**Genetic Engineering Notes**

Genetic engineering: changing the \_\_\_\_\_\_ in living organisms to create something \_\_\_\_\_.

These organisms are called \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(GMO) or ­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_; since genes are transferred from one organism to another

Example:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Genetically modified organisms are called \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; since genes are transferred from one organism to another.

Some genetic engineering techniques are as follows:

1. Artificial selection
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: analyzing DNA

1. **Artificial selection**: breeders choose which \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to mate to produce offspring with desired \_\_\_\_\_\_\_\_\_\_\_\_\_.

 •They cannot control what \_\_\_\_\_\_\_\_\_\_\_\_\_ are passed.

 •When they get offspring with the desired \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, they maintain them by continuing to \_\_\_\_\_\_\_\_\_\_\_\_\_ them.

**Three types of artificial selection:**

 A. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ breeding

 B. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 C. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**A. Selective breeding:** when animals with desired \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are mated to produce offspring with those desired \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Passing of important \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to next generation.

 •Example: Champion race horses, cows with tender meat, large juicy on a tree.

 •People breed dogs for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ purposes. Dachshunds were once bred to \_\_\_\_\_\_\_\_\_\_\_\_ badgers and other burrowing animals. They had to be \_\_\_\_\_\_\_\_\_\_\_\_ to fit into the animal’s hole in the ground.

 **Benefits of selective breeding:**

* Angus cows are bred to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-- muscle mass so that we get more meat.
* Egg-Laying Hen - produces more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the average hen

**B. Hybridizations**: two individuals with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ characteristics are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to produce the best in both organisms.

 •Example: Luther Burbank created a disease \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ potato called the Burbank potato. He crossed a disease \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plant with one that had a large food \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ capacity. Result: disease resistant plant that makes a lot of potatoes.

**C. Inbreeding** - breeding of organisms that are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ similar to maintain desired traits.

•Dog breeds are kept “pure” and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from other breeds. Risk: Since both parents have the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_, the chance that a baby will get a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ genetic disorder is high. Risks: cataracts, hip dysplasia (joint deformities)

**Variation:** difference between individuals of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Variation occurs as a result of combinations of different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in organisms. Results in: different skin color, hair color, eye color, height, etc

**Inbreeding decreases \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ variation because no new \_\_\_\_\_\_\_\_\_\_\_\_ are introduced.**

2. **Cloning:** creating an organism that is an \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ copy of another. There are human clones in our school. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ twins are naturally created clones.

**\_\_\_\_\_\_\_\_\_\_\_\_\_:** group of cells or organisms that are genetically identical as a result of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

They will have the same exact \_\_\_\_\_\_\_\_ as the parent.

How is cloning done?

* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cell is removed from a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organism.
* An entire \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is grown from that cell.
* Remember one cell has all the \_\_\_\_\_\_\_\_\_\_\_\_ needed to make an entire organism.
* Each \_\_\_\_\_\_\_\_\_\_\_\_\_ in the body has the same \_\_\_\_\_\_\_\_\_\_\_, but cells vary because different genes are turned on in each cell. This is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!

What is the name of the first mammal clone?

\_\_\_\_\_\_\_\_\_\_\_\_ was the first mammal cloned. (1996). She had the same exact DNA as her mother and had no ­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Cloning is a form of ­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reproduction, since there is only one genetic parent.

* Remember: **Eggs are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**. **Haploid:** half the chromosomes, 23 in humans
* **Body cells are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**: **Diploid**: two sets of chromosomes, one from mom and one set from dad 46 in humans.

**How could you clone a human?**

Step 1: An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is removed from a female human. Eggs are \_\_\_\_\_\_\_\_\_\_\_\_\_: 23 chromosomes. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the egg is removed and is thrown away.

Step 2: A \_\_\_\_\_\_\_\_\_\_\_\_\_ cell is removed from another person. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the body cell is removed

Step 3: The nucleus of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ body cell is put into the egg. This egg no longer needs to be fertilized since it has all \_\_\_\_\_\_\_\_\_\_\_\_\_ chromosomes.

Step 4: The \_\_\_\_\_\_\_\_\_\_\_\_\_ is then charged with electricity to start \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Step 5: It’s then put into a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ mother so it can grow. It’s going to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the parent of the body cell. But it will be a baby. Plants and animals can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

What are the benefits of cloning?

1. You can make \_\_\_\_\_\_\_\_ copies of organisms with strong traits.
2. Increase \_\_\_\_\_\_\_\_\_\_ supply.
3. \_\_\_\_\_\_\_\_\_\_\_ purposes: clone organs for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. Bring back or stop \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from going \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

What are the risks of cloning?

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ genetic diversity.
2. If one of your clones gets a \_\_\_\_\_\_\_\_\_\_\_, they all get it. Same immune system.
3. Inefficient: high failure rate of \_\_\_\_\_\_%+
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Since Dolly, cats and other organisms have been cloned. Why did the cat that was cloned not have the same fur color as the mother?

* Environment ***CAN*** affect how genes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (phenotype). \_\_\_\_\_\_\_\_\_\_\_\_ twin studies: identical twins raised apart in separate homes/environments showed different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* We can change the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (color) of hydrangea blooms by changing the acidity of the soil:
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ soil produces pink blooms. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ soil produces blue blooms

**Transgenic Organisms**

Trans: means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Genic: refers to \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Transgenic Animals**: Why make transgenic organisms (animals and plants)?

It’s a way to improve amount of food when human population continues to increase! **A**.**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_**: gene inserted to increase milk production.

**B. Spider goat**: gene from spider inserted into goat. Goats make silk of the spider \_\_\_\_\_\_\_\_\_ in their milk. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, yet stronger than steel. Used in bullet proof jackets.

**C. Glow-in-the-dark cats**Scientist used a \_\_\_\_\_\_\_\_\_\_\_\_\_ to insert DNA from jellyfish. The gene made the cat produce a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ protein in its fur.

**Transgenic bacteria**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ inserted into bacteria so they produce things humans need. For example: insulin and clotting factors in blood are now made by \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Transgenic plants:** plants are given \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ so they meet human needs.

**a. Venomous cabbage**

gene from a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tails inserted into cabbage. Cabbage now produces that chemical. Why? Limit ­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ use while still preventing insects from damaging crops. Corporations state the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is modified so it isn’t harmful to humans.

**b. Banana vaccines**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is injected into a banana, the virus DNA becomes part of the plant. As the plant grows, it produces the virus \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ — but not the disease part of the virus. When people eat a bite, their immune systems create \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to fight the disease — just like a traditional vaccine. Vaccines for hepatitis and cholera

Gene therapy: when disease-causing genes are \_\_\_\_\_\_ out and a \_\_\_\_\_\_\_\_ gene is inserted. \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ are used to cut out bad genes. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (vector) are used to insert good genes.

**Human Genome Project**

* Gene therapy could work thanks to the Human Genome Project (2001), a federally funded effort to completely \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the entire human genome.
* Approximately 35,000-40,000 genes on 46 chromosomes have been mapped to specific locations on particular \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Cystic Fibrosis Gene Therapy**

* Experimental trials for \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ are relatively new due to potential lethal side effects. EX: Cystic fibrosis and Severe Combined Immunodeficiency (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

**Severe Combined Immunodeficiency**

* Diagnosed in 40 to 100 babies every year in the US. Results in the inability of the body to fight off \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Gene therapy has cured 8 of 10 children with this disease as of January 2009