

Genetic Engineering and Selective Breeding

Everything you need to know!

Scientists used a bioluminescent gene from a jellyfish to create “glowing” green mice!



- **Know**

- Selective Breeding involves choosing two organisms of the same species and mating them with the hope of getting the best qualities of each parent to show up in the offspring.
- Genetic Engineering involves identifying certain genes and moving them from one organism to another – even to a different species or removing the gene entirely!
- Both activities are controversial.



- **Understand**

- Genetic engineering is an ethical issue that needs to be regulated by the personal, cultural, and global conscience.

- **Do**

- Discuss the advantages and disadvantages of both processes.
- Analyze scenarios and determine if the situation is an example of genetic engineering or selective breeding.

Genetic Engineering: Details

- Taking DNA from one organism and inserting it into another organism's DNA sequence to ensure the organism will have a specific trait.
- It produces an organism that has a new trait it would most likely not have developed on its own

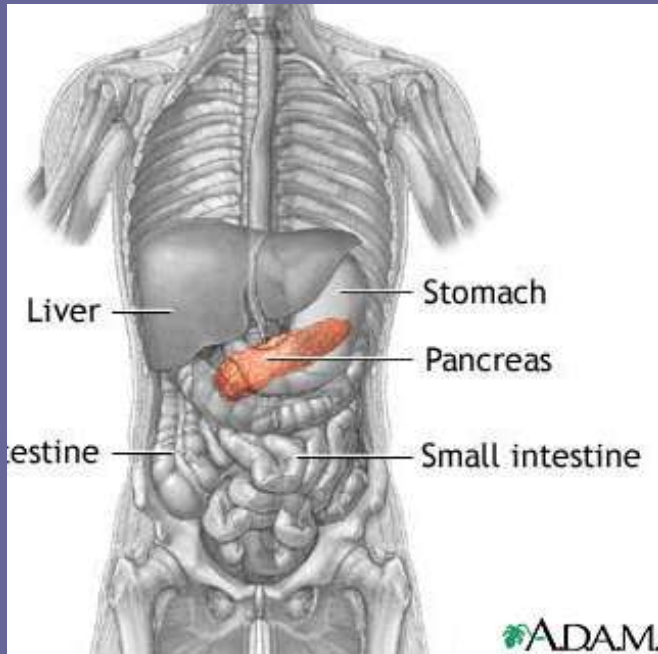


Genetic Engineering Example A:



Give the insulin gene to diabetics.

Diabetic = a person whose pancreas cannot create the important hormone insulin.



1. Take the gene for making insulin from a healthy donor's DNA
2. Add that gene to the DNA of **pancreas** cells from a diabetic
3. Let mitosis happen for a while (in a “test tube”) so you get LOTS of pancreas cells with the **good gene**.
4. Surgically implant the good cells back into the diabetic

Genetic Engineering Example B:



**Make chickens with
no feathers.**

- Scientists engineered chickens to be featherless by REMOVING the gene in chicken DNA that causes them to grow feathers



Genetic Engineering Example C:

Cabbage plant +



scorpion venom =

bug-proof veggies

Scientists added a gene for producing scorpion venom to cabbage plants to kill pesky caterpillars that eat crops!



Genetic Engineering Example D:

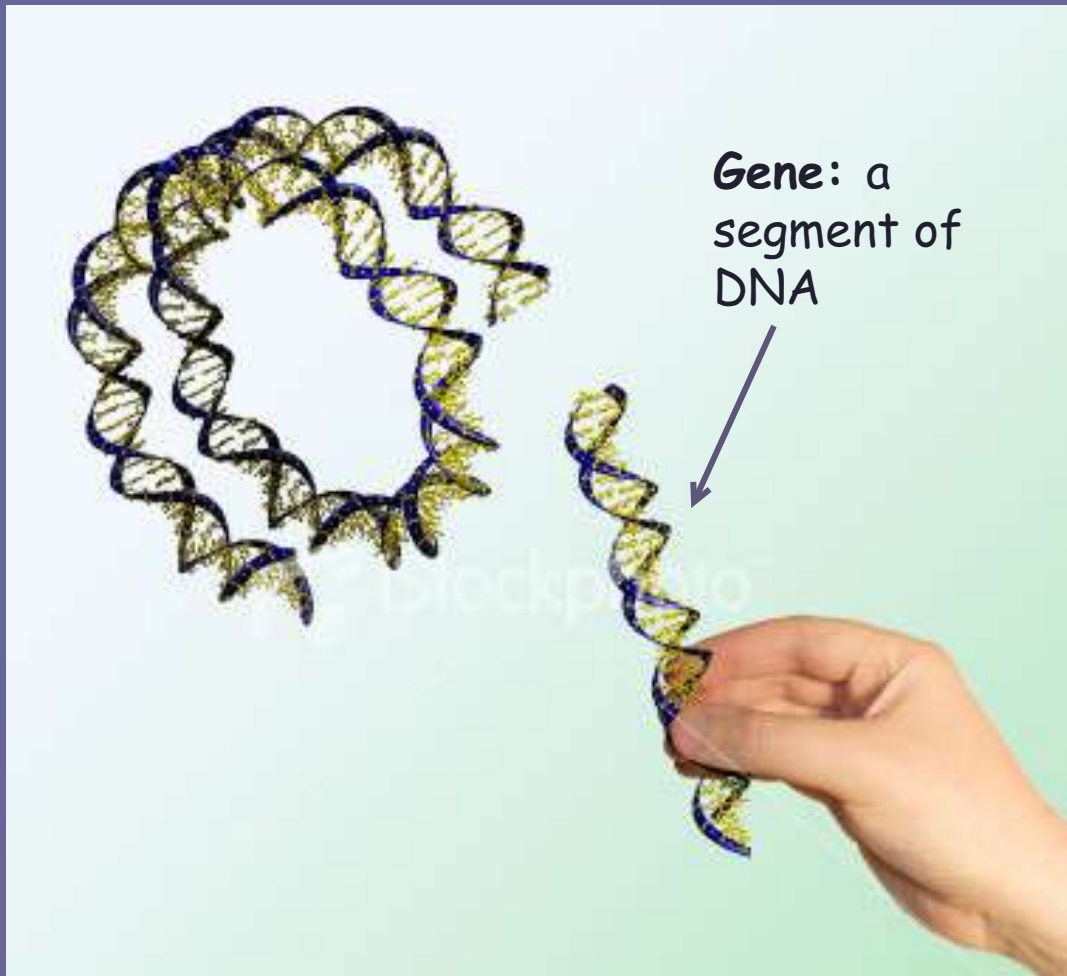


Give tomatoes the ability to make anti-freeze.

- Placing the “anti-freeze gene” from a fish in tomatoes so the tomatoes can still grow in cold weather.



Remember!



Genetic
engineering
involves the
manipulation of
genes!

Genetic Engineering of insect-resistant corn

#2 Use enzymes to cut desired gene loose

#1 Identify desired gene

Bt gene will help corn resist harmful insects



#3 Remove undesired gene

#4 Insert desired gene into corn

Advantages of Genetic Engineering



- Will get improved organisms
- Can create organisms with traits not previously thought possible
- Can remove “bad” genes
- Reduces the chance of getting “undesirable” organisms

Disadvantages of Genetic Engineering

- Co\$tly
- Must be performed in a lab with special equipment
- Ethical issues
- Long term negative affects
- Negative environmental impacts
 - Super-C apples (allergies!)
 - Superweeds!
 - Natural insecticides get into soil
 - Unknowns?????



Genetic engineering has
few limits - except our
imagination, and our
moral or ethical code.

Selective Breeding: Details



- Selective breeding involves mating organisms with different “desirable” traits to get offspring with the desirable traits of both parents
- Selective breeding is used mostly for dogs, cats, other pets, cattle, and crops.

Selective Breeding Example A

Tough Boar + meaty pig = Superpig



Tough wild boars mated with friendly meaty pigs give you robust & meaty pigs for your farm.



Selective Breeding Example B

hot weather cow + beefy cow = supercow



Brahman cattle:
Good resistance to heat, but poor beef.



English shorthorn cattle: Good beef but poor heat resistance.



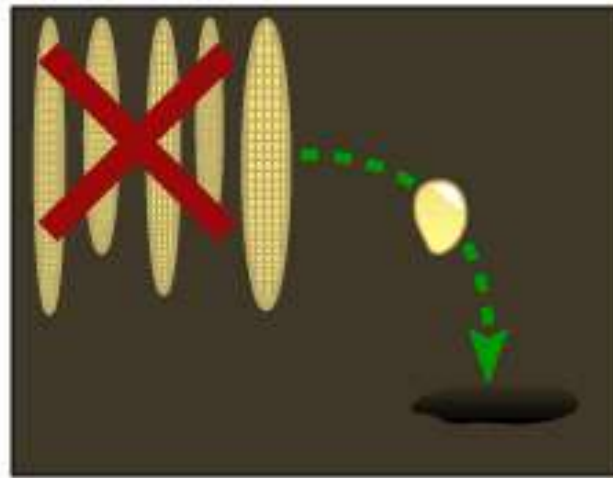
Santa Gertrudis cattle
(cross of 2 breeds)

