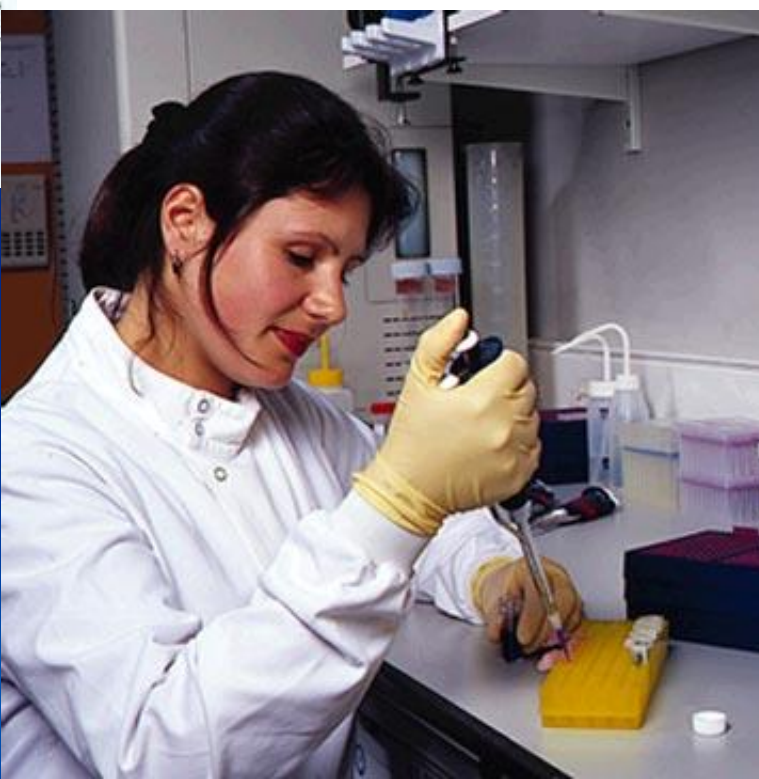


Advanced Genetics



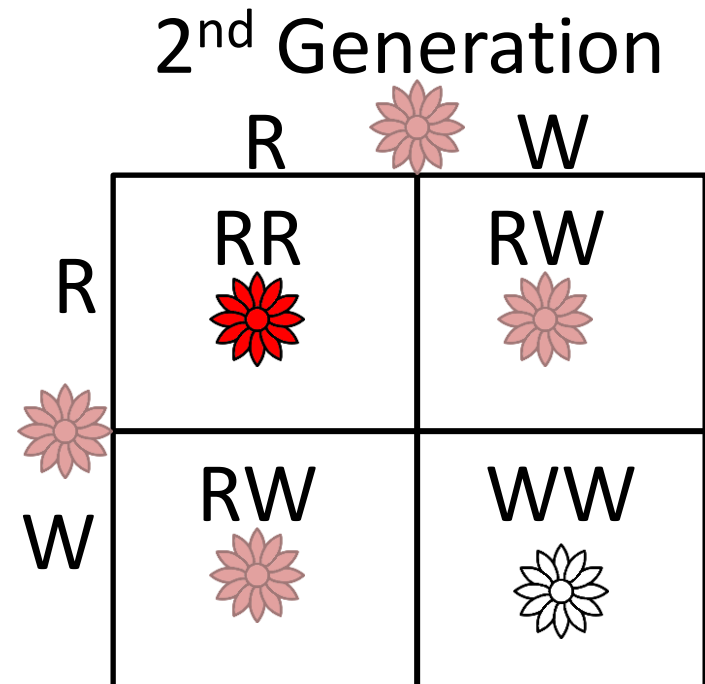
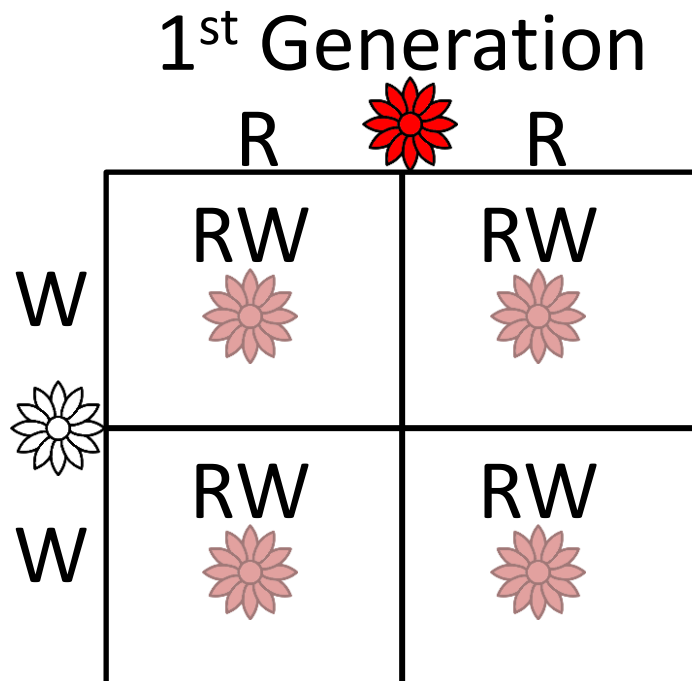
Incomplete Dominance

