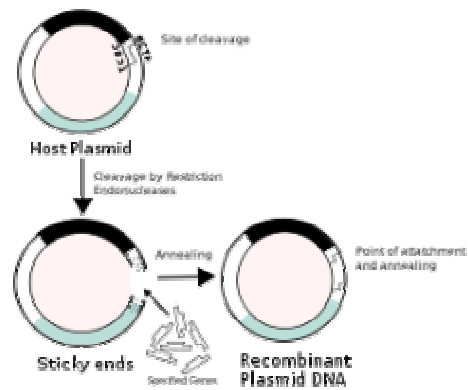


Genetic Engineering & Biotechnology

PART 1

Recombinant DNA Technology

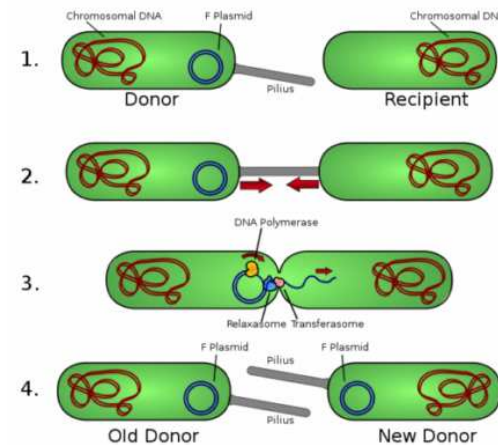
- Identification and isolation of the desired gene or DNA fragment to be cloned.
- Insertion of the isolated gen in a suitable vector.
- Introduction of this vector into a suitable organism or cell called host (transformation).
- Selection of the transformed host cell, and
- Multiplication /expression/ integration followed by expression of the introduced gene in the host. A brief description of these steps is given in the following sections.



- Uses:
- With the **recombinant DNA technology**, scientists have been able to generate artificial enzymes and chemicals found inside humans to treat those suffering from their deficiency.
- Scientists have developed a number of advances that can be used to prevent plants from dying to insects, insecticides, herbicides and even freezing.

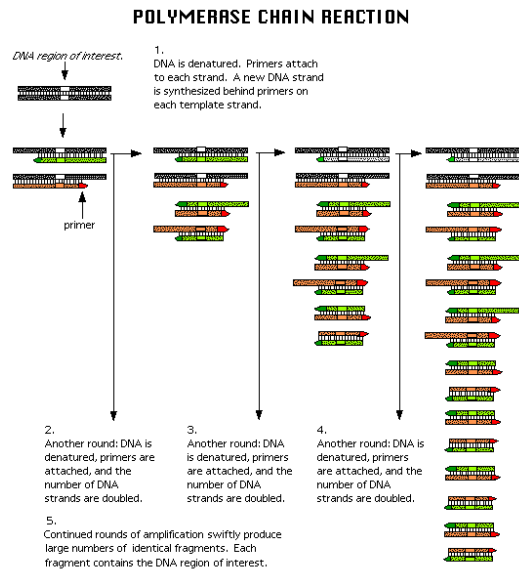
Gene Transfer Using Plasmids- E Coli must be used as an example

- Gene transfer: when a gene is taken from organism A's DNA and then placed into organism B's DNA which then creates an effect for that certain gene.
- Extraction of that gene is usually taken out by the molecular level with computer.
- Gene is then placed in to Gamete B's nucleus and artificially fertilized with another gamete cell to form a zygote.
- New organism is created with modified DNA.
- E. coli is the most widely studied plasmid in the world. Therefore, is most commonly used.



- Uses:
 - It has many strains that are fatal to humans. The E. coli gene which produced vitamin k was extracted then added to cows in Africa so the people would receive appropriate amounts of the vitamin. Makes usage of vitamin K pills useless.
- #### PCR (Polymerase Chain Reaction)
- PCR is a process that uses a DNA photo copier to copy your DNA from just a few segments placed in a test tube.

- DNA is poured into a thermo cycler and after a few hours while it copies the DNA into millions of identical segments for lab use.

