MODERN BIOTECHNOLOGY

Modern biotechnology was initiated with the development of recombinant DNA technology (ie., genetic engineering) and monoclonal antibody technology.

GENETIC ENGINEERING. Genetic engineering became possible as biologists deepened their understanding of deoxyribonucleic acid, or DNA, the molecule that codes the instructions for growth, maintenance, and reproduction of all living things. Each instruction is called a gene. Many genes - 100,000 to 300,000 - make up an organism's genome, its entire instruction manual. Each gene is a blueprint for a single protein. Proteins are natural substances that give living things their structure and control their functions. Enzymes, antibodies, and some hormones are proteins.

Genetic engineering is a process by which biologists combine the gene(s) of one organism (the donor) with the genome of another organism (the recipient). The resulting transgenic organism is genetically altered to produce a new gene product, be it human insulin, antisense RNA, or an industrial enzyme. Moreover, the transgenic organism can pass this alteration onto to its offspring, thus insuring a endless supply of transgenic organisms.

MONOCLONAL ANTIBODIES. This technology involves the commercial production of identical antibodies from individual clones (ie., monoclonal) of hybridoma cells. A hybridoma cell is created by fusing a lymphocyte with a myeloma cell. The hybridoma inherits its ability to produce antibodies from the lymphocyte and its ability to divide indefinitely from the myeloma cell. Monoclonal antibodies have a high affinity for a discrete region of the antigen, be it a drug, hormone, tumor marker, or infectious disease.

Monoclonal antibody technology is the basis of immunodiagnostics Immunodiagnostic test kits allow for the rapid and accurate detection of a disease or physiological state. Clinical laboratories use immunodiagnostic test kits to detect sexually transmitted diseases, hepatitis B, AIDS, cancer types, and infectious agents. Monoclonal antibodies are also being developed as therapeutic drugs to combat infectious agents and autoimmune diseases. Upon binding to the target cell the therapeutic monoclonal elicits an immune response which leads to the death of the cell.

COMMERCIAL BIOTECHNOLOGY

Biotechnology is not a science, nor is it an industry; it is a technology comprised of many scientific disciplines (eg microbiology, biochemistry, genetics, molecular biology, chemical engineering) that are applied to the production of commercial products by living organisms. Biotechnology is utilized by a diverse group of companies with the shared mission of using biological processes to develop products to meet human needs. The following sections reviews biotechnology applications in medicine, agriculture, and the environment.

MEDICAL. Biotechnology has completely revolutionized medicine. Researchers are discovering the genetic and molecular basis of diseases that have stymied the medical community for generations, such as multiple sclerosis, cystic fibrosis, and breast cancer. With this information, new medicines and therapies can be developed which use proteins, enzymes, antibodies, and other substances naturally produced in the human body to fight infections and diseases, as well as to correct genetic disorders. Human genes are the blueprints for the biotherapeutic drugs; plant and animal cells, bacteria and yeasts are the manufacturing plants, or bioreactors.

The traditional method for cloning human genes centered on purifying the therapeutic