Name: _____ Date: _____

Review Sheet: Biotechnology

CLONING

Define Cloning – production of genetically identical organisms.

What are the steps involved in producing a clone (ex. Dolly the sheep)?

1. Donor cell is taken.
2. Egg cell emptied.
3. 2 cells are fused.
4. Fused cell divides.
5. Embryo is placed in the uterus of the foster mother.
6. Embryo develops.

What are the advantages AND disadvantages of cloning?

All will have favorable trait ex- soft wool

All may be wiped out by a disease.

GENETIC ENGINEERING

Define Genetic Engineering – The deliberate modification of the characteristics of an organism by manipulating its genetic material.

Recombinant DNA - Bringing together genetic material from multiple sources

Gene Splicing – DNA of an organism is cut and another gene from a different organism is inserted.

Restriction Enzymes – Cut the DNA in a specific location.

List at least 3 applications/uses for genetic engineering:

Human insulin, improve crops, glowing mice

What are the steps involved in Bacterial Transformation?

Plasmid is cut open → gene is inserted → bacterial produces the protein.

GEL ELECTROPHORESIS

Define Gel Electrophoresis – DNA is cut and separated & arranged by size into a unique banding pattern.

3 reasons for performing a Gel Electrophoresis are:

Paternity, crime scene investigation, evolutionary relationships.

Procedures

1. DNA is cut into fragments using restriction enzymes.
2. The fragments are loaded into wells on the gel.
3. An electric current is turned on, forcing negatively charged DNA fragments to move toward the positive charged electrode.
4. Fragments that are smaller in size are able to move further through the gel than fragments that are larger in size.
5. Each DNA sample produces a specific banding pattern that can be compared with other samples in order to observe similarities and differences.

Genetic Mutations & Biotechnology

1. For centuries, certain animals have been crossed to produce offspring that have desirable qualities. Dogs have been mated to produce Labradors, beagles, and poodles. All of these dogs look and behave very differently from one another. This technique of producing organisms with specific qualities is known as
   1) gene replication
   2) natural selection
   3) random mutation
   4) selective breeding

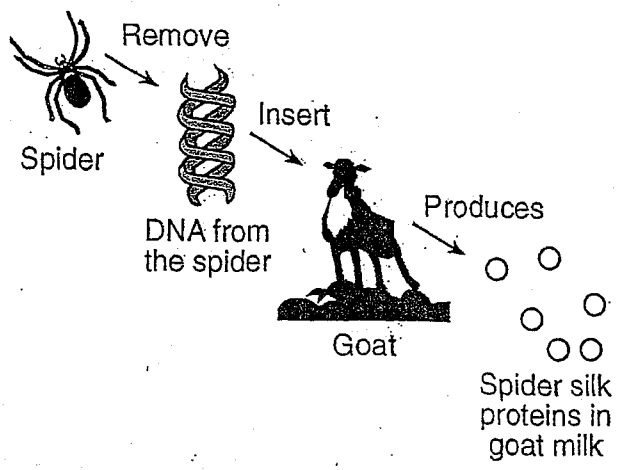
2. Some farmers currently grow genetically engineered crops. An argument *against* the use of this technology is that
   1) it increases crop production
   2) it produces insect-resistant plants
   3) its long-term effects on humans are still being investigated
   4) it always results in crops that do not taste good

3. A great deal of information can now be obtained about the future health of people by examining the genetic makeup of their cells. There are concerns that this information could be used to deny an individual health insurance or employment. These concerns best illustrate that
   1) scientific explanations depend upon evidence collected from a single source
   2) scientific inquiry involves the collection of information from a large number of sources
   3) acquiring too much knowledge in human genetics will discourage future research in that area
   4) while science provides knowledge, values are essential to making ethical decisions using this knowledge

4. The DNA of a human cell can be cut and rearranged by using
   1) a scalpel
   2) electrophoresis
   3) hormones
   4) enzymes

