Chapter 14: Genetic Engineering

1. recombinant DNA technology: DNA from different organisms are spliced together in the lab.
2. genome: total DNA per cell is referred to as a genome.
3. genomic library: collection of DNA fragments that are more or less representative of all the DNA in the genome.
4. plasmids: Plasmids are extra chromosomal fragments of DNA present in some bacteria. A plasmid can transfer genetic material to another bacterium, allowing it to express the transmitted gene(s). Restriction enzymes which cut sequences of DNA at certain spots are used to splice into a plasmid the DNA sequence for the desired gene. The plasmid is then inserted into a bacterium in order to express the gene and produce the protein coded for by the gene. Large amounts of the protein can be produced in a factory with vats of the genetically engineered bacteria. A plasmid is extra chromosomal self replicating circular DNA. Most of the plasmid is used for the production of antibiotics

How do restriction enzymes cut DNA?

- Restriction enzymes are used to cut DNA molecules only in specific places. An example is Hind III which recognizes and cuts a DNA molecule at the restriction site 5' – AAGCTT – 3' while the sequence 5' – GAATTC – 3' is cut by EcoRI.

Summarize properties of plasmids and identify why they are good DNA cloning vectors.

- A plasmid is a separate, much smaller, circular DNA molecule that may be present and able to replicate inside a bacterial cell, typically *E. coli*. Plasmids can be introduced into bacterial cells by a method called transformation. Here researchers alter the bacterial cell walls to make them permeable to plasmid DNA molecules. Once a plasmid enters a cell, it is replicated and distributed to the daughter cells during cell division. When a recombinant plasmid replicates in this way, many copies of the foreign DNA are made.

Distinguish between a genomic DNA library and a cDNA library.

- See genomic library above. cDNA library is formed using mRNA from a single cell type as the starting material.

Example of "sticky ends" resulting from restrictor enzymes.

Vectors

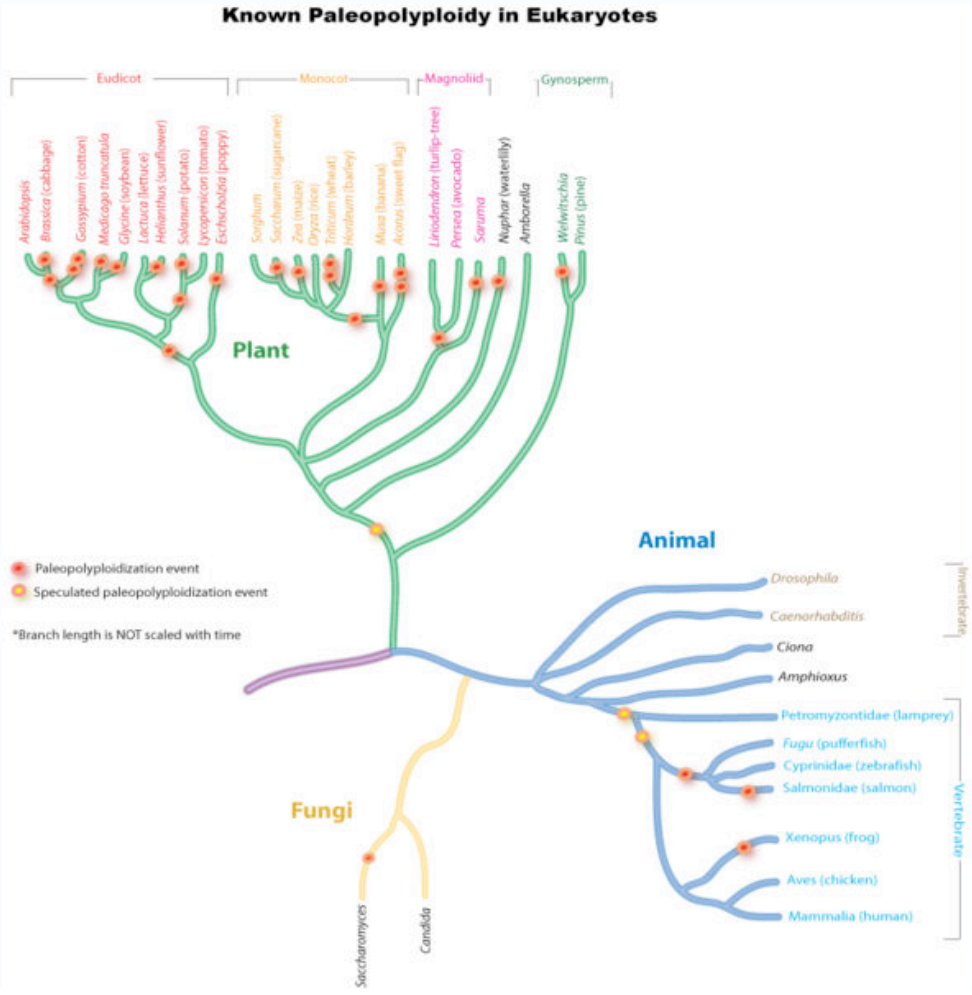
- A Vector DNA is a small piece of DNA containing regulatory and coding sequences of interest.
- A vector is a DNA molecule into which foreign fragments of DNA may be inserted. A vector functions like a "molecular carrier", which will carry fragments of DNA into a host cell.
- Vectors are usually derived from plasmids, which are small, circular, double-stranded DNA molecules occurring naturally in the cytoplasm of bacteria.
- Vectors contain an origin of replication, which enables the vector, together with the foreign DNA fragment inserted into it, to replicate.
- Vectors contain genetic markers that allow for selection of cells which have taken up the plasmid DNA.
- Vector DNA functions to insert and amplify a gene into a target genome. Vector DNA can be used in a DNA vaccine.

