Appendix I

List of Acronyms and Glossary of Terms

List of acronyms

AAU —American Association of Universities
AcNPV –*Autographa californica* nuclear poly-hedrosis virus
ACS —American Cancer Society
AHF -antihemophilic factor
AIDS -acquired immune deficiency syndrome
ANDA —Abbreviated New Drug Application
ANVAR —L'Agence Nationale de la Valorisation de la Recherche; National Agency for the Funding of Research (France)
ARES –Applied Research Systems (Netherlands)
ARS –Agricultural Research Service (U.S.)
AT&T –American Telephone & Telegraph Co. (U.S.)
BCr —Brazilian cruzeiros
BGA –Bundesgesundheitsamt: Federal Health Office @. R. G.)
BISCT —Biotechnology Institute and Studies Centre Trust (U. K.)
BMFT —Bundesministerium ftlr Forschung und Technologies; Federal Ministry of Science and Technology @. R. G.)
BRL –Bethesda Research Laboratories (U. S.)
BTG –British Technology Group (U.K. Department of Industry)
CAMR -Center for Applied Microbiology and Research (U. K.)
CCL <ommodity Control List (U.S.)
CDC -Centers for Disease Control (U.S.)
C.F.R. -Code of Federal Regulations (U. S.)
CNPq -Conselho Nacional de Desenvolvimento Cientifico e Tecnologico; National Research Council, now known as the Council for Development of Science and Technology (Brazil)
CNRS -Centre National de la Recherche Scientiflque; National Center for Scientific Research (France)
CoCom -Coordinating Committee for Muki-Lateral Export Controls
CODIS <Comite d'Orientation des Industries Strategiques; Committee for the Organization of Strategic Industries (France)
COGENE -Committee on Genetic Experimentation (international)
CRGO -Competitive Research Grants Organization (U.S.)
CSIRO -Commonwealth Science and Research Organisation (Australia)
CSRS -Cooperative State Research Service (U.S.)
DARPA —Defense Advanced Research Projects Agency (U.S. Department of Defense)
DECHEMA —Deutsche Gesellschaft ftir Chemisches Apparatewesen; German Society for Chemical Engineering @. R. G.)
DESAT –Defense Business Advanced Technology program (U.S. Department of Defense)
DFG —Deutsche Forschungsgemeinschaft; German Research Society (F. R.G.)
DHHS —Department of Health and Human Services (U. S.)
DM —Deutsche mark
DNA -deoxyribonucleic acid
DOD –Department of Defense (U. S.)
DOE –Department of Energy (U.S.)
DSM —Deutsche Sammlung von Mikroorganismen; German Collection of Micro-Organisms (F.R.G.)
EAA –Export Administration Act of 1979 (U.S.)
ECUT —Energy Conversion and Utilization Technologies program (U. S.)
EEC –European Economic Community
EMBL –European Molecular Biology Laboratory
EPA –Environmental Protection Agency (U.S.)
EPC —European Patent Convention
EPO –European Patent Office (supranational)
ETH —Eidgentissiche Technische Hochschule; Federal Institute of Technology (Switzerland)
FDA –Food and Drug Administration (U. S.)
FFDCA —Federal Food, Drug and Cosmetic Act (Us.)
FIFRA —Federal Insecticide, Fungicide, and Rodenticide Act U.S.)
FINEP —Financiadora de Projetos National Funding Agency for Studies and Projects (Brazil)
FMD —foot-and-mouth disease
FRI —Fermentation Research Institute (.Japan)
F.R.G. —Federal Republic of Germany
F-rc –Federal Trade Commission (U.S.)
GAO -General Accounting Office (U.S.)
GBF -Gesellschaft ftlr Biotechnologische Forschung; Society for Biotechnological Research (l?. R. G.)
GE -General Electric Corp. (U. S.)
G.E. -Guidelines for Examination
GENBANK -Genetic Sequence Data Bank (U. S.)
GG –gamma globulin