5. In the United States, there has been relatively little experimentation involving the insertion of genes from other species into human DNA. One reason for the lack of these experiments is that
   1) the subunits of human DNA are different from the DNA subunits of other species
   2) there are many ethical questions to be answered before inserting foreign genes into human DNA
   3) inserting foreign DNA into human DNA would require using techniques completely different from those used to insert foreign DNA into the DNA of other mammals
   4) human DNA always promotes human survival, so there is no need to alter it

6. Which process is illustrated in the diagram below?



   1) chromatography
   2) direct harvesting
   3) meiosis
   4) genetic engineering

7. Enzymes are used in moving sections of DNA that code for insulin from the pancreas cells of humans into a certain type of bacterial cell. This bacterial cell will reproduce, giving rise to offspring that are able to form
   1) human insulin
   2) antibodies against insulin
   3) enzymes that digest insulin
   4) a new type of insulin

8. People with cystic fibrosis inherit defective genetic information and cannot produce normal CFTR proteins. Scientists have used gene therapy to insert normal DNA segments that code for the missing CFTR protein into the lung cells of people with cystic fibrosis. Which statement does *not* describe a result of this therapy?
   1) Altered lung cells can produce the normal CFTR protein.
   2) Altered lung cells can divide to produce other lung cells with the normal CFTR gene.
   3) The normal CFTR gene may be expressed in altered lung cells.
   4) Offspring of someone with altered lung cells will inherit the normal CFTR gene.

Name: Practice Questions Date:

Genetic Mutations & Biotechnology

Base your answers to questions 9 and 10 on the passage below and on your knowledge of biology.

In Search of a Low-Allergy Peanut

Many people are allergic to substances in the environment. Of the many foods that contain allergens (allergy-inducing substances), peanuts cause some of the most severe reactions. Mildly allergic people may only get hives. Highly allergic people can go into a form of shock. Some people die each year from reactions to peanuts.

A group of scientists is attempting to produce peanuts that lack the allergy-inducing proteins by using traditional selective breeding methods. They are searching for varieties of peanuts that are free of the allergens. By crossing those varieties with popular commercial types, they hope to produce peanuts that will be less likely to cause allergic reactions and still taste good. So far, they have found one variety that has 80 percent less of one of three complex proteins linked to allergic reactions. Removing all three of these allergens may be impossible, but even removing one could help.

Other researchers are attempting to alter the genes that code for the three major allergens in peanuts. All of this research is seen as a possible long-term solution to peanut allergies.

9. Explain how selective breeding is being used to try to produce commercial peanuts that will *not* cause allergic reactions in people.

Cross commercial types with allergen free types.

10. How does altering the DNA of a peanut affect the proteins in peanuts that cause allergic reactions?
   1) The altered DNA is used to synthesize changed forms of these proteins.
   2) The altered DNA leaves the nucleus and becomes part of the allergy-producing protein.
   3) The altered DNA is the code for the antibodies against the allergens.
   4) The altered DNA is used as an enzyme to break down the allergens in peanuts.

11. Steps in a reproductive process used to produce a sheep with certain traits are listed below.

Step 1 — The nucleus was removed from an unfertilized egg taken from sheep *A*.
Step 2 — The nucleus of a body cell taken from sheep *B* was then inserted into this unfertilized egg from sheep *A*.
Step 3 — The resulting cell was then implanted into the uterus of sheep *C*.
Step 4 — Sheep *C* gave birth to sheep *D*.