- If you cross a homozygous red flower with a homozygous white flower, what color offspring would you expect?
 - If the red color is dominant?
 - If the white color is dominant?
- What if the offspring came out pink?
- What if you cross two of the pink flowers and get a combination of red, pink, and white flowers?
 - What does it all mean?



Incomplete Dominance

- Incomplete dominance is when an intermediate phenotype appears in heterozygous organisms (neither allele is dominant)
- Ex) R = Red Flower, W = White Flower



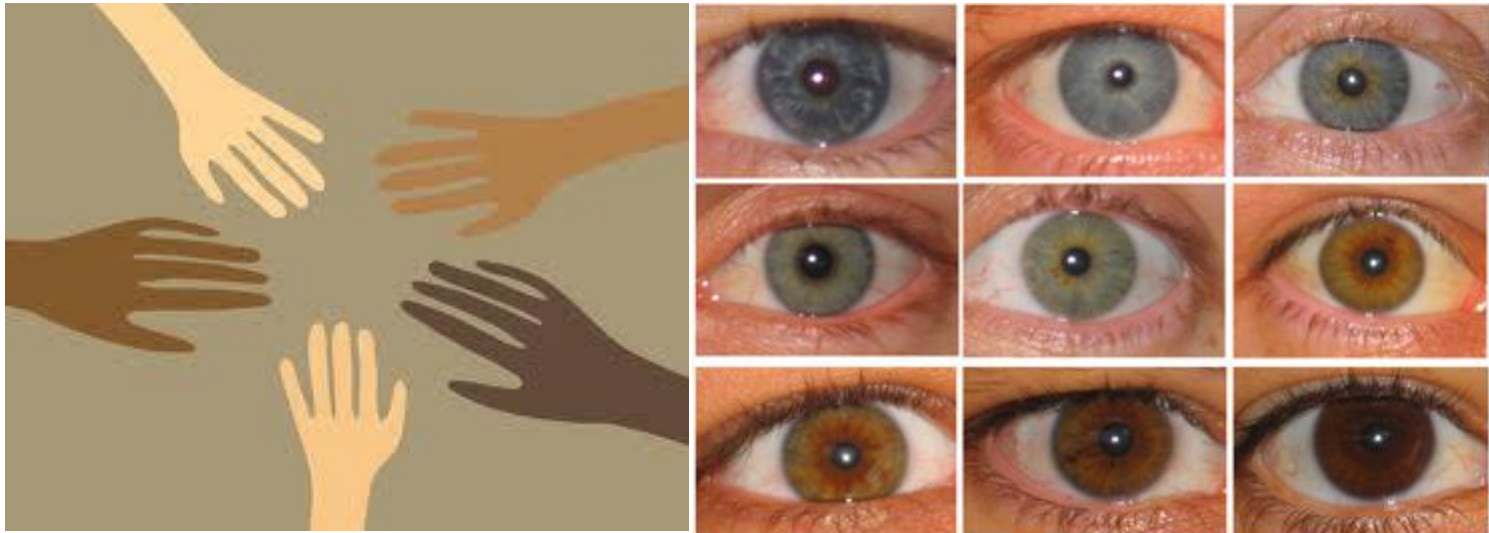
Traits Based on Multiple Alleles

- Many traits have more than two possible alleles
- In this situation:
 - some alleles are more dominant than others
 - some combinations may produce a blended trait
 - Ex) Human Blood Type: 3 alleles (I^A , I^B , and i^O)
 - 6 possibilities
 - $I^A I^A$ – Type A
 - $I^A i^O$ – Type A
 - $I^B I^B$ – Type B
 - $I^B i^O$ – Type B
 - $I^A I^B$ – Type AB
 - $i^O i^O$ – Type O



