Biotechnology: Genetic Engineering

What genetic traits are being expressed?

- https://www.youtube.com/watch?v=xlQrg08AF1U

Do Now:

- Write your homework down and collect it from the front.
- Labeling GMO Salmon
- http://ed.ted.com/on/mKdvoWwC

What is genetic variation?

- Is the amount of diversity or variety present in the DNA sequence for a population
  - Mutations in DNA sequences provide that variation
  - Example: gene may code for folded ears or straight ears for cats

How Do We Get the Characteristics We Want?

- Selective breeding
  - Breeding organisms to get desired trait in future generations
  - Example: Russian foxes bred for tameness

How Do We Get the Characteristics We Want?

- Inbreeding: selecting organisms to breed that have similar traits to ensure those traits are passed on
  - Example: Golden Retrievers
    - Specific colors
    - Behavior
  - Problems: can lead genetic defects like blindness and joint deformities

Selective breeding

- Hybridization
  - Breeding two different species to obtain specific traits
  - Can result in stronger offspring
  - Example: Dog-Wolf hybrid

THINK!!

- HOW HAS SELECTIVE BREEDING BENEFITTED OUR WORLD?
  - Be ready to share an example with the class.

- HOW HAS SELECTIVE BREEDING NEGATIVELY AFFECTED OUR WORLD?
  - Be ready to share an example with the class.

Exit Slip

- List one species you are familiar with that has been changed through selective breeding.
- List one behavior or physical characteristic of that species that was targeted through selective breeding.

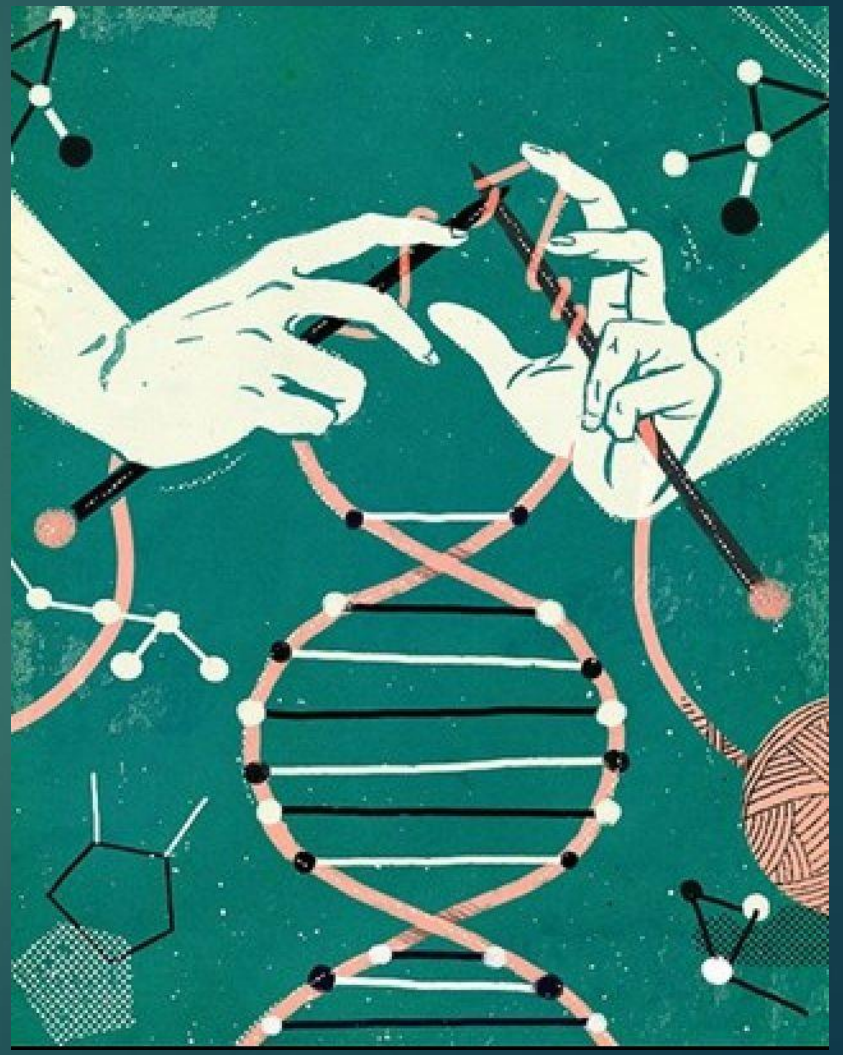
Do Now:

- Write your homework down.
- Watch the video about the "liger".

