A New Breed

The tomatoes in your salad and the dog in your backyard are a result of selective breeding. Over thousands of years, humans have developed breeds of animals and plants that have desirable characteristics. How do breeders predict the results of crossing individuals with different traits?
1. Think of two very different breeds of dogs that are familiar to you. On a sheet of paper, construct a table that has the following three heads: the name of each of the two dog breeds, and “Cross-Breed.

2. The rows of the table should be labeled with characteristics found in both breeds of dogs. Examples might include size, color, type of coat, intelligence, aggression, and so on.

3. Fill in the column for each of the two dog breeds. In the column labeled “Cross-Breed,” write in the characteristic you would expect to see in a cross between the two breeds you have selected.
## Interest Grabber

<table>
<thead>
<tr>
<th>SIZE</th>
<th>Dog Breed #1</th>
<th>Dog Breed #2</th>
<th>Cross-Breed</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLOR</td>
<td></td>
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</tr>
<tr>
<td>COAT</td>
<td></td>
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<td></td>
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<tr>
<td>INTELLIGENCE</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AGGRESSION</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Selective Breeding

Consists of:

- Inbreeding:
  - Which crosses
  - Similar organisms
    - For example:
      - Organism breed A
        - Which
        - Retains desired characteristics

- Hybridization:
  - Which crosses
  - Dissimilar organisms
    - For example:
      - Organism breed A
        - Which
        - Combines desired characteristics
      - Organism breed B
        - Which
Selective Breeding

- Selective breeding is a form of evolution controlled by humans
Genetically Modified Organisms

- A genetically modified organism (GMO) or genetically engineered organism (GEO) is an organism whose genetic material has been altered using genetic engineering techniques.
- An organisms has an altered genome.
Genetically Modified Organisms
Genetically Modified Organisms

http://www.healthproductsguru.com/are-genetically-modified-organisms-gmos-dangerous-part-1/
Gene Therapy

Gene therapy is the insertion, alteration, or removal of genes within an individual's cells and biological tissues to treat disease. It is a technique for correcting defective genes that are responsible for disease development.
Gene Therapy

1. Cells are removed from patient.
2. In the laboratory, a virus is altered so that it cannot reproduce.
3. A gene is inserted into the virus.
4. The altered virus is mixed with cells from the patient.
5. The cells from the patient become genetically altered.
6. The altered cells are injected into the patient.
7. The genetically altered cells produce the desired protein or hormone.
1. What is selective breeding
2. Give an example of an organism that is altered by selective breeding.
3. What is a GMO/GEO?
4. Are GMO/GEO’s harmful?
5. What is gene therapy and what is it used for?
Have you ever used your word processor’s Search function? You can specify a sequence of letters, whether it is a sentence, a word, or nonsense, and the program scrolls rapidly through your document, finding every occurrence of that sequence. How might such a function be helpful to a molecular biologist who needs to “search” DNA for the right place to divide it into pieces?
Interest Grabber cont.

1. Copy the following series of DNA nucleotides onto a sheet of paper

GTACTAGGTTAACTGTACTATCGTTAACGTA
AGCTACGTTAACCTA

2. Look carefully at the series, and find this sequence of letters: GTTTAAC. It may appear more than once.

3. When you find it, divide the sequence in half with a mark of your pencil. You will divide it between the T and the A. This produces short segments of DNA. How many occurrences of the sequence GTTAAC can you find?
Restriction Enzymes

Recognition sequences

DNA sequence

CTTAAG
GAAATTTC

CTTAAG
GAAATTTC
Restriction Enzymes-is an enzyme that cuts double-stranded DNA at specific recognition nucleotide sequences known as restriction sites.

Recognition sequences

Restriction enzyme EcoRI cuts the DNA into fragments.

Sticky end
Gel Electrophoresis is a method used to separate a mixed population of DNA and RNA fragments by length, to estimate the size of DNA and RNA fragments or to separate proteins by charge.
DNA Sequencing - used for determining the order of the **nucleotide** bases—**adenine**, **guanine**, **cytosine**, and **thymine**—in a molecule of **DNA**.

DNA strand with unknown base sequence

DNA fragments synthesized using unknown strand as a template

Dye molecules

Electrophoresis gel

Base sequence as “read” from the order of the dye bands on the gel from bottom to top: T G C A C
1. What are restriction enzymes?
2. What is gel electrophoresis? How could it be used?
3. What is DNA sequencing?
Sneaking In

You probably have heard of computer viruses. Once inside a computer, these programs follow their original instructions and override instructions already in the host computer. Scientists use small “packages” of DNA to sneak a new gene into a cell, much as a computer virus sneaks into a computer.
Interest Grabber cont.

Computer viruses enter a computer attached to some other file.

1. What are some ways that a file can be added to a computer’s memory?

2. Why would a person download a virus program?

3. If scientists want to get some DNA into a cell, such as a bacterial cell, to what sort of molecule might they attach the DNA?
Making Recombinant DNA—bring together genetic material from multiple sources, creating sequences that would not otherwise be found in biological organisms.

Genes for human growth hormone

Gene for human growth hormone

Sticky ends

DNA recombination

DNA insertion

Human Cell

Bacterial Cell

Bacterial chromosome

Plasmid

Gene for human growth hormone

Recombinant DNA

Sticky ends

DNA recombination

DNA insertion

Bacterial cell for containing gene for human growth hormone
The manipulation of DNA allows scientists to do some interesting things. Scientists have developed many transgenic organisms, which are organisms that contain genes from other organisms. Recently, scientists have removed a gene for green fluorescent protein from a jellyfish and tried to insert it into a monkey.
1. Transgenic animals are often used in research. What might be the benefit to medical research of a mouse whose immune system is genetically altered to mimic some aspect of the human immune system?

2. Transgenic plants and animals may have increased value as food sources. What might happen to native species if transgenic animals or plants were released into the wild?
Cloning- creating an organism that is an exact genetic copy of another organism

1. A body cell is taken from a donor animal.
2. An egg cell is taken from a donor animal.
3. The nucleus is removed from the egg.
4. The body cell and egg are fused by electric shock.
5. The fused cell begins dividing, becoming an embryo.
6. The embryo is implanted into the uterus of a foster mother.
7. The embryo develops into a cloned animal.
Cloning of the First Mammal

A donor cell is taken from a sheep’s udder.

These two cells are fused using an electric shock.

The fused cell begins dividing normally.

The embryo is placed in the uterus of a foster mother.

The embryo develops normally into a lamb—Dolly.
NOTEBOOK #7

1. What is recombinant DNA?
2. Why would we use recombinant DNA technology?
3. What is cloning?
4. Can mammals be cloned?
5. How many different organisms are required for cloning?