**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Underline important

concepts as you read.

Points will be deducted

if you don’t.

**Block: \_\_\_\_\_\_**

**What is Biotechnology**

**(November 8, 2012)**

Biotechnology is the application of biological and physical principles of organisms, and of their components, to help solve human problems. Some kinds of biotechnology, such as animal breeding, date back thousands of years. In recent years, many new techniques in genetics, molecular biology, biochemistry, engineering, and computer science have been developed for working with organisms, and their genetic and biochemical material.

**HISTORICAL BIOTECHNOLOGY**

Biotechnology has existed ever since humans started to manipulate organisms for their own purposes. Early kinds of biotechnology included yogurt and cheese making, animal and plant breeding, and herbal-medicine use. These kinds of biotechnology were used successfully a long time before people understood the biological processes that were involved.

After the invention of the microscope in the 1600s, scientists had the first real opportunity to study the world of microscopic organisms. Using microscopes, scientists were able to see cells, the microscopic organisms called protists, and eventually bacteria. The discovery of bacteria led to the germ theory of disease. The development of the germ theory of disease started a revolution in the treatment of diseases.

At the same time that many scientists were investigating the microscopic world, a breakthrough occurred in the understanding of heredity. In the 1850s, an Austrian monk named Gregor Mendel discovered that the inheritance of characteristics in pea plants was governed by some simple rules. Following Mendel, other scientists expanded the study of heredity to include all kinds of living organisms. The scientific study of heredity led to more predictable results in breeding animals and plants.

**THE DNA REVOLUTION**

One of the most profound changes in the study and application of biotechnology came from the discovery of deoxyribonucleic acid, or DNA. During the first half of the twentieth century, scientists were able to show that DNA is the heredity material of organisms. Hundreds of scientists studied how DNA controls the normal activities of cells. Researchers found that mutations in DNA cause many kinds of diseases.

As scientists began to understand the role of DNA in living organisms, they also began to investigate ways to beneficially change the DNA of organisms. Starting with bacteria and viruses, scientists found molecular techniques to permanently change the heredity and functioning of organisms. As scientists learned about these processes, they began to think that they could cure many kinds of diseases by correcting defects in the DNA of organisms.

**SCIENTIFIC AND SOCIAL EFFECTS**

Biotechnology is causing a profound scientific revolution. “A revolution in science is not simply an accumulation of data, a harvest of results, a change in the landscape. It is a change in the way people think, in the way they look at things. It is a change in vision itself,” started Francois Jacob, 1965 Nobel Laureate.

Biotechnology is also causing profound changes in society. Scientists’ ability to alter the DNA of organisms is affecting ethics, law, medicine, and agriculture. Because of the far-ranging ethical and societal implication of many of the new techniques of biotechnology, biotechnology is changing the way people view the world. The diagram in Figure 1.1 on the following page illustrates some of the areas of life affected by biotechnology.

|  |  |  |  |
| --- | --- | --- | --- |
| **Historical****Aspects** | **Business and** **Industry** | **Multidisciplinary****Research** | **Societal/Ethical****Implications** |
| Plant breedingAnimal breedingWine makingDairy productsBread makingAntibioticsHerbal Medicine | BiomedicalAgricultural biotechnologyForensic scienceIndustrial productionConservation and wildlife management | BiochemistryMolecular biologyBiophysicsImmuno-chemistryCell cultureFermentationBacteriologyGenetic medicineConservation biologyEvolutionary biology | Genetic privacyGermplasm ownershipGenetic screeningGenetically engineered foodInsurabilityTreatment of genetic diseasesDNA profilingPatenting of life and intellectual property |

Figure 1.1

Answer the following questions:

1. Name three early (historic) applications of biotechnology that were used before the invention of the microscope.
2. Briefly describe two discoveries in biology, after the invention of the microscope, that had important practical effects.
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Explain why the study of DNA is so important for biotechnology.
6. In the chart above (Figure 1-1), what are the four general areas of life that

biotechnology affects?

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Under each of the four general areas listed, **circle** two careers that you might like to learn more about.