GH –growth hormone
GMAG -Genetic Manipulation Advisory Group (U.K.)
GRAS –generally recognized as safe by qualified experts
GWB -Gesetz gegen Wettbewerbsbeschrankungen; Act Against Restraints of Competition (F.R.G.)
HBsAg —hepatitis B surface antigen
hCG —human chorionic gonadotropin
HFCS –high fructose corn syrup
hGH –human growth hormone
hI —human insulin
HPLC —high-performance liquid chromatography
H.R. —House of Representatives (U.S. Congress)
HSA —human serum albumin
HSE –Health and Safety Executive (U. K.)
HSV —herpes simplex virus
HSV2 –herpes simplex virus type 2
IBC —Institutional Biosafety Committee
IBM —International Business Machines Corp. (U. S.)
ICI –Imperial Chemical Industries (U.K.)
Ifn —interferon
IMC —International Minerals & Chemicals Corp. (U. K.)
IND —Notice of Claimed Investigational Exemption for a New Drug
Ingene —International Genetic Engineering, Inc. (us.)
INSERM —Institut National de la Sante et de la Recherche Medicale; National Institute of Health and Medical Research (France)
IOCM —Interkantonale Kontrollstelle ftir Heilmittel: Intercantonal Office for the Control of Medicaments (Switzerland)
IRS –Internal Revenue Service (U. S.)
ITC —International Trade Commission (U. S.)
JAFCO —Japan Associated Finance Corporation
JDB —Japan Development Bank
JETRO —Japan External Trade Organization
JITC –Japanese Fair Trade Commission (Japan)
LSI —Large-Scale Integration
MAbs —monoclinal antibodies
MAFF —Ministry of Agriculture, Forestry, and Fisheries (Japan)
MCC –Microelectronics Computer Corp. (U. S.)
MCTL —Militarily Critical Technologies List (U.S. Department of Defense)
MEOR —microbial enhanced oil recovery
MGH —Massachusetts General Hospital
MGI –Molecular Genetics, Inc. (U. S.)
MIT —Massachusetts Institute of Technology
MITI —Ministry of International Trade and industry (Japan)
MOF —Ministry of Finance (Japan)
MRC –Medical Research Council (U. K.)
mRNA —messenger RNA
MS —multiple sclerosis
MSG —monosodium glutamate
MSH —melanoycte-stimulating hormone
MSI —Medium-Scale Integration
NAS –National Academy of Sciences (U. S.)
NASA —National Aeronautics and Space Administration (U. S.)
NBFs —new biotechnology firms
NCDRH —National Center for Devices and Radiologic Health (U. S.)
NCI –National Cancer Institute (U. S.)
NDA —New Drug Application
NIBSC —National Institute of Biological Standards and Controls (U. K.)
NIH –National Institutes of Health (U. S.)
NIOSH —National Institute for Occupational Safety and Health (U. S.)
NLG –Netherlands guilder
NRC –National Research Council (Canada)
NSF —National Science Foundation (U. S.)
NYU —New York University
OECD -Organisation for Economic Co-Operation and Development
OMB -Office of Management and Budget (U. S.)
OSHA -Occupational Safety and Health Administration (U. S.)
OSRD -Office of Scientific Research and Development (U. S.)
OSTP -Office of Science and Technology Policy (Executive Office of the President, U.S.)
OTA Office of Technology Assessment (U.S.)
PAL —phenylalanine ammonia Iyase
PEPCase –phosphoenol pyruvate carboxylase
P m —polyhydroxybutyrate
PMA —Pharmaceutical Manufacturers Association (U. S.)
PTo –Patent and Trademark Office (U. S.)
PVPA –Plant Variety Protection Act of 1970 (Us.)
RAc —Recombinant DNA Advisory Committee (Us.)
R&D —research and development
rDNA —recombinant DNA
Ri —root-inducing
RuBPCase —ribulose bisphosphate carboxylase
SAES —State Agricultural Experiment Stations (Us.)
SBA –Small Business Administration (US.)

SBF	–Stiftelsen Bioteknisk Forksning; Biotechnology Research Foundation (Sweden)
SBIC	—Small Business Investment Corporation
SBIR	—Small Business Innovation Research
SCP	—single-cell protein
SERC	—Science and Economic Research Council (U.K.)
SFr	—Swiss francs
SNDA	—Supplemental New Drug Application
SOCal	—Standard Oil of California
SRBCS	—sheep red blood cells
STA	–Science and Technology Agency (Japan)
STU	—Stryelsen for Teknisk Utveckling; National Swedish Board for Technical Development
TDC	—Technical Development Corporation (U.K.)
T-DNA	–transferred-DNA
THMs	—trihalomethanes
Ti	—tumor-inducing
tPA	—tissue plasminogen activator
TRP	—tangible research property
TSCA	–Toxic Substance Control Act (U. S.)
UCLA	—University of California, Los Angeles
UCRDO	—University Connected Research and Development Organization (Israel)
UCSD	—University of California, San Diego
UCSF	—University of California, San Francisco
U.K.	–United Kingdom
UPOV	—International Convention for the Protection of New Varieties and Plants
U.s.c.	—United States Code
USDA	—U.S. Department of Agriculture
USM	–Unlisted Securities Market (U. K.)
UWG	-Gesetz gegen den unlauteren wettbewerb; Unfair Competition Law of 1909 (F.R.G.)
VLSI	—Very-Large Scale Integration
Vocs	—volatile organic compounds
VST Act	–Virus, Serum, Toxin Act of 1913 (U.S.)
WARF	—Wisconsin Alumni Research Fund
WFG	—Deutsche Wagnisfinanzierungs-Gesellschaft; Risk Financing Society (F. R.G.)
WHO	—world Health Organization

Glossary of terms

Accession In biotechnology, the addition of germplasm deposits to existing germplasm storage banks.

Acclimatization The biological process whereby an organism adapts to a new environment. Describes process of developing microorganisms that degrade toxic wastes in the environment.

Active immunity Disease resistance in a person or animal due to antibody production after exposure to a microbial antigen following disease, inapparent infection, or inoculation. Active immunity is usually long-lasting. (Compare ***passive*** *jrnrnunjty.)*

Adsorption The taking up of molecules of gases, dissolved substances, or liquids by the surfaces of solids or liquids with which they are in contact.

Aerobic% Living or acting only in the presence of oxygen.

Affinity chromatography The use of compounds, such as antibodies, bound to an immobile matrix to "capture" other compounds as a highly specific means of separation and purification.

Amino acid= The building blocks of proteins. There are 20 common amino acids.

Amino acid sequence The linear order of amino acids in a protein.