RESULT = good beef
***and* resistant to heat!**

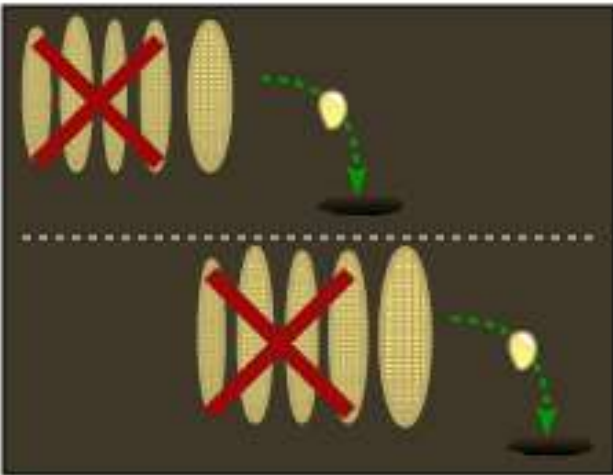




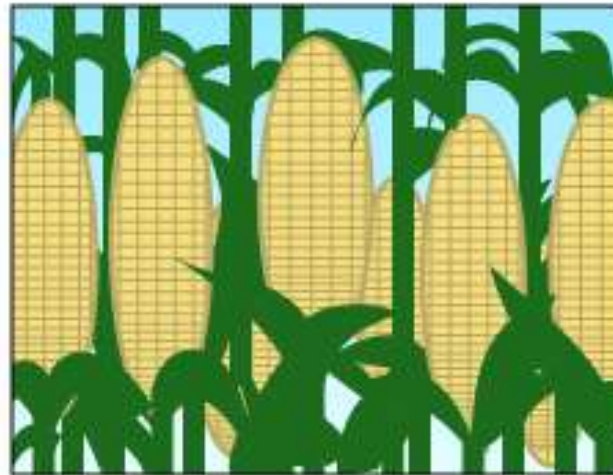
1. Natural variation occurs in the wild population.



2. Seeds for the next generation are chosen only from individuals with the most desirable traits.



3. Repeat this process for several generations.



4. Over time, the quality of the crop increases.



Choosing only the best corn plants for seeds results in better crops over a long time.



Selective Breeding Example D



X



=



little red tomato + big green = BIG RED TOMATO

Remember!



- Selective breeding crosses (mates) organisms with desirable traits to produce offspring that have the traits from both parents!

Advantages of Selective Breeding

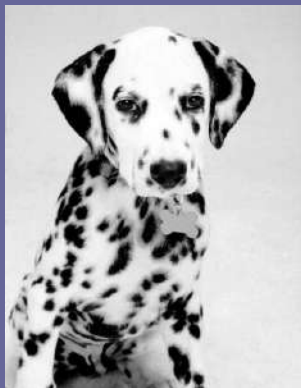


- Might get improved organisms
- Don't need any special tools or lab
- Can be performed easily by farmers & breeders

Disadvantages of Selective Breeding



- Undesirable traits from both parents *may* appear in the offspring
- Disease can accumulate in the population
 - Remember the deaf dalmatians, boxers with heart disease, labs with hip problems, etc.?



REVIEW



- Genetic Engineering
 - Relatively new process performed within labs
 - Manipulates or alters the genetic makeup of organisms
 - Results in organisms with new traits
- Selective Breeding
 - Process has been around for thousands of years
 - Combines the best traits of two organisms
 - Results in organisms that have the desirable traits of their parents

<i>Scientific Example or Fact</i>	<i>GE or SB?</i>
Farmers removed the gene in chicken DNA to make them grow featherless.	GE
This process <u>attempts to</u> combines the best traits of <u>2 parents</u> .	SB
Dog breeders wanted to breed a dog that would run fast but also be born with long, shiny fur, looking for the best characteristics from the parents.	SB
Scientists take out a gene for bioluminescence from a jellyfish and put that gene into a mouse's DNA to see if it will have a glowing effect.	GE
This process is relatively new and done in science labs.	GE
This process manipulates or alters the genes/DNA of organisms.	GE
This results in organisms with new traits.	GE
English Shorthorn cattle, which produced good beef were bred with Brahman cattle from India to make the offspring both tasty and resistant to heat and humidity.	SB
This process has been around for thousands of years.	SB
Scientists removed a gene for fat in bison to make them leaner.	GE
This results in organisms with desirable traits from both parents	SB

