

Genetic Engineering and Selective Breeding

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

These are all baby mice, with no hair yet.

The inserted gene makes the skin glow under ultraviolet (UV) light.



Photo taken under UV light.

These 3 in the middle are normal baby mice.

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.



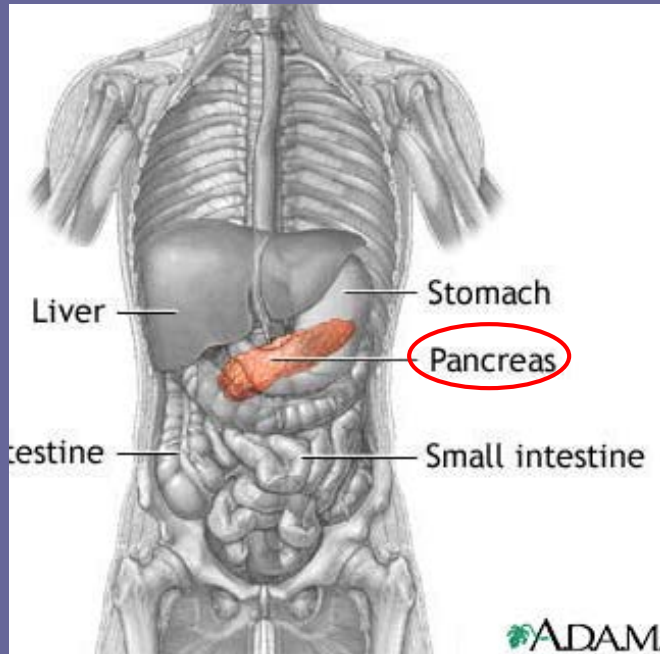
- It produces an organism that has a new trait it would most likely not have developed on its own

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 the crops!



Genetic Engineering Example D:

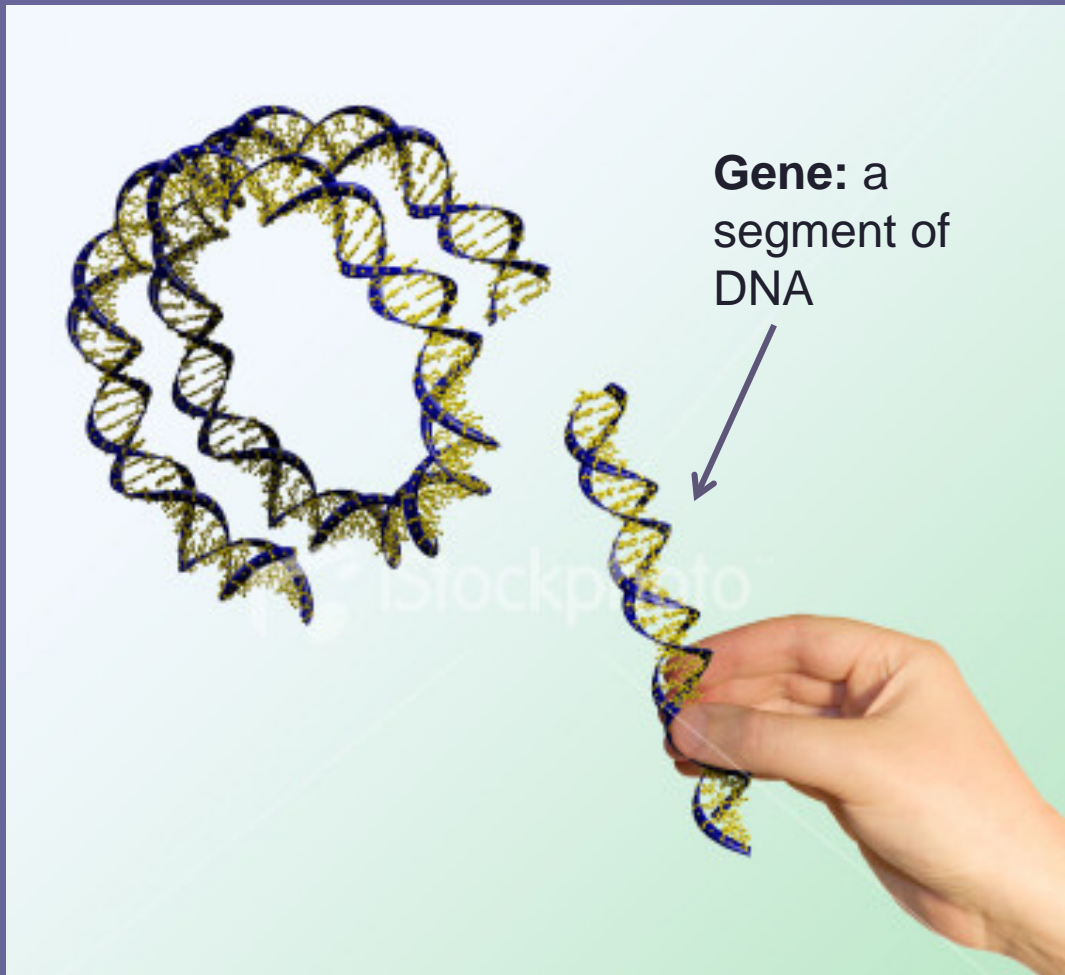
Give tomatoes the ability to make anti-freeze.



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



Remember!