- Discussion question:
- Cheetahs are almost extinct in the wild and have very low genetic diversity. Could hybridization with the leopard bring this species back from the edge? Why or why not?

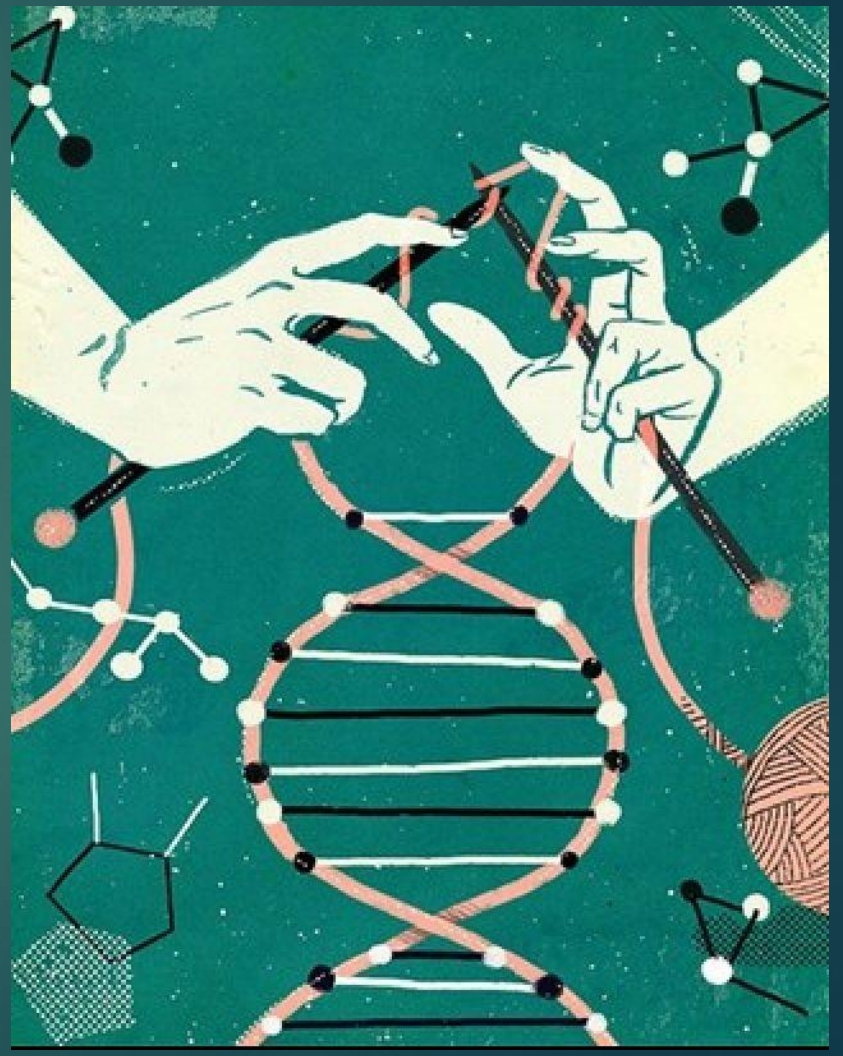
What is Genetic Engineering?

- Making changes to the sequence of nucleotides in DNA
- Manipulating DNA to
  - Identify specific genes
  - Obtain the traits we want…



What is Genetic Engineering?

- Changing DNA to ensure certain traits are present or absent
  - Extracting DNA
  - Cut DNA
  - Sort DNA
  - Copy DNA
  - Paste DNA

