APPLIED GENETICS

Humans have been using the concept of inheritance long before they understood modern genetics. Now that we have a better understanding we have gone quite a few steps further.

Selective breeding: Choosing the organisms with the most desirable traits for mating.

The only way this is possible is if all organisms of the same species are not the same.

Variation = inherited differences

This is the same process that drives evolution except in *natural selection* the environment does the selecting. Not farmers or racehorse breeders.

In exemplar: Dairy cows. Joe-bob-jimbo the farmer wants cows that produce enormous quantities of milk. He recognizes that some cows, for whatever reason (but if they're not genetic reasons this won't work) produce more milk than others. Each breeding season he only breeds those cows that produce lots of milk hoping their calves will inherit their mom's enormous milk-making abilities. Eventually, Joe-bob-jimbo will have cows that produce mucho milk.

When the individuals chosen for mating are closely related it's called *inbreeding*.

Hybridization: In the context of selective breeding, this is mating two different species together. Sometimes this makes for a hardier organism. The classic example is the mule. The mule is stronger and more durable than either the horse or the donkey (the parent species). The problem is, due to chromosomal mismatching, most hybrids are sterile.

Genetic Engineering: This involves the actual manipulation of genes.

Step 1. Isolate the desired gene
Step 2. Combine that gene with the new organism's DNA
Step 3. Insert the combined DNA into the organism.

In exemplar: The Trojan Fish:

Fish farmers want their fish to grow large quickly (=more money faster). Growth rate is controlled by growth hormone a protein coded by one gene. Geneticists. Isolated that gene, made several copies of it and re-inserted multiple copies if the gene into salmon zygotes. The fish developed with extra growth genes, made more growth hormone than normal and therefore grew to giant size quickly.

Another example you need to know about: HUMULIN PRODUCTION

Scientists have engineered bacteria that produce the human insulin protein. A bacteria's genome is often one, large loop of DNA that contains all of the genes for that bacteria. Occasionally, extra bits of DNA are found in bacteria. These extra bits are call *plasmids*. To engineer humulin producing bacteria, scientists inserted the gene for insulin into a plasmid and injected the bacteria with that plasmid. Now the plasmid-containing bacteria's ribosomes make humulin along with the bacteria's normal proteins

The Human Genome Project: Humans contain well over 100,000 genes. This project's goal is to locate and decode each one of these genes. Though not completely finished, this huge undertaking has already yielded useful information on how genes work in general as well as how human genes work.