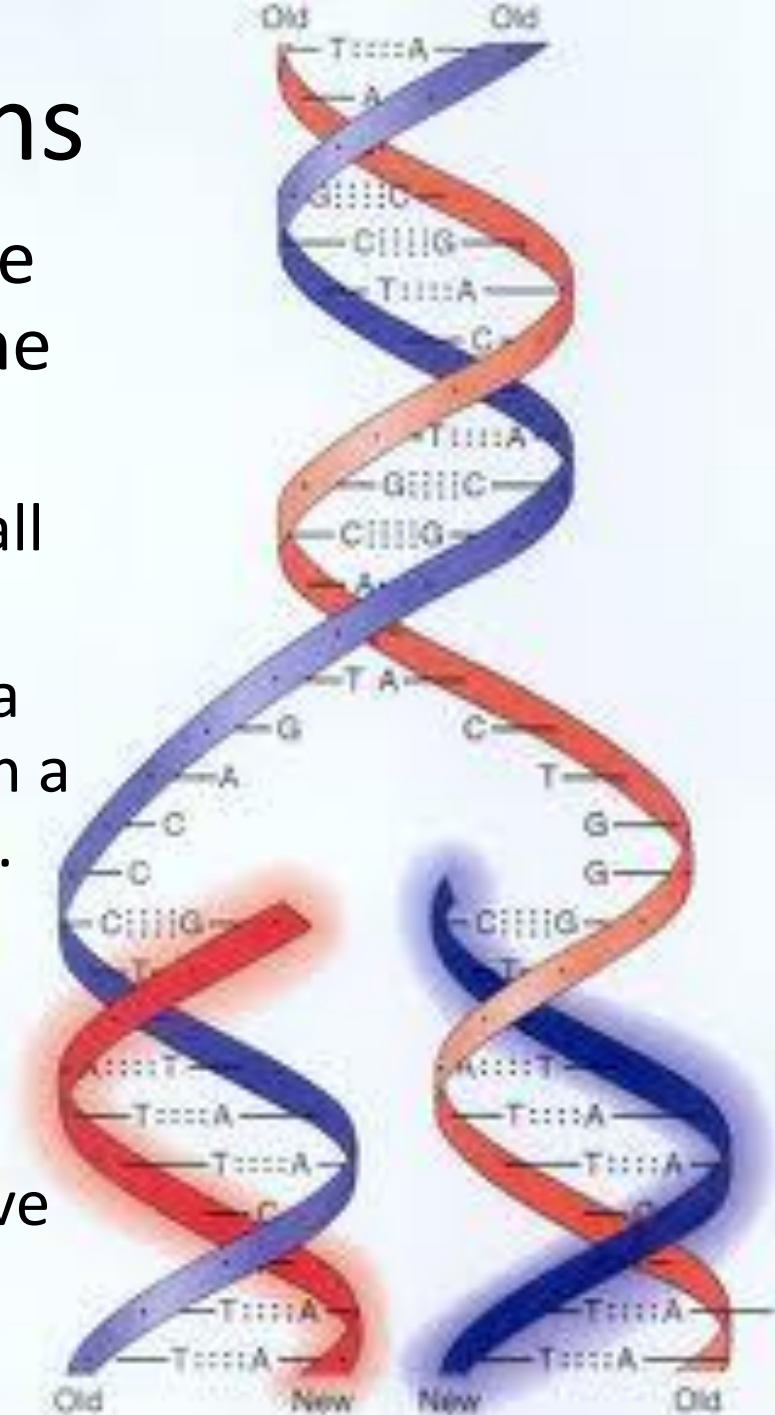
Traits Based on Multiple Genes

- Sometimes, alleles on multiple genes combine to influence a single trait
 - Instead of just the alleles on a single gene
 - Ex) eye color or skin color
 - 3-6 genes control skin color
 - even more genes control eye color