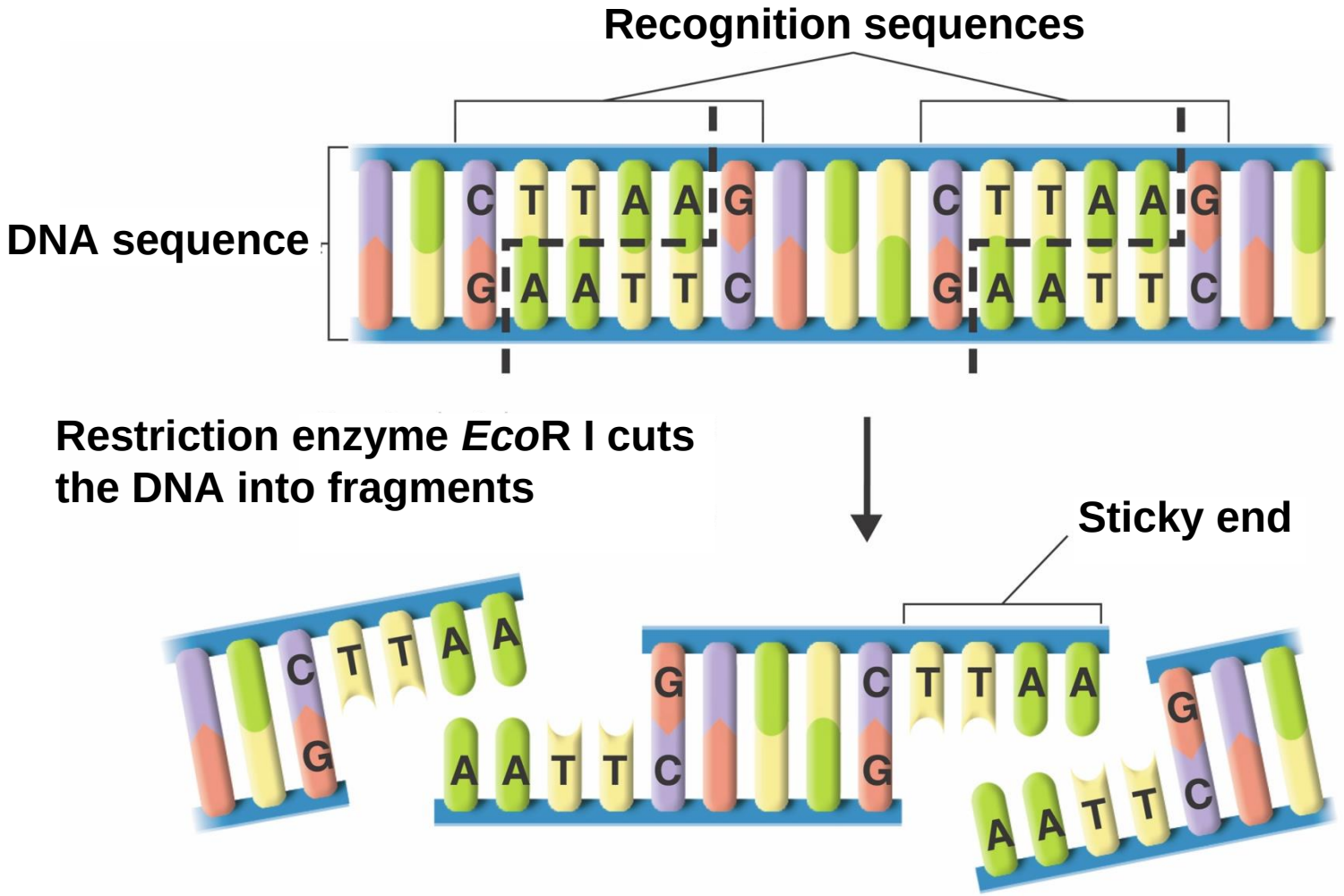


DNA Extraction

- Opening the cell and nucleus using heat, chemicals or physical force
- Removing DNA