Anaerobic Living or acting in the absence of oxygen.

Antibiotk A spedic type of chemical substance that is administered to fight infections, usually bacterial infections, in humans or animals. Many antibiotics are produced by using microorganisms; others are produced synthetically.

Antibody A protein (immunoglobulin) produced by humans or higher animals in response to exposure to a specific antigen and characterized by specific reactivity with its complementary antigen. (See also *monoclinal antibodies.)*

Antidumping laws: Laws that prevent a country from exporting goods to another country and selling those goods below cost or more cheaply than in the home market. Antidumping duties may be imposed by a country to offset damages sustained from dumping. In the United States, the antidumping law most relevant to biotechnology is Section 337 of the Tariff Act of 1930 (19 US.C. 1337).

Antigem A substance, usually a protein or carbohydrate which, when introduced in the body of a human or higher animal, stimulates the production of an antibody that will react specifically with it.

Antihemophilic factor (AHF): The fraction of whole blood that contains blood clotting agents. AI-IF is used to treat hemophilia, a set of hereditary disorders that prevent blood clotting.

Antimicrobial agenti See *antibiotic.*

Antiserum Blood serum containing antibodies from animals that have been inoculated with an antigen. When administered to other animals or humans, antiserum produces passive immunity.

Applied research Research to gain knowledge or understanding necessary for determining the means by which a recognized and specit3c need maybe met (National Science Foundation definition). (See also *generic applied research.)*

Aromatic compound: A compound containing a benzene ring. Many specialty and commodity chemicals are aromatic compounds.

Ascites: Liquid accumulations in the peritoneal cavity. Used as a method for producing monoclinal antibodies.

Assay A technique that measures a biological response.

Attenuated vaccine Whole, pathogenic organisms that are treated with chemical, radioactive, or other means to render them incapable of producing infection. Attenuated vaccines are injected into the body, which then produces protective antibodies against the pathogen to protect against disease.

Autotrophic: Capable of self-nourishment (opposed to heterotrophic).

Bacillus subtilis @3. *subtilis):* An aerobic bacterium used as a host in rDNA experiments.

Bacteria: Any of a large group of microscopic organisms having round, rodlike, spiral, or filamentous unicellular or noncellular bodies that are often aggregated into colonies, are enclosed by a cell wall or membrane, and lack fully differentiated nuclei. Bacteria may exist as free-living organisms in soil, water, organic matter, or as parasites in the live bodies of plants and animals.

Bacteriophage (or phage)/bacterial virus: A virus that multiplies in bacteria. Bacteriophage lambda is commonly used as a vector in rDNA experiments.

Basic research: Research to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind (National Science Foundation definition).

Batch processing: A method of bioprocessing in which a bioreactor is loaded with raw materials and microaganisms, and the process is run to completion, at which time products are removed. (Compare *continuous processing.)*

Betaendorphin: A neuro-active polypeptide with analgesic properties similar to opiate compounds such as morphine.

Biocatalyst: An enzyme that plays a fundamental role in living organisms or industrially by activating or accelerating a process.

Biochemical Characterized by, produced by, or involving chemical reactions in living organisms; a product produced by chemical reactions in living organisms.

Biochip: An electronic device that uses biological molecules as the framework for molecules that act as semiconductors and functions as an integrated circuit.

Bioconversiom A chemical conversion using a biocatalyst.

Biodegradation: The breakdown of substances by

Biological oxygen demand (BOD): The oxygen used in meeting the metabolic needs of aerobic organisms in water containing organic compounds.

Biological response modifer: Generic term for hormones, neuroactive compounds, and immunoactive compounds that act at the cellular level; many are possible targets for production with biotechnology.

Biological warfare agents: Biological products or processes that are determined to be useful in military applications and whose export is restricted for national security reasons.

Biologics: Vaccines, therapeutic serums, toxoids, antitoxins, and analogous biological products used to induce immunity to infectious diseases or harmful substances of biological origin.

Biomass: All organic matter that grows by the photosynthetic conversion of solar energy.

Biooxidation: Oxidation (the loss of electrons) catalyzed by a biocatalyst.

Biopolymers: Naturally occurring macromolecules - that include proteins, nucleic acids, and polysaccharides.

Bioprocess Any process that uses complete living cells or their components (e.g., enzymes, chloroplasts) to effect desired physical or chemical changes.

BioreactoR: Vessel in which a bioprocess takes place.

Biosensor: An electronic device that uses biological molecules to detect specific compounds.

Biosurfactant: A compound produced by living organisms that helps solubilize compounds such as organic molecules (e.g., oil and tar) by reducing surface tension between the compound and liquid.

Biosynthesis Production, by synthesis or degradation, of a chemical compound by a living organism.

Biotechnology Commercial techniques that use living organisms, or substances from those organisms, to make or modify a product, and including techniques used for the improvement of the characteristics of economically important plants and animals and for the development of microorganisms to act on the environment. In this report, biotechnology is used to mean "new" biotechnology, which only includes the use of *novel* biological techniques—specifically, recombinant DNA techniques, cell fusion techniques, especially for the production of monoclinal antibodies, and new bioprocesses for commercial production.

Callus An undifferentiated cluster of plant cells that is a first step in regeneration of plants from tissue culture.