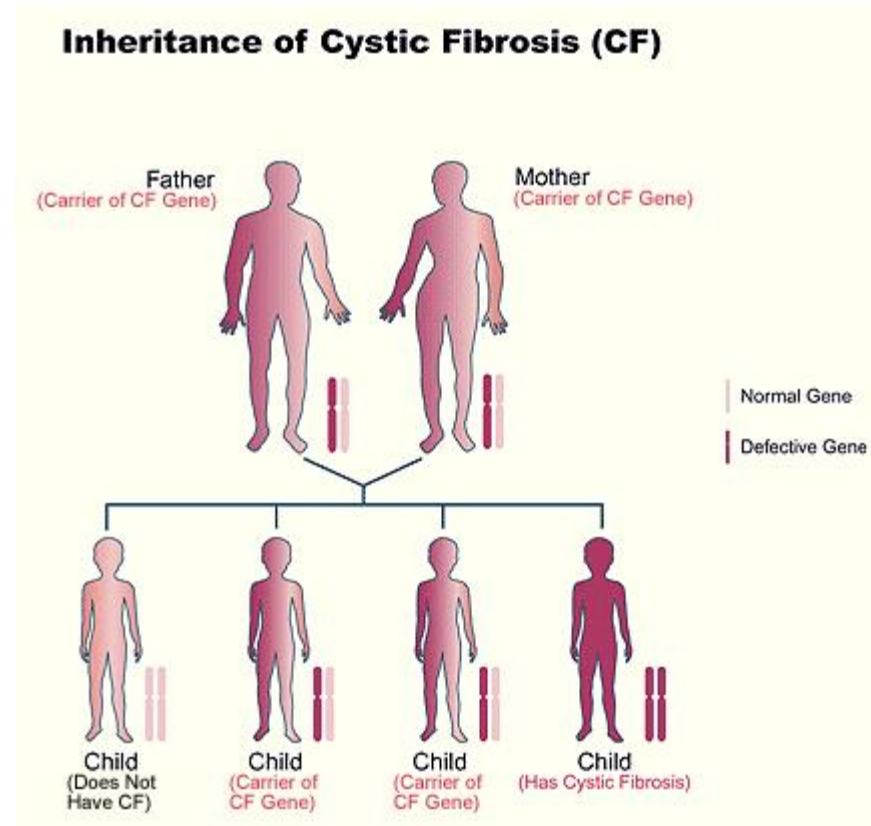
Mutations

- Occasionally, errors occur in the DNA when it is copied inside the cell.
 - Sometimes, these errors are small and have little to no effect.
 - Other times, these errors cause a change in the gene that results in a trait that is expressed differently.
- These changes are called “mutations”.
 - Some mutations can be harmful, some helpful, and others will have no effect on the organism.



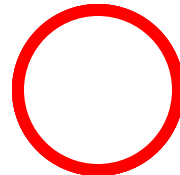
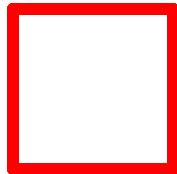
Genetic Disorders

- Many genetic disorders are caused by recessive genes that are the result of mutations.
- If the parents are heterozygous, they will not have the disorder, but they carry the affected genes and may pass the disease on to their child (if it receives the recessive allele from each parent).



