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.

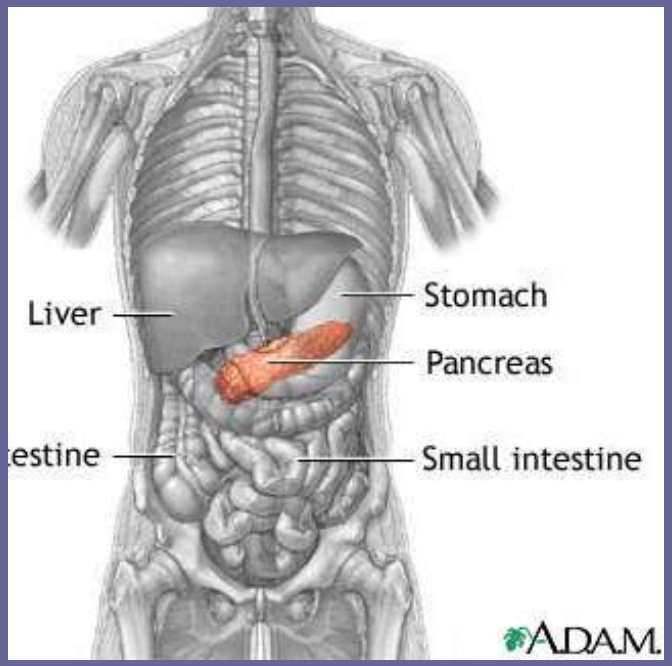
Genetic Engineering: Details

- 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

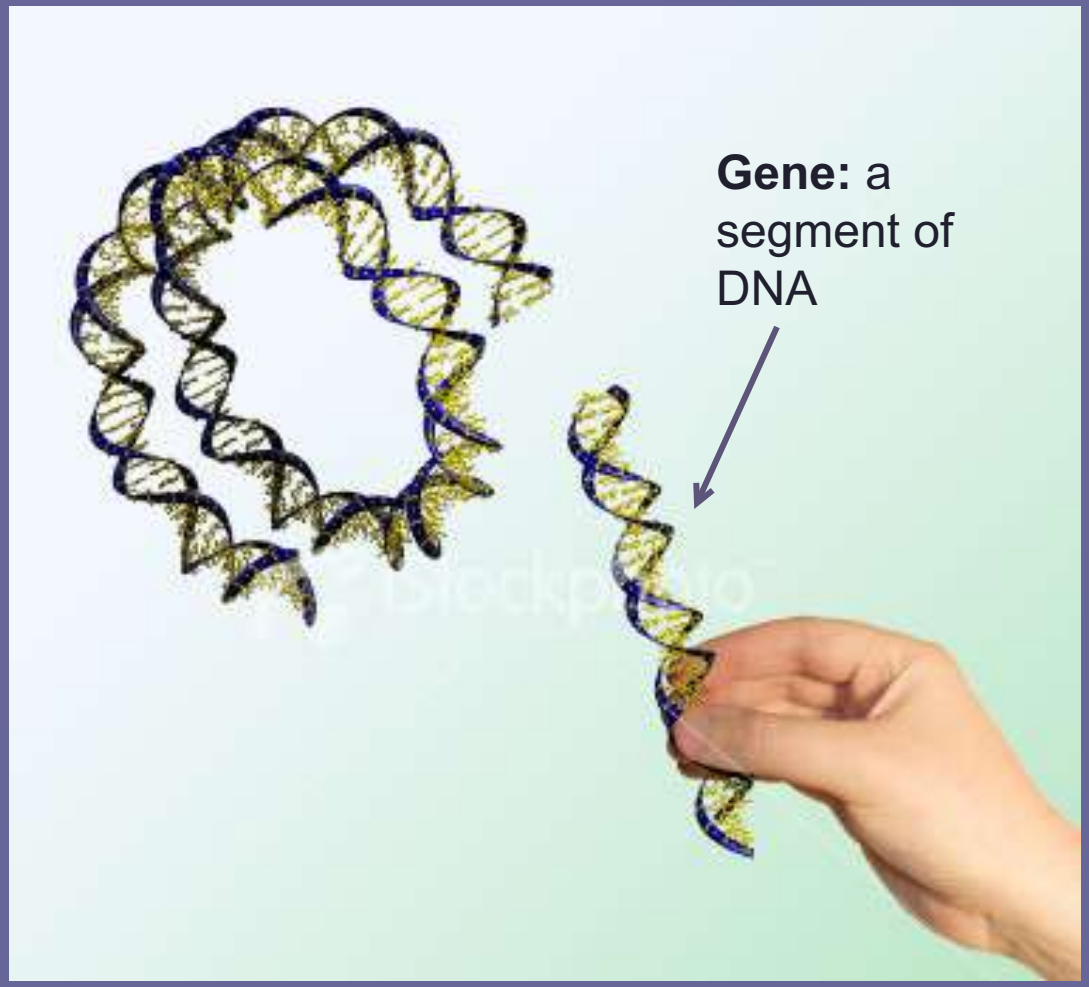
Scientists added a gene for producing scorpion venom to cabbage plants to kill pesky caterpillars that eat crops!