Capacito~ A device that consists of two conductors insulated from each other by a dielectric. A capaci -

current, and introduces alternating current into a circuit.

Carboxylatiom The addition of an organic acid group (COOH) to a molecule.

Catalysi= A modification, especially an increase, in the rate of a chemical reaction induced by a material (e.g., enzyme) that is chemically unchanged at the end of the reaction.

Catalysfi A substance that induces catalysis; an agent that enables a chemical reaction to proceed under milder conditions (e.g., at a lower temperature) than otherwise possible. Biological catalysts are enzymes; some nonbiological catalysts include metallic complexes.

Gelk The smallest structural unit of living matter capable of functioning independently; a microscopic mass of protoplasm surrounded by a semipermeable membrane, usually including one or more nuclei and various nonliving products, capable alone, or interacting with other cells, of performing all the fundamental functions of life.

Cell culture The in vitro growth of cells isolated from multicellular organisms. These cells are usually of one type.

Cell differentiation The process whereby descendants of a common parental cell achieve and maintain specialization of structure and function.

Cell fusion: Formation of a single hybrid cell with nuclei and cytoplasm from different cells.

Cell line Cells that acquire the ability to multiply indefinitely in vitro.

Cellulase: The enzyme that digests cellulose to sugars.

Cellulose: A polymer of six-carbon sugars found in all plant matter; the most abundant biological compound on earth.

Centrifugc: A machine for whirling fluids rapidly to separate substances of different densities by centrifugal force; also, to whirl in a centrifuge.

***Chakrabarty* decision:** *Diamond v. Chakrabarty*, U.S. Department of Commerce, PTA, sec. 2105, 1980; landmark case in which U.S. Supreme Court majority held that the inventor of a new microorganism, whose invention otherwise met the legal requirements for obtaining a patent, could not be denied a patent solely because the invention was alive,

Chemostat selectiom Screening process used to identify micro-organisms with desired properties, such as micro-organisms that degrade toxic chemicals. (See also *acclimatization,)*

Chloroplastcx Cellular organelles where photosynthesis occurs.

Chromatography A process of separating gases, liquids, or solids in a mixture or solution by adsorption as the mixture or solution flows over the absorbent medium, often in a column. The substances are separated because of their differing chemical interaction with the absorbent medium.

Chromosomeex The rodlike structures of a cell's nucleus that store and transmit genetic information; the physical structure that contain genes. Chromosomes are composed mostly of DNA and protein and contain most of the cell's DNA. Each species has a characteristic number of chromosomes.

Clinical triak One of the final stages in the collection of data for drug approval where the drug is tested in humans.

Clone A group of genetically identical cells or organisms produced asexually from a common ancestor.

Cloning The amplification of segments of DNA, usually genes.

Coding sequence% The region of a gene (DNA) that encodes the amino acid sequence of a protein.

Cofactom Additional molecules needed for enzymatic function.

Colibacillosis A bacterial disease that causes diarrhea, dehydration, and death in calves and piglets,

Commodity chemical=s Chemicals produced in large volumes that sell for less than $1 per pound (500 per kg). (Compare *specialty chemicals.)*

Commodity controls list (CCL): Large roster of items that have been identified under the Export Administration Act by the U.S. Department of Commerce to require a "validated license" before they can be exported to certain countries.

Complementary DNA (cDNA): DNA that is complementary to messenger RNA; used for cloning or as a probe in DNA hybridization studies.

Compulsory licensing: Laws that require the licensing of patents, presumably to ensure early application of a technology and to diffuse control over a technology.

Continuous processing: Method of bioprocessing in which raw materials are supplied and products are removed continuously, at volumetrically equal rates. (Compare *batch processing.)*

***Corn* wet milliqp** The processing of corn, including hydrolysis of starch, to yield products used for food and chemicals.

Cosmid: A DNA cloning vector consisting of plasmid and phage sequences.

Countervailing duties Duties charged to importers when their product is determined to cause or threaten material injury to domestic industries producing similar products.

Corporate venture capitak Capital provided by

major corporations exclusively for high-risk investments.

Culture deposits: See *accession.*

Culture medium: Any nutrient system for the artificial cultivation of bacteria or other cells; usually a complex mixture of organic and inorganic materials.

Cytoplasm The "liquid" portion of a cell outside and surrounding the nucleus.

Cytotoxic: Damaging to cells.

Debt financing: The use of outside or borrowed capital to finance business activities.

Deoxyribonucleic acid (DNA): A linear polymer, made up of deoxyribonucleotide repeating units, that is the carrier of genetic information; present in chromosomes and chromosomal material of cell organelles such as mitochondria and chloroplasts, and also present in some viruses. The genetic material found in all living organisms. Every inherited characteristic has its origin somewhere in the code of each individual's DNA,

Deposit requirement= Patent requirements for inventors to turn over at the time of patent application a sample of the invention which is maintained throughout the life of the patent.

Diagnostic products Products that recognize molecules associated with disease or other biologic conditions and are used to diagnose these conditions,

Dicots (dicotyledons): Plants with two first embryonic leaves and nonparallel veined mature leaves. Examples are soybean and most flowering plants.

Disclosure requirements: A patent requirement for adequate public disclosure of an invention that enables other people to build and use the invention without "undue" experimentation.

