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.

These 3 in the middle are normal baby mice.

Photo taken under UV light.
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

#1 Identify desired gene

#2 Use enzymes to cut desired gene loose

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**

- 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
Choosing only the best corn plants for seeds results in better crops over a long time.
Selective Breeding Example D

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
<table>
<thead>
<tr>
<th>Scientific Example or Fact</th>
<th>GE or SB?</th>
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<tbody>
<tr>
<td>Farmers removed the gene in chicken DNA to make them grow featherless.</td>
<td>GE</td>
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<tr>
<td>This process attempts to combines the best traits of 2 parents.</td>
<td>SB</td>
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<tr>
<td>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.</td>
<td>SB</td>
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<tr>
<td>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.</td>
<td>GE</td>
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<tr>
<td>This process is relatively new and done in science labs.</td>
<td>GE</td>
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<tr>
<td>Humans choose the desired traits in this process.</td>
<td>BOTH</td>
</tr>
<tr>
<td>This results in organisms with new combinations of traits that may never have existed before.</td>
<td>BOTH</td>
</tr>
<tr>
<td>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.</td>
<td>SB</td>
</tr>
<tr>
<td>This process has been around for thousands of years.</td>
<td>SB</td>
</tr>
<tr>
<td>Scientists removed a gene for fat in bison to make their meat leaner.</td>
<td>GE</td>
</tr>
<tr>
<td>This process can be done using organisms of 2 very different species.</td>
<td>GE</td>
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