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.

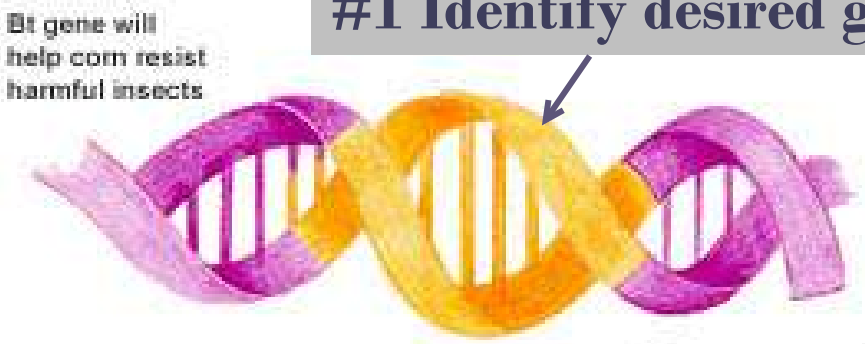
Remember!



Genetic engineering involves the **manipulation** of **genes**!

Genetic Engineering of insect-resistant corn

#1 Identify desired gene



#2 Use enzymes to cut desired gene loose

#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 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.

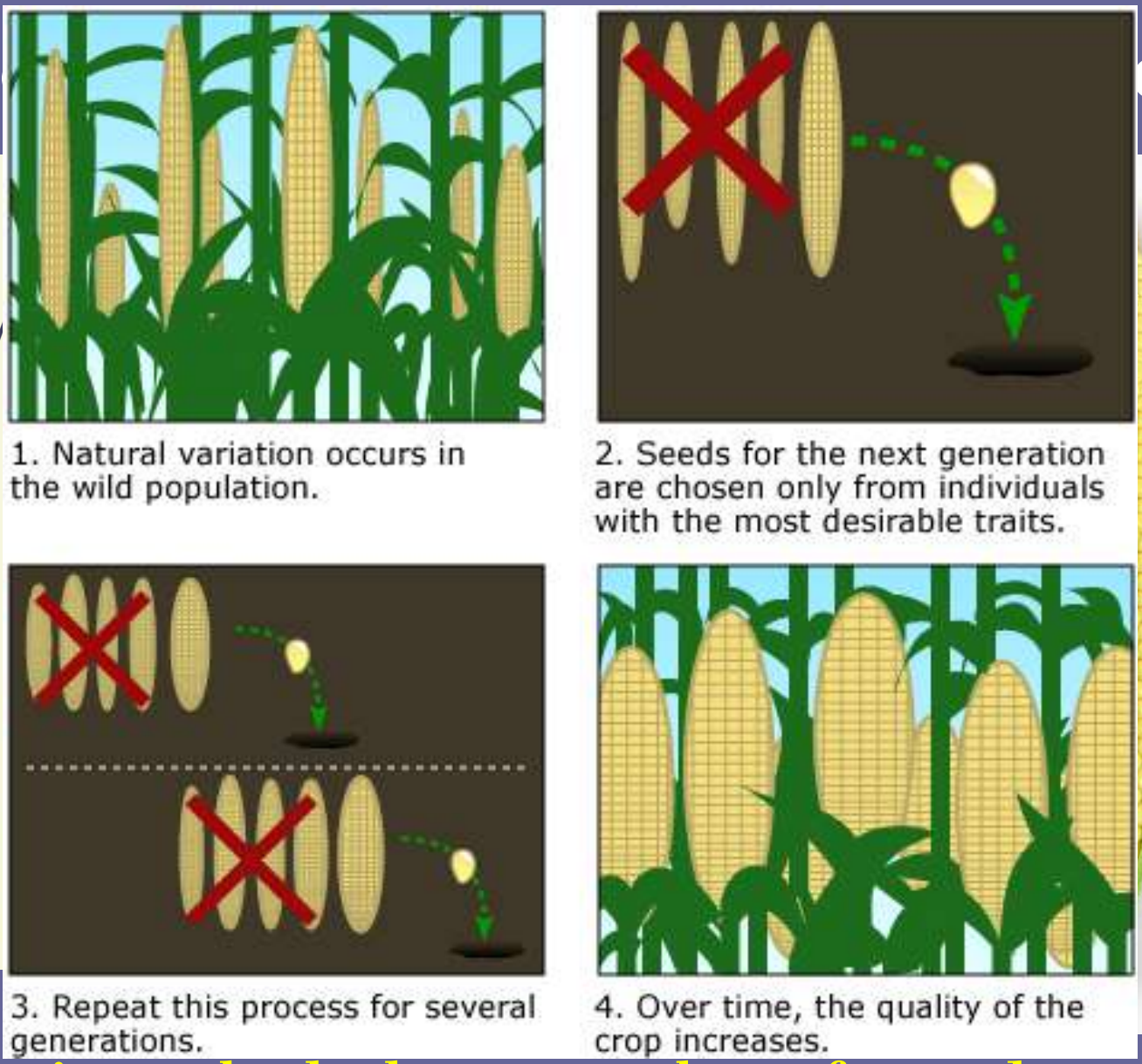
English shorthorn cattle: Good beef but poor heat resistance.