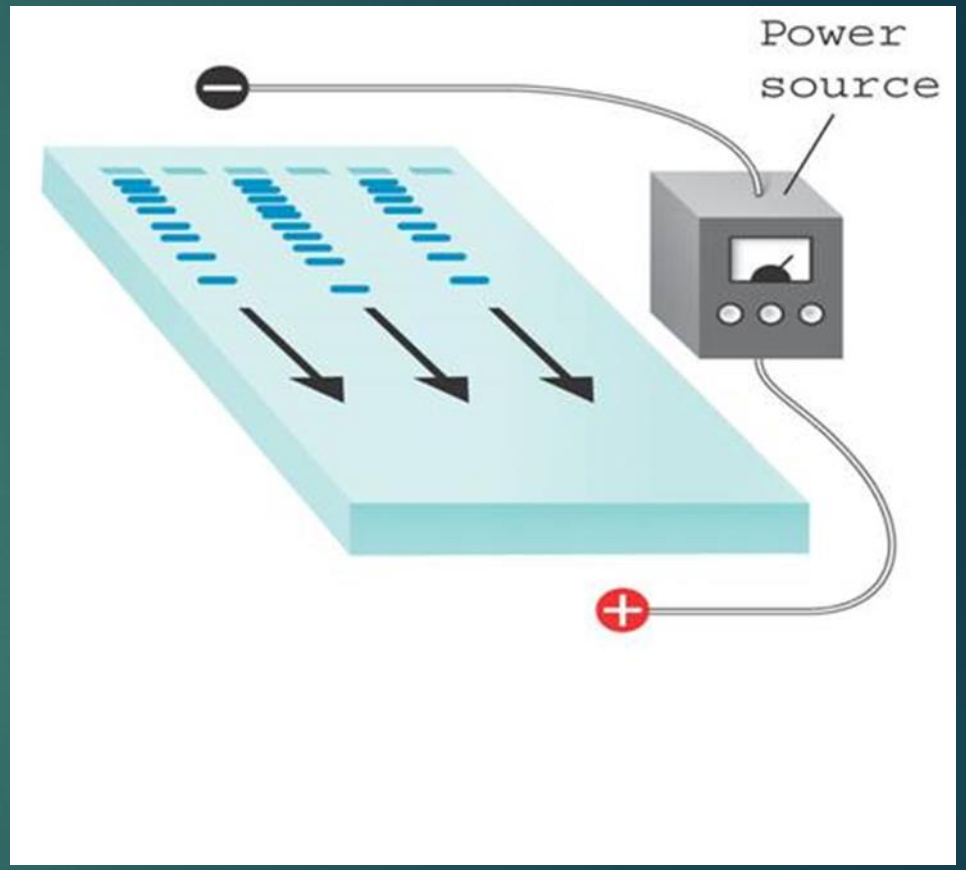
Cutting DNA

Each **restriction enzyme** cuts DNA at a specific sequence of nucleotides.



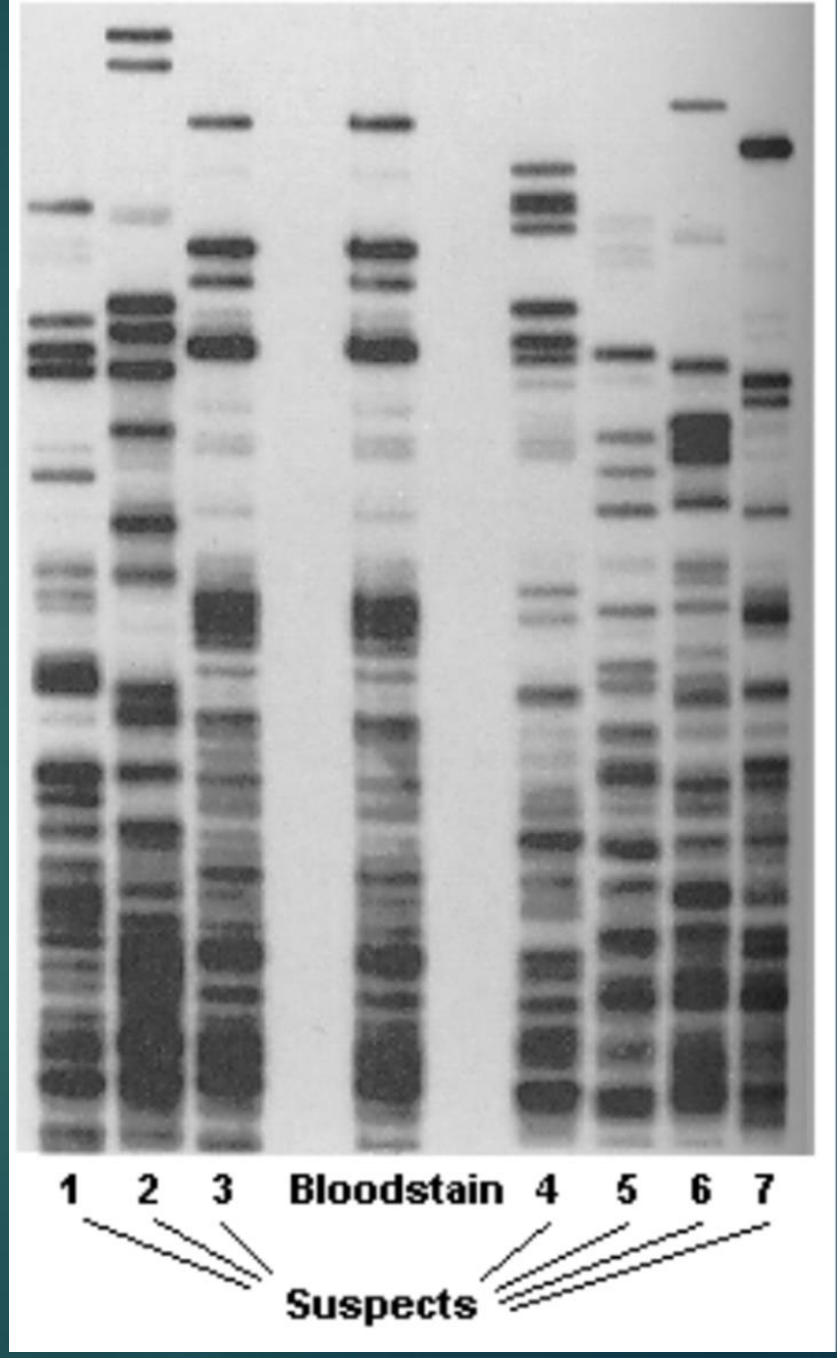
DNA Sorting

- Electrophoresis
  - Sorts large and small fragments of DNA
  - DNA fragments placed in tray
  - Small fragments move faster and farther than larger fragments



