Types of Biotechnology

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Types of Biotechnology

- **Microbial Biotechnology**
- **The use of yeast for making beer and wine is on e of oldest application of biotechnology.**
- **By manipulating microorganisms such as bacteria and yeast , microbial biotechnology has created better enzymes and organisms for making many foods, simplifying manufacturing and production process, and making decontamination processes for the removal of industrial waste products more efficient.**
- **Microbes are used to make vaccines and to clone and product batch amounts of important proteins used in human medicine including insulin and growth hormone.**

Types of Biotechnology

- **Microbial Biotechnology**
- **Explore strategies used to detect microbes for diagnostic purpose in humans, food samples and other sources and approaches to detect and combat microbes as possible bioweapons.**

Agriculture Biotechnology

- **Plant biotechnology and agricultural applications of biotechnology also called ag biotech.**
- **From genetically engineered, pest resistant plants that do not need to be sprayed with pesticides to foods with higher protein or vitamin content and drugs developed and grown as plant products.**
- **United Nations Food and Agriculture Organization has predicted that feeding a world population of 9.1 billion people in 2050 will require raising overall food production by some 70 percent.**
- **Provides solutions for today's farmers in the form of plants that are more environmentally friendly while yielding more per acre, resisting diseases and insect pests, and reducing farmers production costs.**

Agriculture Biotechnology

- **Genetic manipulation of plants has been used for over 20 years to produce genetically engineered plants with altered growth characteristics such as drought resistance, tolerance to cold temperature, and greater food yields.**
- **Research conducted during past 10 years clearly demonstrated that plants can be engineered to produce a wide range of pharmaceutical proteins in a broad array of crop species and tissues.**
- **The use of plants as sources of pharmaceutical products is an application of agricultural biotechnology commonly called molecular pharming.**

Agriculture Biotechnology

- **Tobacco is a nonfood crop that has been subject of many years of breeding and agronomic research.**
- **Tobacco plants have been engineered to produce recombinant proteins in leaves, and these plants an be grown in large fields for molecular pharming but gene transfer to nontarget plants has already occurred and some varieties of super weeds has occurred resulting in changes in use of some bioengineered plants.**
- **The bioethics of these solutions has already created strong opinions on both sides about the continued development and use of GM plants.**

Agriculture Biotechnology

- **Agriculture waste, prairie grass and other high cellulose sources including corn by products will have to become efficient sources of energy through new decomposition and fermentation methods developed by biotechnology. These challenges are well under way.**

Animal Biotechnology

- **Animal biotechnology is one of the most rapidly changing and exciting areas of biotechnology.**
- **Animals can be used as bioreactors to produce important products.**
- **For example goats, cattle, sheep and chickens are being used as sources of medically valuable proteins such as antibodies- protective proteins that recognize and help body cells to destroy foreign materials.**
- **antibody treatments are being used to help improve immunity in patients with immune system disorders.**
- **Many other human therapeutic proteins produced from animals are in use, yet most of these proteins are needed in quantities that exceed hundreds of kilograms. To achieve this large scale production, scientists can create female transgenic animals that express therapeutic proteins in milk.**

Animal Biotechnology

- **Transgenic animals contain genes from another source. For instance, human genes for cloning proteins can be introduced into goats for the production of these proteins in their milk.**
- **Animals are also very important in basic research as model organisms. For instance, gene knockout experiments, in which one or more genes are disrupted can be helpful for learning about the function of gene.**
- **The idea behind a knockout is to disrupt a gene and then, by looking at which function are affected in an animal as a result of loss of a particular gene, determine the role and importance of that gene.**

Animal Biotechnology

- **Because of many genes found in animals (including mice and rats) are also present in humans, learning about gene function in animals can lead to greater understanding of gene function in humans.**
- **Similarly, the design and testing of drug and genetic therapies in animals often leads to novel treatment strategies in humans.**
- **In 1997, scientists and the general public expressed surprise, excitement, and reservations about the announcement that scientists at the Roslin institute in Scotland had cloned the now famous sheep called Dolly.**
- **Dolly was the first mammal created by a cell nucleus transfer process.**

Animal Biotechnology

- **Many other animals have been cloned since Dolly.**
- **In 2009, FDA approved the first drug (Anticlotting protein) produced in animals. Although animal cloning has elicited fears and concern about the potential for human cloning.**
- **Scientists for a number of reasons, are generally excited about the techniques used to clone animals. For instance, these techniques may lead to the cloning of animals containing genetically engineered organs that can be transplanted into humans without fear of tissue rejection.**
- **Does a ready supply of donor organs of all types for all people who need organ transplants sound like a good plant to you. If so, not everyone agrees. Animals cloning and the controversies surrounding organism are important subjects.**