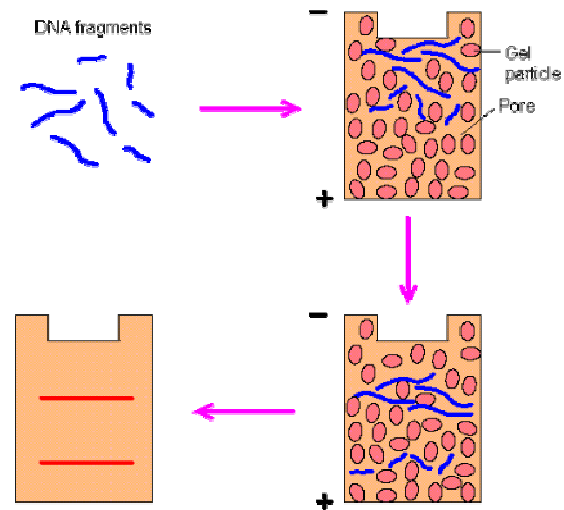


- Use:
- Usually used in a crime scene. If the suspect has a few cells left behind such as cheek cells, skin cells, or saliva, the machines are able to reproduce the DNA. Since you are unable to produce lab results with a mere few cells, having the Polymerase Chain reaction that can make copies is a breakthrough for forensics.

Gel Electrophoresis

- Gel electrophoresis: The fragmenting of DNA, to eventually find out its origin.

- Then enzymes are used to chop and split filaments in to fragments.
- The DNA is placed end to end in a gel. The gel layer is open, and electricity is sent through the biggest and heaviest molecules, making them stationary. They are then attached to the gel.
- The smaller, lights particles pass through the gel to the other side. While the normal sized particles are pushed in-between the large and small particles of DNA.



- Use:
- To help organize the DNA from other people into a chart making it easy to read, match and see the patterns and variations of DNA from person to person.

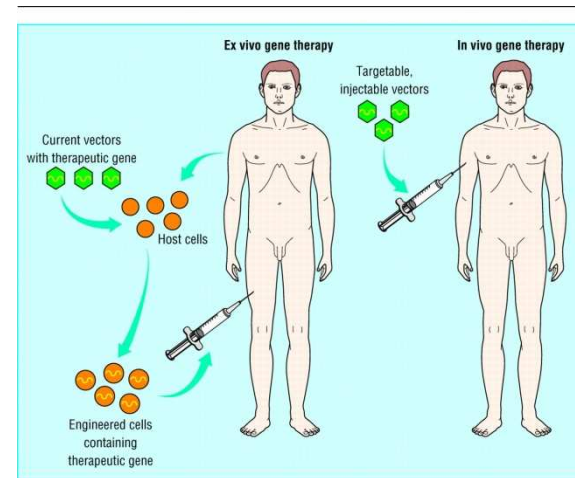
DNA Profiling (DNA Fingerprinting) - include paternity and forensic investigations

- DNA profiling: The matching of 2 segments of DNA to each other with aid from a gel electrophoresis chart.
- Match is found by looking at the DNA patterns, lines and shading from the chart. Allows scientists to determine if the DNA is from one or two people.

- Use:
- For us to identify the clues for a crime scene. The process helps match DNA of the suspect to the criminals and provide concrete proof. This process is usually referred to DNA finger printing.

Gene therapy- ex vivo and in vivo

- Ex vivo and in vivo: the processes in which you surgically remove the diseased cells form an organism, and then replace them with the correct DNA in cultures.
- The cell is then put back onto the organism i.e. liver cells replaced after Jaundice.
- Ex vivo is gene therapy to the whole organism or animal
- In vivo is to specific cells or tissue in an organism or animal. Both correct the old DNA from the diseased DNA.



