genetics, and Population Genetics and Evolution. Within each area, there is a logical progression from simple to complex concepts and principles.

History of genetics The observation that living things inherit traits from their parents has been used since prehistoric times to improve crop plants and animals through selective breeding. His second law is the same as what Mendel published. In his third law, he developed the basic principles of mutation he can be considered a forerunner of Hugo de Vries. Blending of traits in the progeny is now explained by the action of multiple genes with quantitative effects. Another theory that had some support at that time was the inheritance of acquired characteristics: Bateson both acted as a mentor and was aided significantly by the work of female scientists from Newnham College at Cambridge, specifically the work of Becky Saunders , Nora Darwin Barlow , and Muriel Wheldale Onslow. In , Thomas Hunt Morgan argued that genes are on chromosomes , based on observations of a sex-linked white eye mutation in fruit flies. Each strand of DNA is a chain of nucleotides , matching each other in the center to form what look like rungs on a twisted ladder. Although genes were known to exist on chromosomes, chromosomes are composed of both protein and DNA, and scientists did not know which of the two is responsible for inheritance. The structure also suggested a simple method for replication: This property is what gives DNA its semi-conservative nature where one strand of new DNA is from an original parent strand. In the following years, scientists tried to understand how DNA controls the process of protein production. The nucleotide sequence of a messenger RNA is used to create an amino acid sequence in protein; this translation between nucleotide sequences and amino acid sequences is known as the genetic code. In this theory, Ohta stressed the importance of natural selection and the environment to the rate at which genetic evolution occurs. This technology allows scientists to read the nucleotide sequence of a DNA molecule. Mendelian inheritance A Punnett square depicting a cross between two pea plants heterozygous for purple B and white b blossoms. At its most fundamental level, inheritance in organisms occurs by passing discrete heritable units, called genes , from parents to offspring. These different, discrete versions of the same gene are called alleles. In the case of the pea, which is a diploid species, each individual plant has two copies of each gene, one copy inherited from each parent. Diploid organisms with two copies of the same allele of a given gene are called homozygous at that gene locus , while organisms with two different alleles of a given gene are called heterozygous. The set of alleles for a given organism is called its genotype , while the observable traits of the organism are called its phenotype. When organisms are heterozygous at a gene, often one allele is called dominant as its qualities dominate the phenotype of the organism, while the other allele is called recessive as its qualities recede and are not observed. Some alleles do not have complete dominance and instead have incomplete dominance by expressing an intermediate phenotype, or codominance by expressing both alleles at once. Notation and diagrams[edit] Genetic pedigree charts help track the inheritance patterns of traits. Geneticists use diagrams and symbols to describe inheritance. A gene is represented by one or a few letters. When the F1 offspring mate with each other, the offspring are called the "F2" second filial generation. One of the common diagrams used to predict the result of cross-breeding is the Punnett square. When studying human genetic diseases, geneticists often use pedigree charts to represent the inheritance of traits. Multiple gene interactions[edit] Human height is a trait with complex genetic causes. Organisms have thousands of genes, and in sexually reproducing organisms these genes generally assort independently of each other. This means that the inheritance of an allele for yellow or green pea color is unrelated to the inheritance of alleles for white or purple flowers. Some genes do not assort independently, demonstrating genetic linkage , a topic discussed later in this article. Often different genes can interact in a way that influences the same trait. In the Blue-eyed Mary Omphalodes verna , for example, there exists a gene with alleles that determine the color of flowers: Another gene, however, controls whether the flowers have color at all or are white. When a plant has two copies of this white allele, its flowers are whiteâ€”regardless of whether the first gene has blue or magenta alleles. This interaction between genes is called epistasis , with the

second gene epistatic to the first. These complex traits are products of many genes. For example, human height is a trait with complex causes. Bases pair through the arrangement of hydrogen bonding between the strands. The molecular basis for genes is deoxyribonucleic acid DNA. DNA is composed of a chain of nucleotides , of which there are four types: Genetic information exists in the sequence of these nucleotides, and genes exist as stretches of sequence along the DNA chain. DNA normally exists as a double-stranded molecule, coiled into the shape of a double helix. Each nucleotide in DNA preferentially pairs with its partner nucleotide on the opposite strand: A pairs with T, and C pairs with G. Thus, in its two-stranded form, each strand effectively contains all necessary information, redundant with its partner strand. This structure of DNA is the physical basis for inheritance: DNA replication duplicates the genetic information by splitting the strands and using each strand as a template for synthesis of a new partner strand. In bacteria , each cell usually contains a single circular genophore , while eukaryotic organisms such as plants and animals have their DNA arranged in multiple linear chromosomes. These DNA strands are often extremely long; the largest human chromosome, for example, is about million base pairs in length. While haploid organisms have only one copy of each chromosome, most animals and many plants are diploid , containing two of each chromosome and thus two copies of every gene. Chromosomes are copied, condensed, and organized. Then, as the cell divides, chromosome copies separate into the daughter cells. Many species have so-called sex chromosomes that determine the gender of each organism. In evolution, this chromosome has lost most of its content and also most of its genes, while the X chromosome is similar to the other chromosomes and contains many genes. The X and Y chromosomes form a strongly heterogeneous pair. Asexual reproduction and Sexual reproduction When cells divide, their full genome is copied and each daughter cell inherits one copy. This process, called mitosis , is the simplest form of reproduction and is the basis for asexual reproduction. Asexual reproduction can also occur in multicellular organisms, producing offspring that inherit their genome from a single parent. Offspring that are genetically identical to their parents are called clones. Eukaryotic organisms often use sexual reproduction to generate offspring that contain a mixture of genetic material inherited from two different parents. The process of sexual reproduction alternates between forms that contain single copies of the genome haploid and double copies diploid. Diploid organisms form haploids by dividing, without replicating their DNA, to create daughter cells that randomly inherit one of each pair of chromosomes. Most animals and many plants are diploid for most of their lifespan, with the haploid form reduced to single cell gametes such as sperm or eggs. Some bacteria can undergo conjugation , transferring a small circular piece of DNA to another bacterium. Recombination and genetic linkage[edit] Main articles: The diploid nature of chromosomes allows for genes on different chromosomes to assort independently or be separated from their homologous pair during sexual reproduction wherein haploid gametes are formed. In this way new combinations of genes can occur in the offspring of a mating pair. Genes on the same chromosome would theoretically never recombine. However, they do, via the cellular process of chromosomal crossover. During crossover, chromosomes exchange stretches of DNA, effectively shuffling the gene alleles between the chromosomes. The first cytological demonstration of crossing over was performed by Harriet Creighton and Barbara McClintock in Their research and experiments on corn provided cytological evidence for the genetic theory that linked genes on paired chromosomes do in fact exchange places from one homolog to the other. For an arbitrarily long distance, the probability of crossover is high enough that the inheritance of the genes is effectively uncorrelated. The amounts of linkage between a series of genes can be combined to form a linear linkage map that roughly describes the arrangement of the genes along the chromosome.

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