Santa Gertrudis cattle
*(**cross** of 2 breeds)*

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

hot weather cow + beefy cow = supercow

S e C



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!

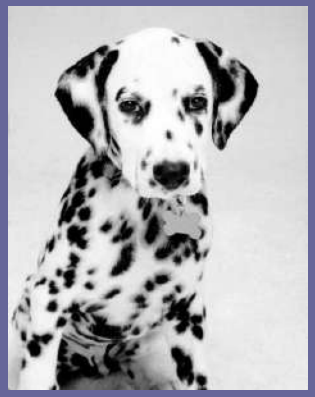
- Selective breeding crosses (mates) organisms with **desirable traits** to produce offspring that have the traits from both parents!

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.?

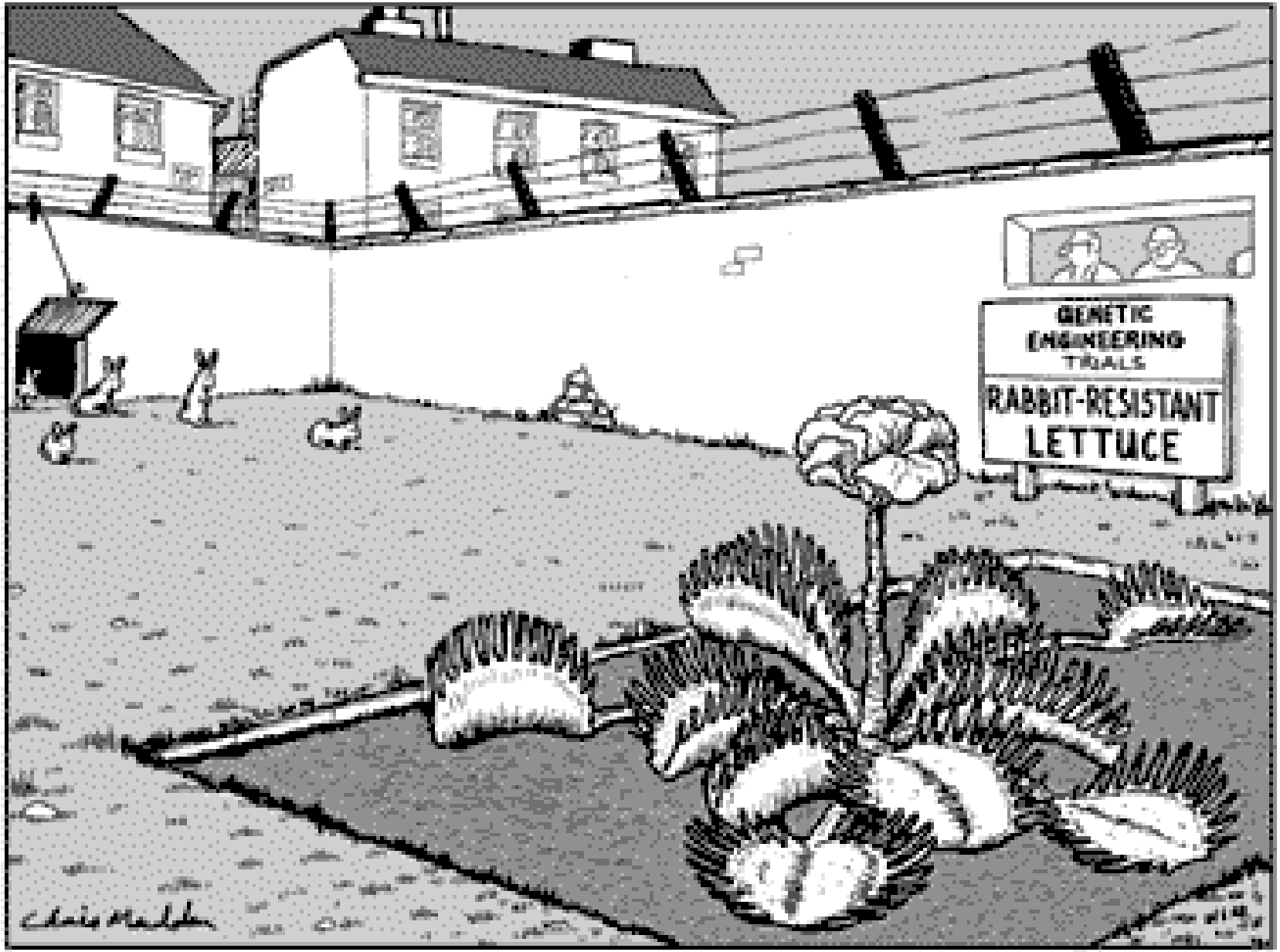


REVIEW

- 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

Scientific Example or Fact	*GE or SB?*
Farmers removed the gene in chicken DNA to make them grow featherless.	GE
This process attempts to combines the best traits of 2 parents.	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.	BOTH
This results in organisms with new traits.	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 them leaner.	GE
This results in organisms with desirable traits from both parents	SB


GENETIC
ENGINEERING
TRIALS
RABBIT-RESISTANT
LETTUCE