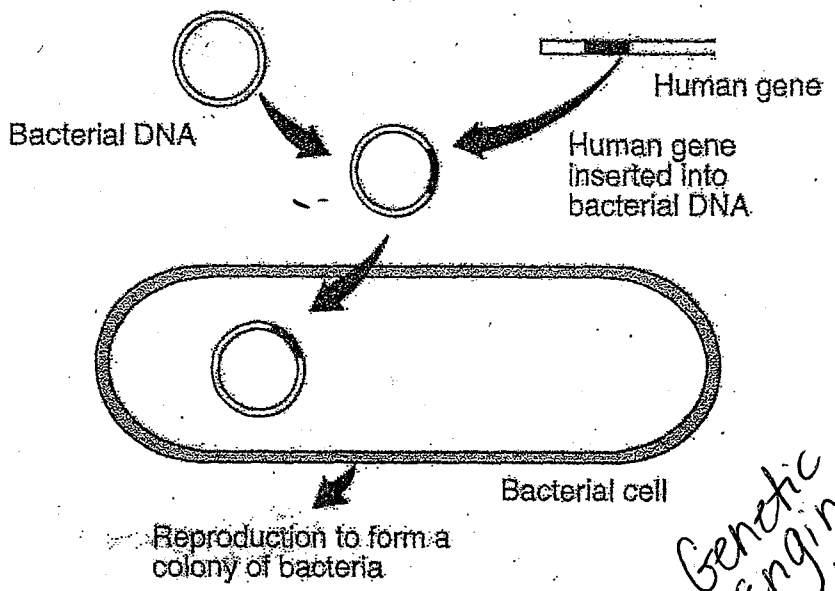
Which sheep would be most genetically similar to sheep *D*?
   1) sheep *A*, only
   2) sheep *B*, only
   3) both sheep *A* and *B*
   4) both sheep *A* and *C*

12. Cloning an individual usually produces organisms that
   1) contain dangerous mutations
   2) contain identical genes
   3) are identical in appearance and behavior
   4) produce enzymes different from the parent

13. A small amount of DNA was taken from a fossil of a mammoth found frozen in glacial ice. Genetic technology can be used to produce a large quantity of identical DNA from this mammoth's DNA. In this technology, the original DNA sample is used to
   1) stimulate differentiation in other mammoth cells
   2) provide fragments to replace certain human body chemicals
   3) act as a template for repeated replication
   4) trigger mitosis to obtain new base sequences

14. Which situation would most directly affect future generations naturally produced by a maple tree?
   1) Ultraviolet radiation changes the DNA sequence within some leaves of the tree.
   2) Ultraviolet radiation changes the DNA sequence within the gametes of some flowers of the tree.
   3) An increase in temperature reduces the number of cell divisions in the roots.
   4) Rapidly growing cells just under the bark are exposed to radiation, causing changes in genetic material.

15. The diagram below represents a genetic procedure.

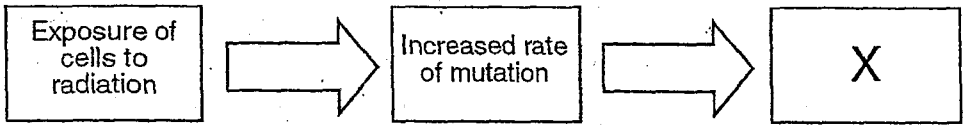


Genetic engineering/ Recombinant DNA

Which statement best describes the outcome of this procedure?

1) Bacterial cells will destroy defective human genetic material.
2) Bacterial cells may form a multicellular embryo.
3) The inserted human DNA will change harmful bacteria to harmless ones.
4) The inserted human DNA may direct the synthesis of human proteins.

16. Which phrase belongs in box *X* of the flowchart below?



1) Increased chance of cancer
2) Increase in the production of functional gametes
3) Decrease in genetic variability of offspring
4) Decreased number of altered genes

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Genetic Mutations & Biotechnology

Base your answers to questions 17 through 19 on the table below, which represents the DNA codes for several amino acids.