Forensic Biotechnology

- **DNA fingerprinting- A collection of methods for detecting an organism unique DNA pattern-**
- **Forensic biotechnology is a powerful tool for law enforcement that can lead to the inclusion or exclusion of a person from suspicion, based on DNA evidence.**
- **DNA fingerprinting can be accomplished using trace amounts of tissue, hair, blood or body fluids left behind at a crime scene**
- **It was first used in 1987 to convict a rapist in England but is now routinely introduced as evidence in court cases throughout the world to convict criminals as well as to free those wrongly accused of a crime.**

Forensic Biotechnology

- **DNA fingerprinting has many applications, including use in paternity cases for pinpointing a child's father and identifying human remains.**
- **Another application is the DNA fingerprinting of endangered species.**
- **Scientists also use DNA fingerprinting to track and confirm organisms that spread disease, such as Escherichia coli in contaminated meat and to track diseases such as AIDS, meningitis, tuberculosis, lyme disease and West Nile virus.**
- **Recently, a French company even developed a gene expression test designed to determine if expensive food products contain cheap, substitute, mystery meats from species such as cats and eels.**
- **The need to develop tests for valuable species that can be used to fingerprint.**

Bioremediation

- **The use of biotechnology to process and degrade a variety of natural and human made substances, particularly those contribute to environmental pollution.**
- **Bioremediation is being used to clean up many environmental hazards that have been caused by industrial progress.**
- **The Exxon valdez oil spill in prince William sound, Alaska. By stimulating the growth of oil degrading bacteria, which were already present in the Alaska soil, many miles of shoreline were cleaned up nearly three times faster than they would have been chemical cleaning agents alone been used.**
- **Rapid degradation by microbes of dispersed oil droplets from the Deep water horizon spill in 2010 has already enabled research into natural degrading organisms and the enzymes in future spill.**

Aquatic Biotechnology

- **Vast biotechnology possibilities are offered by water- the medium that covers the majority of our planet.**
- **One of the oldest applications of aquatic biotechnology is aquaculture, raising finfish or shellfish in controlled conditions for use as food source.**
- **Trout, salmon, and catfish are among many important aquatic culture in the united states.**
- **Aquaculture is growing in popularity throughout the world, especially in developing countries.**
- **It has recently been estimated that close to 50 percent of all fish consumed by humans worldwide produced by aquaculture.**
- **Use of genetic engineering to produce disease resistant strains of oysters and vaccines against viruses that infect salmon and other finfish.**

Aquatic Biotechnology

- **Transgenic salmon have been created that overproduce growth hormone, leading to extraordinary growth rates over short growing periods and thus decreasing the time and expense required to grow salmon for market sale.**
- **The uniqueness of many aquatic organisms is another attraction for biotechnologies.**
- **In our ocean, marine bacteria, algae , shellfish, finfish and countless other organisms liver under some of the harshest conditions in the world.**
- **Extreme cold, pressure from living at great depths, high salinity, and other environmental constraints are hardly a barrier because aquatic organisms have been adapted to their difficult environments. As a results, such organisms are thought to be rich and valuable sources of new genes, proteins and metabolic processes that may have human**

Aquatic Biotechnology

- **Bioprospecting efforts are ongoing around the world to identify aquatic organisms with novel properties that may be exploited for commercial purposes.**
- **For instance, certain species of marine plankton and snails have been found to be rich sources of antitumor and anticancer molecules.**
- **Intensive research efforts are under way to better understand the wealth of potential biotechnology applications that our aquatic environments may harbor.**

Medical Biotechnology

- **We introduced the concept that many recombinant proteins are being manufactured for human medical applications.**
- **From preventive to medicine to the diagnosis of health and illness to the treatment of human disease conditions**
- **over 350million people worldwide have been helped by drugs and vaccines developed through biotechnology.**
- **It seems as though hardly a week goes by without news of a genetic breakthrough such as discovery of a human gene involved in a disease process.**
- **Television, newspapers, and popular magazines all report important discoveries of new genes and other headlines involving DNA.**

Medical Biotechnology

- **Every day, new information from the human project is helping scientists identify defective genes and decipher the details of genetic diseases such as sickle cell anemia, Tay Sachs disease, cystic fibrosis and cancer as well as and forms of infertility, to give just a few examples.**
- **The human genome project has resulted in new techniques for genetic testing to identify defective genes and genetic disorders and we explore many of the techniques in this text.**
- **The 1000 genomes project has already identified over 20, 000 genetic variations between 629 humans whose DNA was sequenced for genes that they shared. These variations are been extensively researchered as possibly beneficial in protecting from disease.**

Medical Biotechnology

- **Gene therapy approaches, in which genetic disease conditions can be treated by inserting normal genes into a patient or replacing diseased genes with normal genes, are being pioneered.**
- **Stem cell technologies are some of the newest, most promising aspects of medical biotechnology, but they are among the most controversial topics in all of science.**
- **Stem cells are immature cells that have the potential to develop and specialize into nerve cells, blood cells, muscle cells and virtually any other type of cell in the body.**
- **Stem cells can be grown in a laboratory and when treated with different types of chemicals can be coaxed to develop into different types of human tissue that might be used in transplantation to replace damaged tissue.**