DNA: Deoxyribonucleic acid.

DNA base pahz A pair of DNA nucleotide bases. Nucleotide bases pair across the double helix in a very specific way: adenine can only pair with thymine; cytosine can only pair with guanine.

DNA probcz A sequence of DNA that is used to detect the presence of a particular nucleotide sequence.

DNA sequenc= The order of nucleotide bases in the DNA helix; the DNA sequence is essential to the storage of genetic information.

DNA synthesis The synthesis of DNA in the laboratory by the sequential addition of nucleotide bases.

Downstream processhqp After bioconversion, the purification and separation of the product.

Drug: Any chemical compound that may be administered to humans or animals as an aid in the treatment of disease.

Elution: The removal of adsorbed material from an adsorbent, such as the removal of a product from an enzyme bound on a column.

Emulsification The process of making lipids soluble in water.

Enablement requirement A patent requirement for adequate public disclosure of an invention, enabling others in the relevant field of technology to build and *use* the invention.

Endorphin& Opiate-like, naturally occurring peptides with a variety of analgesic effects throughout the endocrine and nervous systems,

Enkephalins Small, opiate-like peptides with analgesic effects in the brain.

Enzynm Any of a group of catalytic proteins that are produced by living cells and that mediate and promote the chemical processes of life without themselves being altered or destroyed,

Equity capitak Capital proceeds arising from the sale of company stock.

Equity investment: An investment made in a company in exchange for a part ownership in that company.

Escherichia colJ(E cd): A species of bacteria that inhabits the intestinal tract of most vertebrates. Some strains are pathogenic to humans and animals. Many nonpathogenic strains are used experimentally as hosts for rDNA.

Eukaryote A cell or organism with membrane-bound, structurally discrete nuclei and well-developed cell organelles. Eukaryotes include all organisms except viruses, bacteria, and blue-green algae. (Compare *prokaryote,)*

Export controhx Laws that restrict technology transfer and trade for reasons of national security, foreign policy, or economic policy.

Fatty acids Organic acids with long carbon chains. Fatty acids are abundant in cell membranes and are widely used as industrial emulsifiers.

Feedstocks Raw materials used for the production of chemicals.

Fermentation An anaerobic bioprocess. Fermentation is used in various industrial processes for the manufacture of products such as alcohols, acids, and cheese by the action of yeasts, molds, and bacteria.

Fibrinolytic agents: Blood-borne compounds that activate fibrin in order to dissolve blood clots.

Flocculating agent: A reagent added to a dispersion of solids in a liquid to bring together the fine particles into larger masses.

Food additive (or food ingredient): A substance that becomes a component of food or affects the characteristics of food and, as such, is regulated by the U.S. Food and Drug Administration.

Foot-and-mouth disease A highly contagious virus disease of cattle, pigs, sheep, and goats that is characterized by fever, salivation, and formation of vesicles in the mouth, pharynx and on the feet and is transmissible to humans.

Fractionation (of blood): Separation of blood by centrifugation, resulting in components sold as plasma, serum albumin, antihemophilic factor, and other products.

Freeliving organisrm An organism that does not depend on other organisms for survival.

Fungus: Any of a major group of saprophytic and parasitic plants that lack chlorophyll, including molds, rusts, mildews, smuts, and mushrooms.

Gamma globulin (GG): A protein component of blood that contains antibodies and confers passive immunity.

Gen~ The basic unit of heredity; an ordered sequence of nucleotide bases, comprising a segment of DNA. A gene contains the sequence of DNA that encodes one polypeptide chain (via RNA).

Gene amplification In biotechnology, an increase in gene number for a certain protein so that the protein is produced at elevated levels.

Gene expression The mechanism whereby the genetic directions in any particular cell are decoded and processed into the final functioning product, usually a protein. See also *transcription* and *translation.*

Generic applied research Research along the continuum between the two poles of basic and applied. This research may be characterized as follows: 1) it is not committed to open+mded expansion of knowledge as university basic research typically is but is less specific (more widely applicable or "generic") than the typical industrial product or process development effort; 2) it has more welldefined objectives than basic research but is long term relative to product and process development; and 3) it is high risk, in the sense that the stated objectives may fail and the resources committed may be lost for practical purposes.

Gene transfen The use of genetic or physical manipulation to introduce foreign genes into host cells to achieve desired characteristics in progeny.

Genom= The genetic endowment of an organism or individual.

Genus A taxonomic category that includes groups of closely related species.

Germ celk The male and female reproductive cells; egg and sperm.

Germplasnx The total genetic variability available to a species.

Glycoproteintx Proteins with attached sugar groups.

Glucose A 6-carbon sugar molecule used as a basic energy source by the cells of most organisms.

Glycosylatiom The attachment of sugar groups to a molecule, such as a protein.

Government procurement: The acquisition by a government of goods or services. Government procurement may stimulate development of technology.

Growth hormone (GH): A group of peptides involved in regulating growth in higher animals.

Helminth: Parasitic worm.

Herbicide An agent (e.g., a chemical) used to destroy or inhibit plant growth; speciilcally, a selective weed killer that is not injurious to crop plants,

High performance liquid chromatography (HPLC): A recently developed type of chromatography that is potentially important in downstream processing.

Hormone A chemical messenger found in the circulation of higher organisms that transmits regulatory messages to cells.