Why do we use Electrophoresis?

- Can be used to detect changes in DNA sequence
- DNA fingerprints for forensic and paternity tests
- Which suspect could be the criminal?



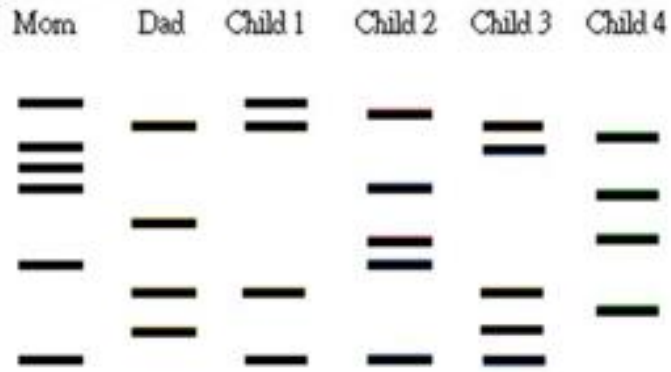
Do Now:

- DNA Fingerprint… Paterni

DNA Fingerprint Analysis

Case 1

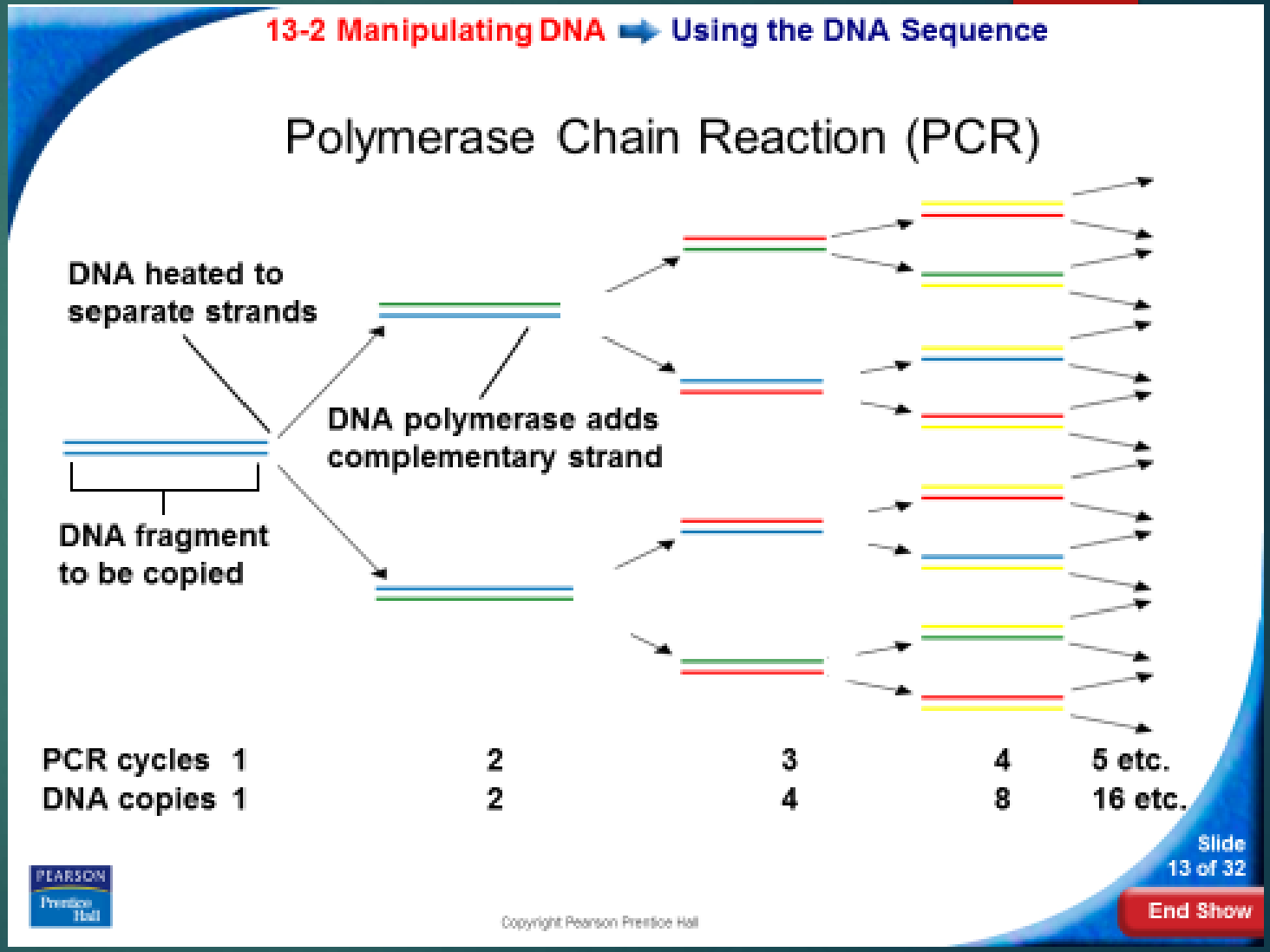
Mr. Chan's family consists of mom, dad and four kids. The parents have one daughter and one son together, another daughter is from the mother's previous marriage, and the other son is adopted. Here are the DNA analysis results:



1. Which child is adopted? Why?
2. Which child is from the mother's previous marriage? Why?
3. Who are the own children of Mr and Mrs Chan?

DNA Copying

- Polymerase Chain Reaction (PCR)
  - Can make multiple copies of DNA sequences



What do you do with DNA once you've…

- Cut it (using restriction enzymes)
- Sorted it (Electrophoresis)
- Copied it (PCR)

- Paste it!

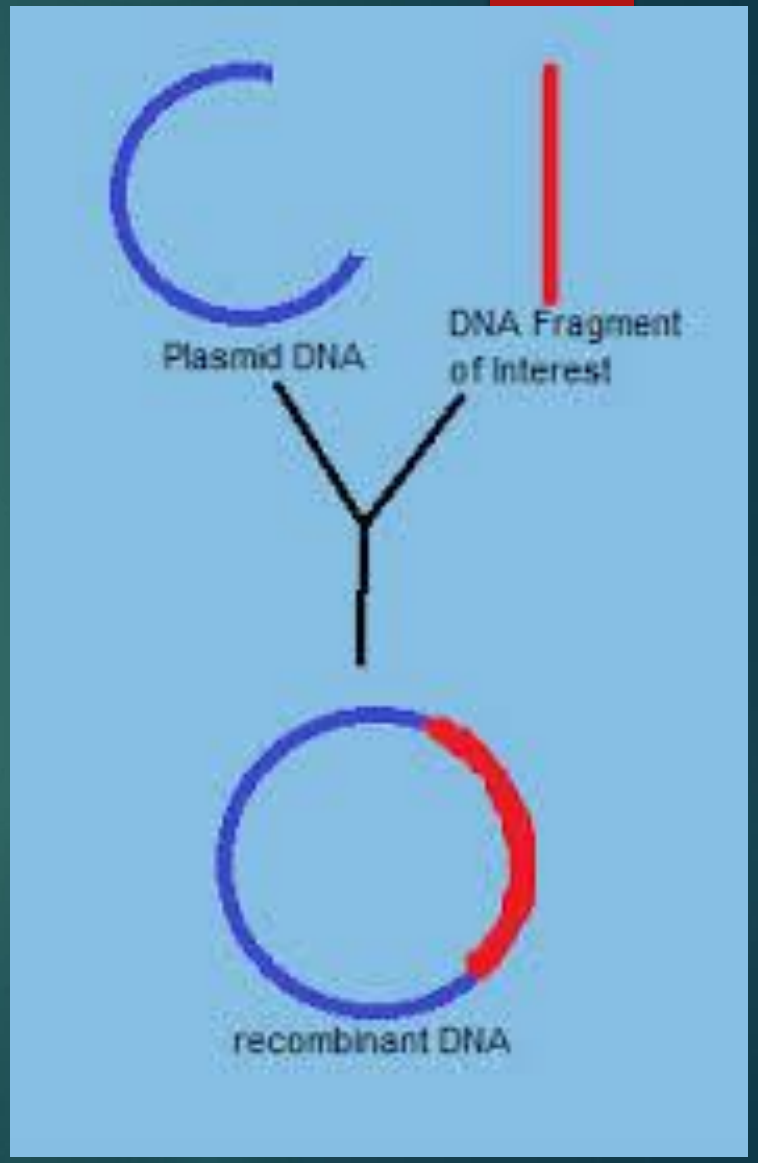
What is Recombinant DNA?