Pedigree Charts

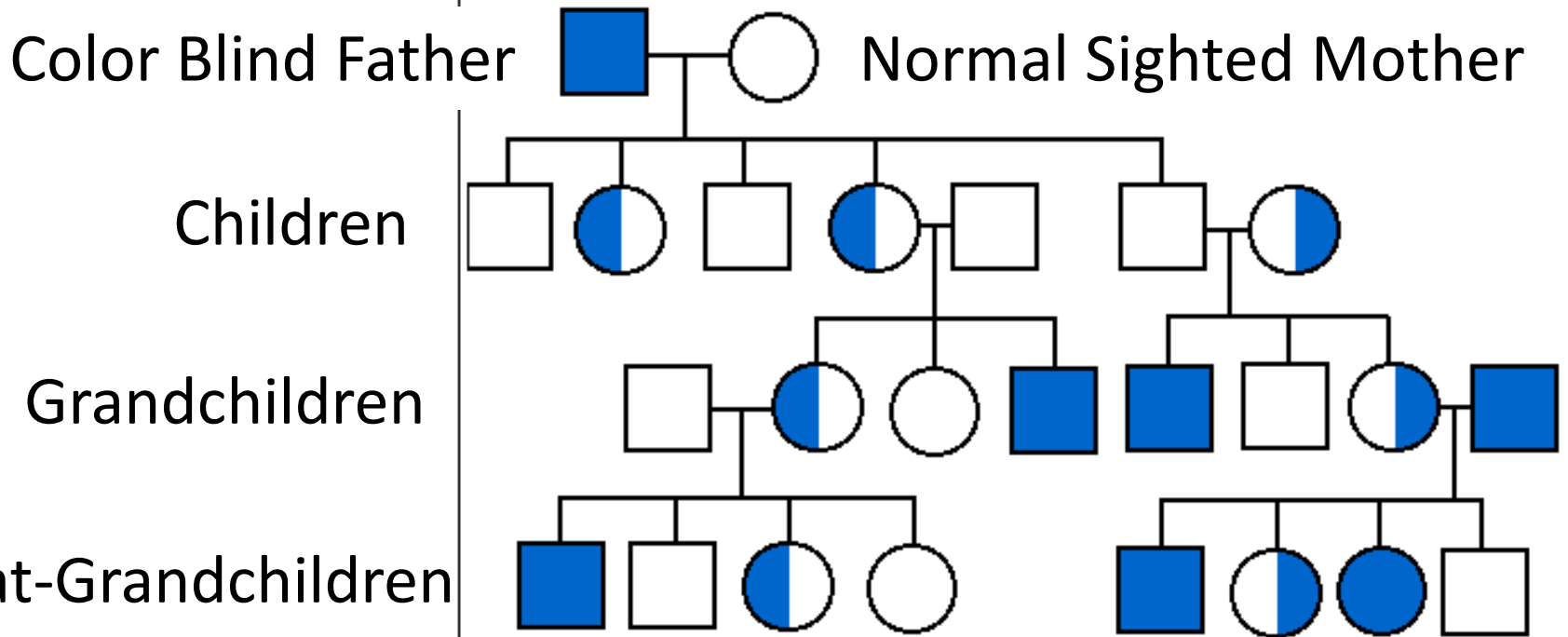
- Pedigree charts are visual tools used to track a specific trait through generations of a family.
 - Males are represented by squares.
 - Females are represented by circles.
 - If the square/circle is completely filled, the person exhibits that trait.
 - If the square/circle is half filled, the person is a carrier of that trait, but does not exhibit it.
 - If the square/circle is completely empty, the person does not carry or exhibit the trait.



Pedigree Charts

- Ex) Color Blindness

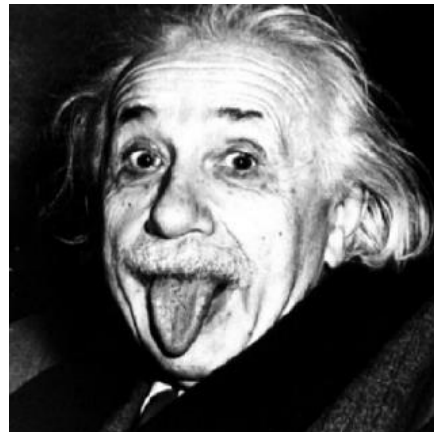
**Inheritance of Red-Green Color Blindness:
an X-linked Recessive Trait**