Hosti A cell whose metabolism is used for growth and reproduction of a virus, plasmid, or other form of foreign DNA.

Host-vector system Compatible combinations of host (e.g., bacterium) and vector (e.g., plasmid) that allow stable introduction of foreign DNA into cells.

Human chorionic gonadotropin (HCG): A hormone produced by human placenta, indicating pregnancy; widespread target of MAb developers to diagnose pregnancy at an early stage.

Human insulin (hI): Hormone that stimulates cell growth via glucose uptake by cells. Insulin deficiency leads to diabetes.

Human serum albumin (HSA): Abundant protein in human blood; as a product, used in highest quantities in medicine, primarily in burn, trauma, and shock patients.

Hybrid: The offspring genetically dissimilar parents (e.g., a new variety of plant or animal that results from cross-breeding two different existing varieties, a cell derived from two different cultured cell lines that have fused).

Hybridization The act or process of producing hybrids.

Hybridomm Product of **fusion** between **myeloma cell (which divides continuously in culture and is "immortal") and lymphocyte (antibody-producing cell); the resulting cell grows in culture and produces monoclinal antibodies.**

Hybridoma technology See *monoclinal antibody technology*.

Hydrolysis Chemical reaction involving addition of **water to break bonds.**

Hydroxylatiom Chemical reaction involving addition of **hydroxyl** (-OH) **group to chemical compound.**

Immobilized enzyme or cell techniques Techniques used for the fixation of enzymes or cells onto solid supports. Immobilized cells and enzymes are used in continuous bioprocessing.

Immune response The reaction of an **organism to invasion** by a **foreign substance. Immune responses are often complex, and** may **involve the production** of **antibodies from special cells (lymphocytes), as well as** the **removal** of the **foreign substance by other cells.**

Immunoassay The use of **antibodies to identify and quantify substances. The binding** of **antibodies to antigen, the substance being measured,** is **often followed** by **tracers such as radioisotopes.**

Immunogenic Capable of causing an **immune** response. **(See also *antigen.)***

Immunotoxin: A **molecule attached to an antibody capable** of **killing cells that display** the **antigen to which** the **antibody binds.**

Interferon (Ifns): A **class of glycoproteins (proteins with sugar groups attached at specific locations) important in immune function and thought to inhibit viral infections.**

In vitro: Literally, in glass; **pertaining to a biological reaction taking place in** an **artificial apparatus; sometimes used to include** the **growth** of **cells from multicellular organisms under cell culture conditions. In** vitro diagnostic **products** are **products used to diagnose disease outside** of the **body after a sample has been taken from** the **body,**

In vivo: Literally, in **life; pertaining** to a **biological reaction taking place in a living cell** or **organism. In vivo products are products used within the body.**

Joint venture Form of **association** of **separate business entities which falls short of a formal merger but unites certain agreed on resources of each entity for a limited purpose; in practice most joint** ventures are **partnerships.**

Leaching: The removal of a **soluble compound such as an ore from a solid mixture by washing** or **percolating.**

Li@in: A **major component** of wood.

Lignocellulose The composition of woody **biomass, including lignin and cellulose.**

Lignolytic Pertaining to the breakdown of **lignin.**

Linke~ A **small fragment of synthetic DNA that has a restriction site useful for gene cloning, which** is **used for** joining **DNA strands together.**

Lipid= A **large, varied class of water-insoluble organic molecules; includes steroids, fatty acids, prostaglandins, terpenes, and waxes.**

Liposome transfe~ The process of enclosing biological compounds inside a lipid membrane and allowing the complex to be taken up by a cell.

Lymphocytetw Specialized white blood cells involved in the immune response; B lymphocytes produce antibodies.

Lymphokine~ Proteins that mediate interactions among lymphocytes and are vital to proper immune function.

Medical device: An instrument or apparatus (including an in vitro reagent such as MAbs) intended for use in the diagnosis or treatment of a disease or other condition and which does not achieve its intended purpose through chemical action within or on the body.

Messenger RNA (mRNA): RNA that serves as the template for protein synthesis; it carries the transcribed genetic code from the DNA to the protein synthesizing complex to direct protein synthesis,

Metabolism: The physical and chemical processes by which foodstuffs are synthesized into complex elements, complex substances are transformed into simple ones, and energy is made available for use by an organism.

Metabolitcx A product of metabolism.

Metallothioneins: Proteins, found in higher organisms, that have a high affinity for heavy metals.

Methanogens: Bacteria that produce methane as a metabolic product.

Mic~o~anismw Microscopic living entities; microorganisms can be viruses, prokaryotes (e.g., bacteria), or eukaryotes (e.g., fungi).

Microencapsulatiom The process of surrounding cells with a permeable membrane.

Mixed culture: Culture containing two or more types of microorganisms.

Moleculcx A group of atoms held together by chemical forces; the smallest unit of matter which can exist by itself and retain its chemical identity.

Monoclinal antibodies (MAbs): Homogeneous antibodies derived from a single clone of cells; MAbs recognize only one chemical structure. MAbs are useful in a variety of industrial and medical capacities since they are easily produced in 1arge quantities and have remarkable specificity.