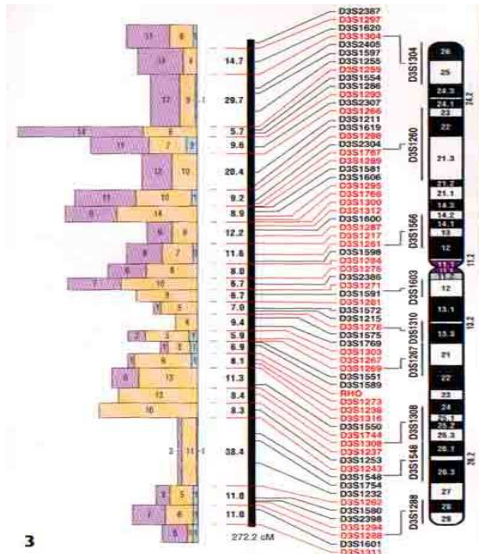
- Use:
- Simplest method to fixed damaged cells b/c it requires no drugs and capitalizes on the bodies regular healing of healthy DNA. Treating cancer cells by taking the effected cancer cells, and replaced damaged DNA.

PART 2

The Human Genome

- Genome: Complete set and pairing of the genetic material in all individual living organisms.
- Goals for the human genome project:
- -To find all 20,000-25,000 genes that is found in human DNA.

- -To determine the sequences of the 3 billion chemical base pairs that are found in the human genome and that make up human DNA.

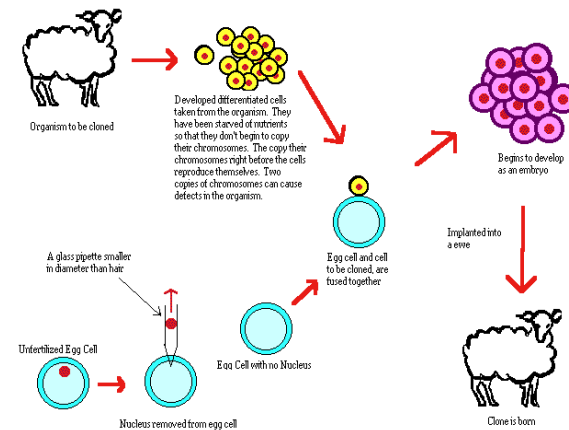


- 3
- 3 outcomes of the human genome:
- 30 000 genes in humans.
- .less than 7 protein families appeared to be vertebrate specific at the time of draft sequencing.
- 1.1%-1.4% of genes are used to code for genes

Cloning (pg. 513)

- Cloning: To make an exact copy of an object or organism.
- The technique flowing process is used to clone other whole organisms:
- One donor mother donates an egg while another donor mother gives up her unfertilized egg allow the process to start.

- The nucleus is removed from the unfertilized egg, The udder egg is then cultured with other udder cells.
- The nucleus is removed from the cultured udder cells and added into the unfertilized egg after its own nucleus had been removed.
- A jolt of electricity is used to join the egg, and the nucleus together.
- The egg becomes a blastocyst.
- The blastocyst is added into the surrogate mother.
- Clone is produced.



- Ethical issues surrounding therapeutic cloning

The negative side is that people believe the recreation of the human embryo is morally wrong, and human embryos should only be used for reproduction.

The positive side to therapeutic cloning is that we can grow skin to repair serious burns, grow new heart muscle to repair an failing heart. Even though many researchers are against the idea, they see promising future in therapeutic cloning.

GMO's

5 uses for transgenic bacteria:

- **Error! Bookmark not defined.**
- Tissue plasminogen activator
- Insulin
- Human growth hormone
- Interferon

Several uses with specific examples for transgenic plants:

- Parasite resistance to many crops.
- Allows tomatoes to be resistance to cold temperature because of GM with arctic fish.
- The ability to grow more versatile food in larger areas for cheaper prices. This is done by playing with the genes of i.e. corn and patenting and corn type with good genes.
- Several uses with specific examples for transgenic animals
 - Transgenic sheep can produce factor IX and help people with haemophilia. The IX factor can help increase creation of protein.



List the potential benefits and possible harmful effects of one example

- GM are more versatile, and require less fertilizer than organic.
- Farmers gain control of foods that are given to their livestock.
- They have in their farm. They can get more money per GM crop than non GM crop.
- The long term effects are unknown because this is a new type of research.
- GM crops become invasive, dominant species.

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