- Combining DNA from different sources.

Steps

1. DNA is removed from one source
2. DNA sequences are cut and “pasted” together.

Animation: https://www.dnalc.org/view/15476-Mechanism-of-Recombination-3D-animation-with-with-basic-narration.html



TEDEd Video

- http://ed.ted.com/on/bhmjqvQ9#review

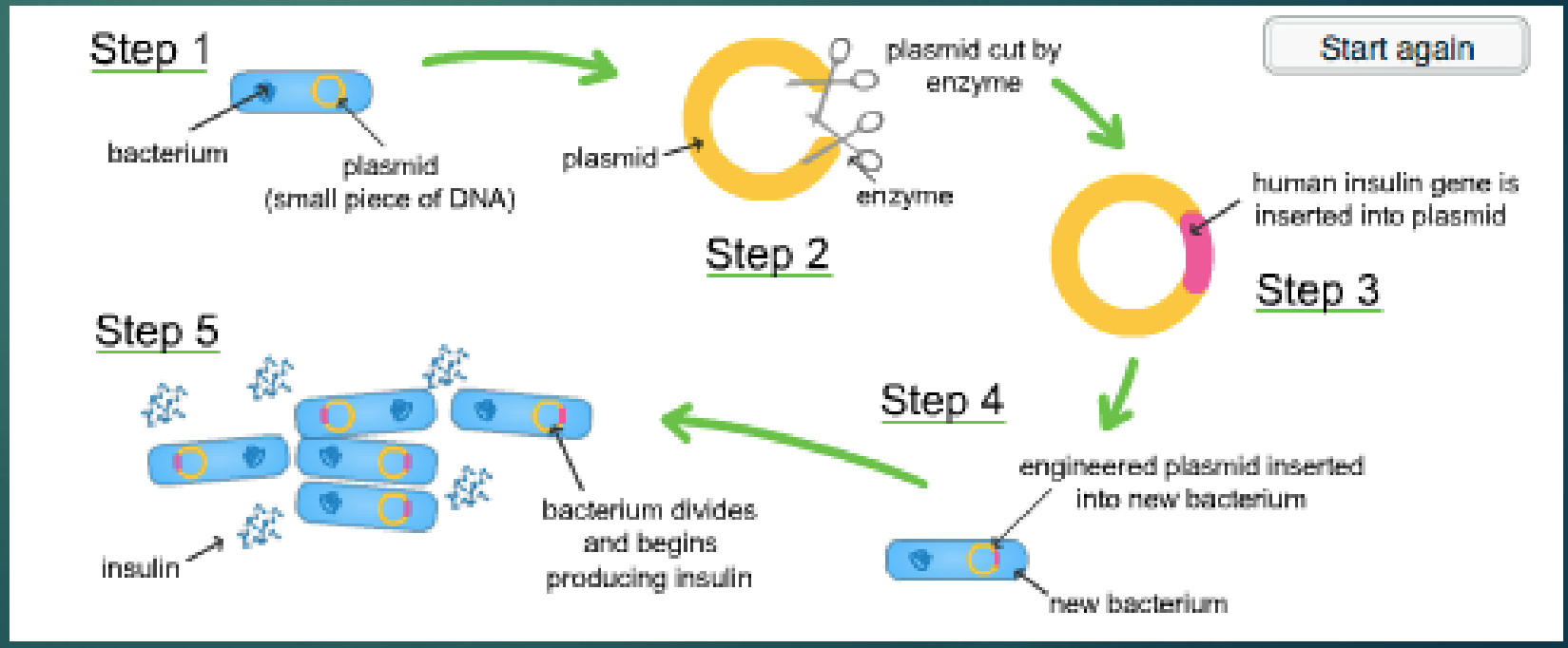
What is a Transgenic Organism?

- Produced using recombinant DNA technology
- Have DNA from two different sources

- A specific gene has been added to the cats' DNA which causes them to glow in the dark.
- Normally, the gene is found in jellyfish
- That gene was cut, copied, and pasted into the cat's DNA.

Making Insulin

- Insulin gene removed from human DNA
- Inserted into a bacteria



Feline IV

- FIV – Feline version of HIV
- Gene that prevents the FIV from becoming active was inserted along with the gene that caused them to glow
- Scientists know that if the cat glows, then the FIV resistant gene was also inserted and is active.