Amino Acid	DNA Code Sequence
Cysteine	ACA *or* ACG
Tryptophan	ACC
Valine	CAA *or* CAC *or* CAG *or* CAT
Proline	GGA *or* GGC *or* GGG *or* GGT
Asparagine	TTA *or* TTG
Methionine	TAC

17. A certain DNA strand has the base sequence: TACACACAAACGGGG. In the space provided below, write the sequence of amino acids synthesized from this code if it is read from left to right. AUG UGU GUU UGC CCC

Met - Cys - Val - Cys - Pro

18. The DNA sequence undergoes the following change:

TACACACAAACGGGG → TACACCCAAACGGGG

How would the sequence of amino acids be changed as a result of this mutation? SKIP

One amino acid would be different.

19. The original DNA sequence undergoes the following change:

TACACACAAACGGGG →TACACACAAACGGGT

State *one* reason this mutation produces *no change* in the action of the final molecule that will be synthesized from this code.

GGG and GGT code for same amino acid.

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20. Scientists have successfully cloned sheep and cattle for several years. A farmer is considering the advantages and disadvantages of having a flock of sheep cloned from a single individual. Discuss the issues the farmer should take into account before making a decision. Your response should include:

- how a cloned flock would be different from a noncloned flock
- *one* advantage of having a cloned flock
- *one* disadvantage of having a cloned flock
- *one* reason that the farmer could *not* mate these cloned sheep with each other to increase the size of his flock
- *one* reason that the offspring resulting from breeding these sheep with an unrelated sheep would *not* all be the same

*Reviewed in class

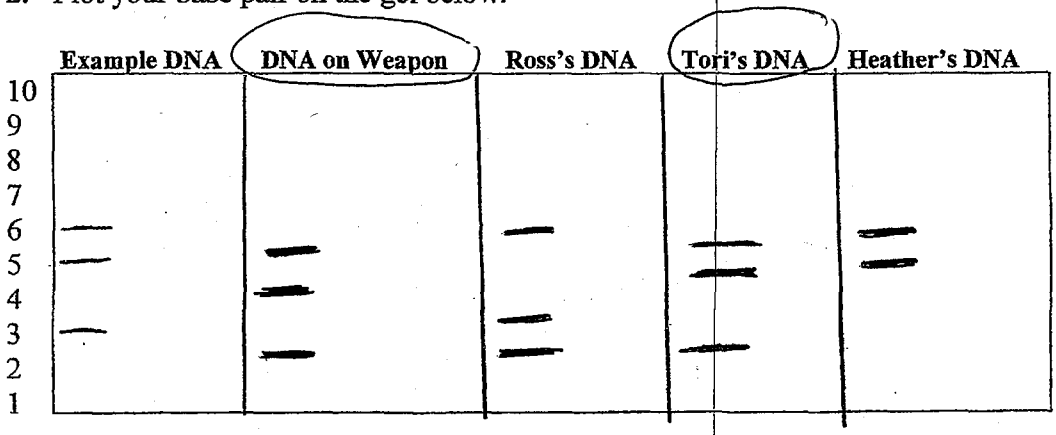
Name_____ Date_____

DNA was found on a murder weapon. There are three suspects – Ross, Tori and Heather. Help solve the crime.

1. Use the restriction enzyme _____ase to cut the DNA below.
   (Make up the name of your enzyme)
   This specific enzyme cuts after the GT sequence. For example, AG|T|CAAGT|CCTAAA.
   3 base pairs, 5 base pairs, 6 base pairs

DNA on the weapon:	ACGGT|TGGT|AC (5, 4, 2)
Ross – Suspect #1's DNA:	CGT|CCATGT|AT (3, 6, 2)
Tori – Suspect #2's DNA:	TCCGT|AAGT|GG (5, 4, 2)
Heather – Suspect #3's DNA:	ACGGT|ACGCGG (5, 6)

2. Plot your base pair on the gel below.



3. Who committed the crime? Tori

4. Facts to Know about Gel Electrophoresis:
   a. DNA is negatively charged.
   b. DNA will always move towards the positive electrode.
   c. The smaller segments will move much more easily through the small holes in the gel.
   d. The larger fragments of DNA lag behind.