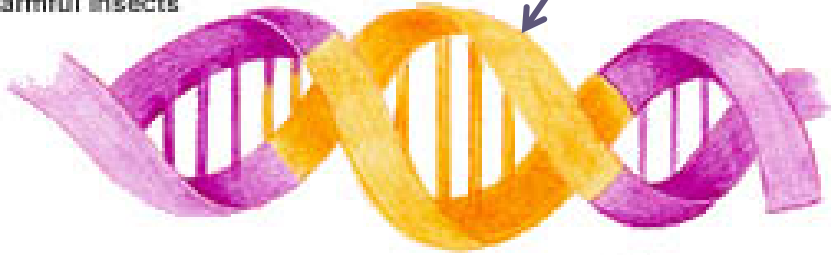
Genetic engineering involves the manipulation of genes!

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 seep into soil & kill good insects!
- 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

SAME SPECIES!



- Selective breeding is used mostly for dogs, cats, other pets, cattle, and crops.

Selective Breeding Example A

I'm giving $\frac{1}{2}$ my genes!



I'm so glad Farmer Jane introduced us!

I'm giving $\frac{1}{2}$ my genes, too!



Our offspring will be so handsome & healthy & tasty!

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

Tough Boar + meaty pig = Superpig



Selective Breeding Example B



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)

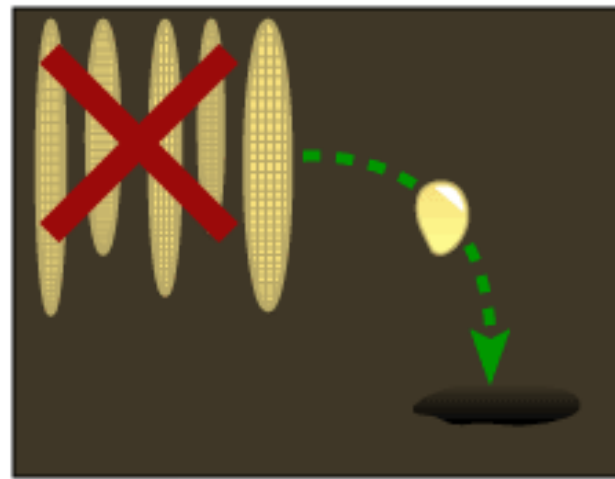
RESULT = good beef
and resistant to heat!

hot weather cow + beefy cow = supercow

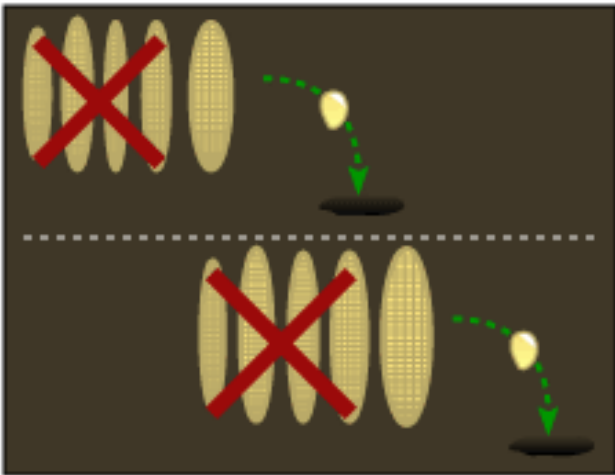




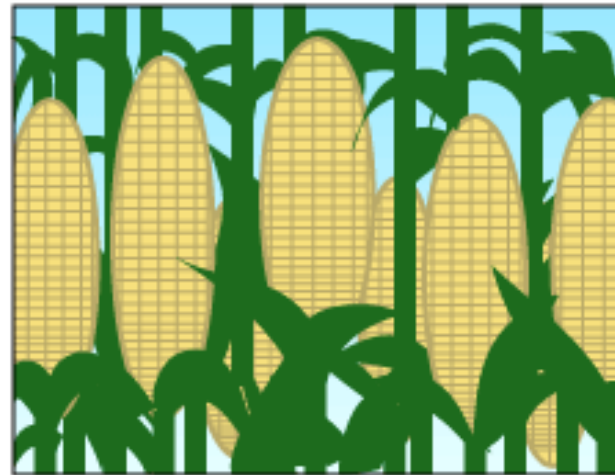
1. Natural variation occurs in the wild population.



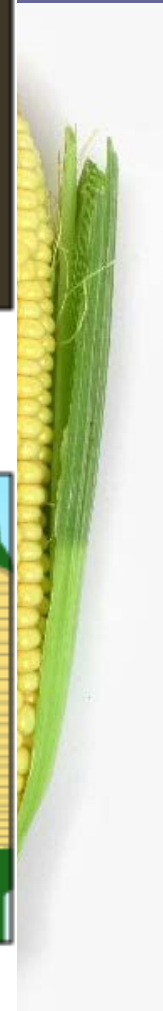
2. Seeds for the next generation are chosen only from individuals with the most desirable traits.



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

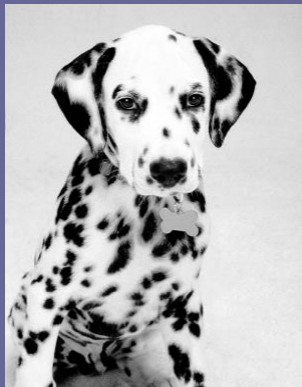


- Might get improved organisms
- Don't need any special tools or lab
- Can be performed easily by farmers & breeders

Disadvantages of Selective Breeding



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



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
Humans choose the desired traits in this process.	BOTH
This results in organisms with new combinations of traits that may never have existed before.	BOTH
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 their meat leaner.	GE
This process can be done using organisms of 2 very different species.	GE

