**Biotechnology Review Sheet**

**SC.912.L.16.10: Evaluate the impact of biotechnology on the individual, society, and the environment, including medical and ethical issues.**

GENETIC ENGINEERING (GENOMICS):

* sometimes called biotechnology
* process of transferring a gene (DNA) from one organism to another
* Organisms with transferred gene now produce “recombined” genetic code ( called “recombinant DNA”)

Ex: insulin produced through bacteria Ex: oil-eating bacteria

* Has application in medicine, environment, industry, agriculture, selective breeding

**Human Genome Project**

The Human Genome Project (HGP) was the international, collaborative research program whose goal was the complete mapping and understanding of all the genes of human beings. All our genes together are known as our "genome."

**DNA Fingerprinting**

Fingerprinting is a technique used especially for identification (as for forensic purposes) by extracting and identifying the base-pair pattern of an individual's DNA—called also DNA typing, genetic fingerprinting.

**Genetically modified organism (GMO)**

A GMO is an organism or microorganism whose genetic material has been altered by means of genetic engineering. Plant crops, including both food and fiber harvests, have been subject to several types of genetic modification. Genes used to increase yields include those conveying drought, pest and disease-resistance. Genetically modified seeds have been grown in the U.S. since 1996, with the trend towards using GMO seeds steadily increasing. GMO animals are also frequently seen in agriculture. Genes for increased milk and egg production, disease-resistance and higher meat proportions are among those introduced into these populations. The inception of genetic modification has transformed the field of medicine. According to the Institute for Traditional Medicine, one of the first applications of genetic modification was the creation a bacterial strain capable of producing human insulin. Insulin, the hormone lacking in people with diabetes, was previously isolated from pig pancreas. Bioremediation describes any process by which living organisms are used to clean up contaminated soil or water. Bioremediation generally uses microorganisms, small bacteria and yeasts, which ingest the contaminants in a given site and render them inert through the cells' own metabolic processes. Although certainly advantageous, bioremediation has had limited use because the organisms must be able to survive, and indeed thrive, in a contaminated environment in order to do their work.

**Stem cells and tissue engineering**

Embryonic stem cells are the cells within the protective layer of the blastocyst. They are pluripotent, which means they can develop into any of the cells of the adult body. Researchers believe that, because they are pluripotent, and easy to grow, they have the best potential for replacing damaged or lost tissue or body parts. Adult stem cells, also known as progenitor cells or somatic stem cells, are located, in small quantities, throughout the body and generate specialized cells for the area they are located. These cells do not renew themselves as well as embryonic stem cells. Still, if these cells are put in a different environment, they may produce a different type of cells from the originating cell. Tissue engineering is the use of a combination of cells, engineering and materials methods, and suitable biochemical and physicochemical factors to improve or replace biological functions.

**Xenotransplantation**

A living cell, tissue or organ transplant between different species.



1. Genetic screening is a procedure where a person’s DNA is analyzed to identify a genetic predisposition to lethal diseases. One advantage of genetic screening is that it allows doctors to prevent and treat diseases before patients have symptoms. Which of the following is a disadvantage of genetic screening?
   1. Genetic screening results could be used to determine inheritance patterns in families.
   2. The likelihood of a child contracting an inheritable disease could be predicted by genetic screening.
   3. A doctor could combine a patient’s current symptoms with genetic screening results to diagnose and treat the patient.
   4. Insurance companies could drop a patient’s medical coverage based on potential medical issues projected by genetic screening.
2. Animal pharming is becoming more popular as the demand for human proteins and vaccines continues to grow. Animal pharming is the process of using transgenic animals to produce human drugs such as insulin and human growth hormone. Transgenic animals are animals which have been genetically transformed by splicing and inserting foreign genes into their chromosomes. If successful, the inserted gene can enable an animal to make certain proteins in its milk, blood, sperm, or eggs. Which of the following is NOT true about transgenic animals?
   1. Transgene DNA may insert itself into the genome in a way that disrupts the animal’s normal gene function.
   2. Transgenic animals cannot pass their ability to produce the desired drug to its offspring.
   3. Transgenic animals can produce the desired drug at high levels without endangering its own health.
   4. Transgenic animals can be easily tested for the new gene.
3. In October of 1990, the US Department of Energy’s Office of Science and the US National Institute of Health began the process of mapping the human genome. This process was referred to as The Human Genome Project and was intended to identify the 20,000 – 25,000 genes of the human genome. A working draft of the genome was announced in 2000 and a complete one in 2003. Which of the following describes the main benefit of completing The Human Genome Project?
   1. Cloning humans
   2. Designing new human genes
   3. Patenting specific human genes
   4. Identifying genetically-based diseases
4. Genetic engineering has both positive and negative outcomes. One of the most common areas where genetic engineering is used is in agriculture. If farmers plant more genetically modified crops, which of the following negative outcomes could occur?
   1. An increase in the use of pesticides
   2. A decrease in genetic diversity of the crops
   3. An increase in the contamination of the water supply
   4. A decrease in crop productivity
5. Rice, the most popular food crop in the world, can be successfully grown only in certain places. If trends in climate change continue, the areas in which rice currently grows will be significantly reduced. Which of the following is the best way that biotechnology can keep the harvest of rice from decreasing?
   1. Identifying new areas with soil fertile enough for rice production.
   2. Developing clean energy sources to reduce carbon dioxide production worldwide.
   3. Seeing clouds with dry ice to produce more rainfall where it is needed.
   4. Genetically engineering rice crops that are tolerant to change in the environment.