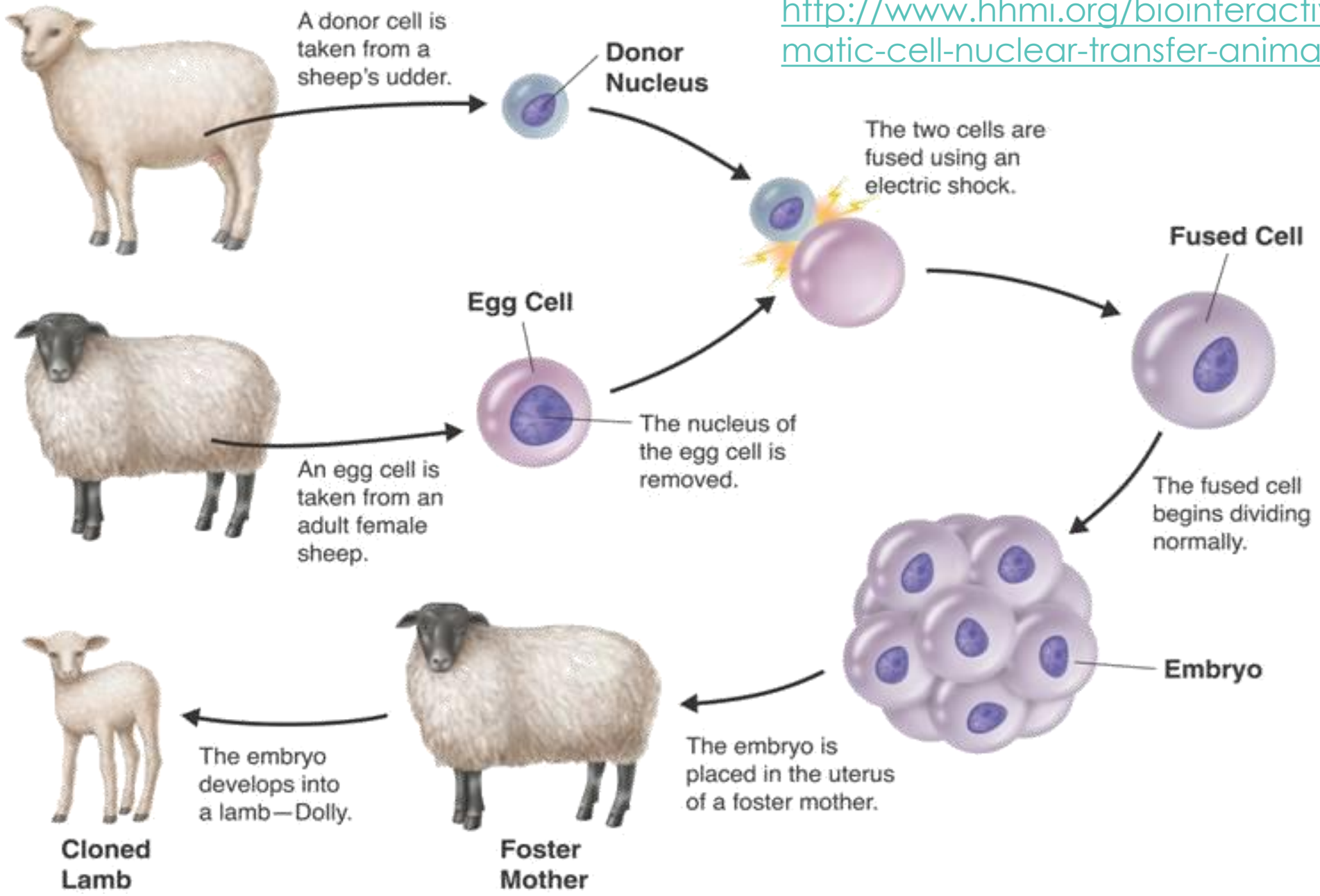
Why modify genes?

- Increase food production
- Increase resistance to disease and pests in plants
- Treat genetic abnormalities
- Produce medical treatments
  - For example:
  - Insert human gene for insulin into bacteria
  - Bacteria replicate quickly through binary fission
  - Can create tremendous amounts of insulin

Clone Wars?

- What is a “clone”?
  - Genetically identical individuals created from a single cell.

Animation: http://www.hhmi.org/biointeractive/somatic-cell-nuclear-transfer-animation



THINK:
Why would we want to clone a individual?

1. To revive an extinct species
2. To ensure survival of endangered species
3. To increase food production
4. To increase medicine production