Test Questions

1. A large number of copies of any DNA segment can be obtained by
    a. Introducing foreign DNA into a microorganism so that is can be replicated.
2. "Sticky ends" are
    a. The single-stranded ends of a DNA segment that pair with complementary single-stranded ends.
3. A genomic library is a collection of
    a. DNA fragments that are spliced into plasmids
4. To avoid the introduction of introns into the vector, a _____- copy of mature mRNA is made, using the enzyme _____
    a. cDNA; reverse transcriptase
5. Which of the following statements regarding cDNA libararies is *false*
    a. They contain introns and exons
6. A _____ is required to transfer genes from one organism to another
    a. Vector

Chapter 15: The Humane Genome

1. human gnome: totality of genetic information in human cells.
2. autosomes: is a non-sex chromosome. It is an ordinary paired, of chromosome that is the same in both sexes of a species. For example, in humans, there are 22 pairs of autosomes. The X and Y chromosomes are not autosomal.
3. polyploidy: is the condition of some biological cells and organisms manifested by the presence of more than two homologous sets of chromosomes. Polyploid types are termed according to the number of chromosome sets in the nucleus: triploid (three sets; 3x), tetraploid (four sets; 4x), pentaploid (five sets; 5x), hexaploid (six sets; 6x) and so on. A haploid has only one set of chromosomes. Haploidy may also occur as a normal stage in an organism's life cycle as in ferns and fungi. In some instances not all the chromosomes are duplicated and the condition is called aneuploidy. Where an organism is normally diploid, some spontaneous aberrations may occur which are usually caused by a hampered cell division.
4. aneuploidy: is a change in the number of chromosomes that can lead to a chromosomal disorder. Aneuploidy is common in cancerous cells.



Test Questions

1. Nearly half of the pregnancies that end in miscarriage have
    a. Major chromosomal abnormalities
2. Aneuploidies describe
    a. A condition in which an extra chromosome is present or one is absent
3. Which of the following statements about fragile X syndrome is *not* correct
    a. It results in the formation of a shorter-than-normal sequences of CGG
4. What factor allows the dominant mutant allele for Huntington's disease to persist in human populations give its devastating effects
    a. The fact that its symptoms do not typically show until after the individual has had children
5. The current status of gene therapy is
    a. It is being evaluated to assess the risks associated with potential side effects

Disease List

Trisomy 13 → Patau syndrome

Trisomy 18 → Edwards syndrome

Trisomy 21 → Down syndrome

XO → Turner syndrome

XXY → Klinefelter syndrome

XYY → XYY karotype

XXX → Triple-X

Sickle cell anemia

Cystic fibrosis

Phenylketonuria

Tay-Sachs disease