**Biotechnology: The Tools of the Trade**

**Complete the activities by visiting the web pages, then answer the questions accompanying each.**

**Website#1: DNA Fingerprinting & Gel Electrophoresis** <http://www.pbs.org/wgbh/nova/education/body/create-dna-fingerprint.html>

1. What is the function of a restriction enzyme? What determines the sites where a restriction enzyme works?
2. What is electrophoresis? Why does it allow scientists to separate pieces of DNA?
3. Why do you have to add radioactive probe to the DNA? Without the probes, would the DNA show up on the x-ray film?
4. Which suspect committed the crime? What did you notice about her DNA?
5. Based on the evidence, could any of the other suspects have committed the crime? Why or why not?

**Website #2: Transgenic Organisms** <http://www.pbs.org/wgbh/harvest/engineer/>

1. Read the two paragraphs on the homepage and the following question. How did humans first alter crops? What method are scientists using today to change crops?
2. Click on “Selective Breeding” and complete the activity. Which type of corn did you select in each generation to increase size over time?
3. Was the change in seed size immediate or gradual? Did the change occur in all the seeds or only some?
4. Go back to the previous page and click “Transgenic Manipulation. ” Complete this activity. What happens during transgenic manipulation?
5. What is a vector? Why do you think DNA from one organism can be put into another organism?
6. What kind of tomato plant resulted from the experiment? How did you know the plant was resistant to the caterpillar?
7. Can you think of any other ways that transgenic manipulation could be useful? Quickly google search to find a few examples.

**Website #3: Cloning Learn.Genetics at http://learn.genetics.utah.edu/**

**Click on “Cloning" to the right**

Browse the articles at the site to find the answers to the following questions.

What is Cloning?

1. Define Cloning: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What is the difference between natural twinning and artificial twinning? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. What is SCNT? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. To make Dolly the clone, they first isolated a cell from where? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. They transferred the nucleus of this cell to where? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Click and Clone**

6. List all the materials needed to clone a mouse.

7. Place the following steps in the correct order.

\_\_\_\_\_\_\_\_Stimulate cell division

\_\_\_\_\_\_\_\_Deliver baby

\_\_\_\_\_\_\_\_ Remove and discard the nucleus from the egg cell

\_\_\_\_\_\_\_\_ Isolate donor cells from egg donor and germ cell donor

\_\_\_\_\_\_\_\_ Transfer the somatic cell nucleus into the egg cell

\_\_\_\_\_\_\_\_ Implant embryo into a surrogate mother

8. Explain how the nucleus is removed from the donor egg:

9. What color with the cloned mouse be? \_\_\_\_\_\_\_\_\_\_\_\_\_ What is the name of this mouse? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Why Clone?**

10. List the four main reasons given on the page for justifying cloning:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. What is a stem cell? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. What are two reasons a person might want to clone a human? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Cloning Myths**

13. Briefly describe in your own words, why CC the cat was not identical in color to Rainbow, even though she was a clone?

14. Explain why Frank #2 might have a different personality than Frank #1.

**Is it Cloning or Not?**

15. For each of the following scenarios, indicate YES (it is cloning) or NO (it is not cloning)

\_\_\_\_\_\_\_\_\_\_\_Sperm taken from a mole goat is combined with a female's egg in a petri dish. The resulting embryo is implanted into the female's uterus to develop

\_\_\_\_\_\_\_\_\_\_\_A sheep embryo, composed of 16 cells, is removed from the mother's uterus and separated into individual cells. Each cell is allowed to multiply, creating 16 separate embryos, which are then implanted in different female sheep to develop to maturity.

\_\_\_\_\_\_\_\_\_\_\_A cow with many desirable traits is stimulated with hormones to produce a number of egg cells. Each of these eggs is fertilized and implanted into a surrogate mother.

\_\_\_\_\_\_\_\_\_\_\_ In vitro fertilization

\_\_\_\_\_\_\_\_\_\_\_ Cell nuclei from an extinct wolly mammoth are placed into enucleated cow cells.

 **What Are the Risks of Cloning?**

16. What is one reason why cloning animals has such a high failure rate?

 17. What is LOS? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

18. What is a telomere? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**What Are Some Issues in Cloning?**

19. Pick one of the questions to ponder and ....ponder it. Write 3-7 sentences on your thoughts and opinions.