Monoclinal antibody technology The use of hy - bridomas that produce monoclinal antibodies for a variety of purposes. Hybridomas are maintained

in cell culture or, on a larger scale, as tumors (ascites) in mice.

MonoCots (monocotyledons): Plants with single first embryonic leaves, parallel-veined leaves, and simple stems and roots. Examples are cereal grains such as corn, wheat, rye, barley, and rice.

Multigeni~ A trait specified by several genes.

Mutagenesicx The induction of mutation in the genetic material of an organism; researchers may *use* physical or chemical means to cause mutations that improve the production of capabilities of organsims.

Mutagem An agent that causes mutation.

Mutant: An organism with one or more DNA mutations, making its genetic function or structure different from that of a corresponding wild-type organism.

Mutatiom A permanent change in a DNA sequence.

Myelom= Antibody-producing tumor cells.

Myeloma cell lin= Myeloma cells established in culture.

Neumtrammittemx Small molecules found at nerve junctions that transmit signals across those junctions.

New biotechnology firm (NBF): A company formed after 1976 whose sole function is research, development, and production using biotechnological means.

NIH Guidelineex Guidelines established by U.S. National Institutes of Health to regulate the safety of NIH-funded research involving recombinant DNA.

Nitrate A compound characterized by a NO,-group. Sodium nitrate and potassium nitrate are used as fertilizers.

Nitrogen fixatiom The conversion of atmospheric nitrogen gas to a chemically combined form, ammonia (NH~) which is essential to growth. Only a limited number of microorganisms can fix nitrogen.

Nodukz The anatomical part of a plant root in which nitrogen-fixing bacteria are maintained in a symbiotic relationship with the plant.

Nodulinw Proteins, possibly enzymes, present in nodules; function unknown.

Nontariff trade barrien A government regulation, other than a tariff (see below), that directly alters the volume or composition of international trade. Examples include quotas (restrictions on the quantity of goods imported), orderly marketing agreements (by which exporters agree to restrict the volume of goods exported), exchange controls (which constrain the value of foreign exchange spent rather than the number of units purchased), government preferences in purchases, and standards and certification systems.

Nucleic acid= Macromolecules composed of sequences of nucleotide bases. There are two kinds of nucleic acids: DNA, which contains the sugar deoxyribose, and RNA, which contains the sugar ribose.

Nucleotide ba~ A structural unit of nucleic acid. The bases present in DNA are adenine, cytosine, guanine, and thymine. In RNA, uracil substitutes for thymine.

Nucleu~ A relatively large spherical body inside a cell that contains the chromosomes.

Oligonucleotide~ Short segments of DNA or RNA.

Organelhx A specialized part of a cell that conducts certain functions, Examples are nuclei, chloroplasts, and mitochrondria, which contain most of the genetic material, conduct photosynthesis, and provide energy, respectively.

Organic compoundtx Molecules that contain carbon.

Organic micmpollutanti Low molecular weight organic compounds considered hazardous to humans or the environment.

Passive immunity Disease resistance in a person or animal due to the injection of antibodies from another person or animal. Passive immunity is usually short-lasting. (Compare *acti"ve immum"ty.)*

Patent: A limited property right granted to inventors by government allowing the inventor of a new invention the right to exclude all others from making, using, or selling the invention unless specifically approved by the inventor, for a specified time period in return for full disclosure by the inventor about the invention.

Pathogem A disease-producing agent, usually restricted to a living agent such as a bacterium or virus.

Peptide A linear polymer of amino acids. A polymer of numerous amino acids is called a *pdypptide.* Polypeptides may be grouped by function, such as "neuroactive" polypeptides.

pH: A measure of the acidity or basicity of a solution on a scale of O (acidic) to 14 (basic). For example, lemon juice has a pi-i of 2,2 (acidic), water has a pH of 7.o (neutral), and a solution of baking soda has a pH of 8.5 (basic).

Pharmaceutical= Products intended for use in humans, as well as in vitro applications to humans, including drugs, vaccines, diagnostics, and biological response modifiers.

Photorespiratiom Reaction in plants that competes with the photosynthetic process. Instead of fixing CO_2, RuBPCase can utilize oxygen, which results in a net loss of fixed CO_2.

Photosynthesis The reaction carried out by plants where carbon dioxide from the atmosphere is fixed into sugars in in the presence of sunlight; the transformation of solar energy into biological energy.

Plant Patent Act of 1930 (35 U.S.C. ~5161-164): Confers exclusive license on developer of new and distinct asexually produced varieties other than tuber-propagated plants for 17 years.

Plant Variety Protection Act of 1970 (7 U.S.C. $2321): Provides patent-like protection to new plants reproduced sexually.

Plasmw The liquid (noncellular) fraction of blood. In vertebrates, it contains many important proteins (e.g., fibrinogen, responsible for clotting).

Plasmkb An extrachromosomal, self-replicating, circular segment of DNA; plasmids (and some viruses) are used as "vectors" for cloning DNA in bacterial "host" cells.

Polyme~ A linear or branched molecule of repeating subunits.

Polypeptide A long peptide, which consists of amino acids.

Polysaccharid~ A polymer of sugars.

Prior ak Publicly known technology; patent requirements include the demonstration of the novelty of an invention, as distinguished from prior art.

Probtz See ***DNA probe.***

Proinsulim A precursor protein of insulin.