Pedigree Charts

- **A pedigree can help a geneticist determine if a trait is...**

- Recessive
- Dominant
- Sex-linked



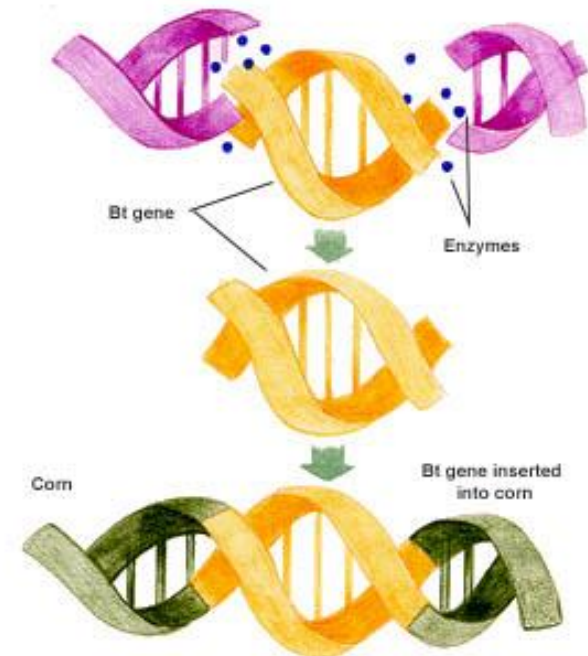
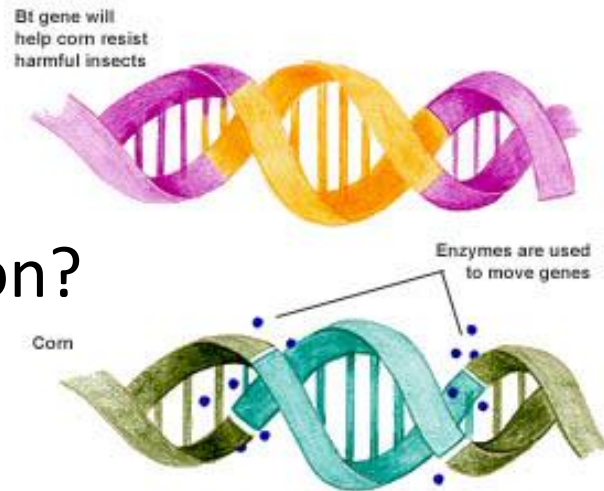
- **Pedigrees can also help breeders select desirable traits in animals or plants**

- Better sense of smell in a dog
- Larger watermelons



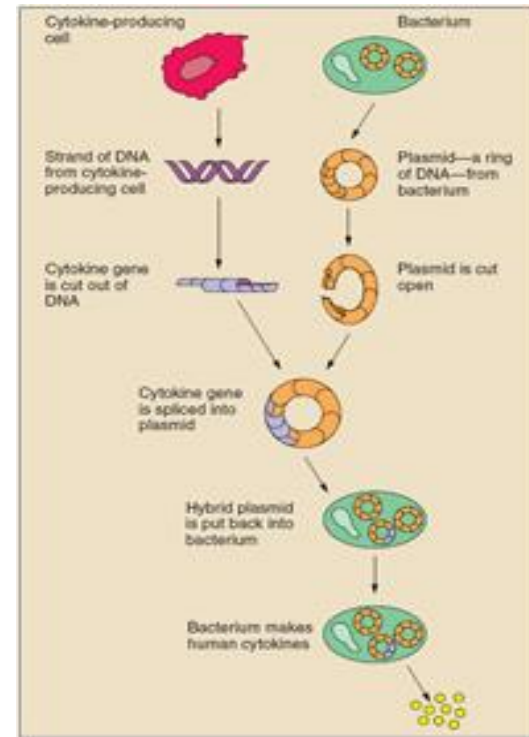
Genetic Engineering

- Scientists can change the arrangement of DNA that makes up a gene, which can change the function of that gene.
- Uses:
 - Medicine
 - Agriculture
 - Reproduction?



Genetic Engineering in Medicine

- Replacing the DNA in bacteria can aide in the production of medicines
- Placing normal DNA in viruses and having them target defective cells is a possible treatment for many diseases such as cystic fibrosis, cancer, and heart disease.
- Stem cells can be used to grow certain human body parts on mice that can be used as replacements for cosmetic surgery.



Genetic Engineering in Agriculture

- Plant DNA can be changed to make the plants more resistant to disease/insects
- Plants can be cross bred to produce different fruit/vegetables
- Genes can be altered to produce more crops or bigger crops



Genetic Engineering in Human Reproduction?

- Imagine, as a parent, being able to see the DNA of your unborn child and check it for diseases, fixing any problems before the child is born...
- Imagine being able to select certain traits that you want your child to have...
 - Imagine being able to select your child's features like you would select the features you want on a computer you order online...



Ethical Concerns of Genetic Engineering

- By altering DNA to create medicines, can we accidentally introduce unnatural diseases?
- Is it okay to mess with natural selection?
- Is it okay to use animals to benefit humans medically?
- Can eating genetically engineered crops harm us?
- Is it immoral to change human DNA, or select traits for our children?
- You decide...