Prokaryot~ A cell or organism lacking membrane-bound, structurally discreet nuclei and organelles. Prokaryotes include bacteria and the blue-green algae. (Compare ***eukaryote.)***

Pmmote~ A DNA sequence in front of a gene that controls the initiation of "transcription" (see below).

prophylaxis: prevention of disease.

pmteas~ Protein digesting enzyme.

Protein* A polypeptide consisting of amino acids. In their biologically active states, proteins function as catalysts in metabolism and, to some extent, as structural elements of cells and tissues.

Protoplasm fusiom The joining of two cells in the laboratory to achieve desired results, such as increased viability of antibiotic-producing cells.

Protozoa: Diverse phylum of eukaryotic microorganisms; structure varies from simple single cells to colonial forms; nutrition may be phagotropic or autotrophic; some protozoa are pathogenic.

Pyrogenicit~ The tendency for some bacterial cells or parts of cells to cause inflammatory reactions in the body, which may detract from their usefulness as pharmaceutical products.

Public offering: The Securities and Exchange Commission approved sale of company stock to the public,

R&D limited partnership: A risk capital source and tax sheltered mechanism for funding the R&D of new products. It raises the potential rate of return to investors without adding extra cost to the corporation.

Reagenti A substance that takes part in a chemical reaction.

Recombinant DNA (rDNA): The hybrid DNA produced by joining pieces of DNA from different organisms together in vitro.

Recombinant DNA technolo~ The use of recombinant DNA for a specific purpose, such as the formation of a product or the study of a gene.

Recombinatiorx Formation of a new association of genes or DNA sequences from different parental origins.

Regeneration: The laboratory process of growing a whole plant from a single cell or small clump of cells.

Regulatory sequence: A DNA sequence involved in regulating the expression of a gene.

Replication: The synthesis of new DNA from existing DNA and the formation of new cells by cell division.

Resistance gene: Gene that provides resistance to an environmental stress such as an antibiotic or other chemical compound.

Resiston A device designed to limit electron flow in an electric circuit by a definite amount, resulting in a limited current or a voltage drop.

Restriction enzymew Bacterial enzymes that cut DNA at specific DNA sequences.

Ri-plasmid* Plasmid from ***Agrobactern"um rhizogenes*** used as plant vector.

RNA Ribonucleic acid. (See also ***messenger RNA.)***

RuBPCase (ribulose bisphosphate carboxylase): An enzyme that catalyzes the critical step of the photosynthetic CO_2 cycle.

Saccharificatiom The degradation of polysaccharides to sugars.

Scaleup: The transition of a process from an experimental scale to an industrial scale.

Selectiom A laboratory process by which cells or organisms are chosen for specific characteristics.

Semiconducto~ A material such as silicon or germanium with electrical conductivities intermediate between good conductors such as copper wire and insulators such as glass.

Semiconductor devictx An electronic device that uses a semiconductor to limit or direct the flow of electrons. Examples are transistors, diodes, and integrated circuits.

Semiconductor industry: Companies that manufacture semiconductor devices. As used in this report, the description of the semiconductor in-

dustry is that deriving from the period between 1947 (discovery of the transistor) to the early 1960's.

Single cell proteim Cells, or protein extracts, of microorganisms grown in large quantities for use as human or animal protein supplements.

Slimew Aggregations of microbial cells that pose environmental and industrial problems; may be amenable to biologic control,

Sludge Precipitated solid matter produced by water and sewage treatment or industrial problems; may be amenable to biologic control.

Small Business Investment Corporations (SBICS): private companies licensed by the Small Business Association (SBA) and owned by stockholders who have made investments in exchange for equity. SBICS are required by SBA to invest or loan money exclusively to U.S. small businesses.

somaclonal variatiom **Genetic** variation produced from the culture of plant cells from a pure breeding strain; the source of the variation is not known.

Specialty chemicals Chemicals, usually produced in small volumes, that sell for more than $1 per pound (50c per kg). (Compare commodity ***chem"cals.)***

Speciecx A **taxonomic subdivision** of a genus. A group of closely related, morphologically similar individuals which actually or potentially interbreed.

Spectmmetem An instrument used for analyzing the structure of compounds on the basis of their light-absorbing properties.

Starch A polymer of **glucose** molecules **used by some** organisms as a means of energy storage; starch is broken down by enzymes (amylases) to yield glucose, which can be used as a feedstock for chemical or energy production.

Startup financing: Financing usually supplied by venture capitalist to fund the early R&D, production, sale of a new company's products.

Steroid: A group of organic compounds, some of which act as hormones to stimulate cell growth in higher animals and humans.

Storage protein **genes: Genes** coding for the major proteins found in plant seeds.

Strairu A group of organisms of the **same species** having distinctive characteristics but not usually considered a separate breed or variety. A genetically homogeneous population of organisms at a subspecies level that can be differentiated by a biochemical, pathogenic, or other taxonomic feature.

subsidy: A government intervention in the form of either grants, **loans, or tax** preferences that are directed to a particular domestic industry.

Substrate: A substance acted upon, for example, by an enzyme.

Subunit vaccine A vaccine that contains only portions of a surface molecule of a pathogen. Subunit **vaccines can be** prepared by using rDNA technology to produce all or part of the surface protein molecule or by artificial (chemical) synthesis of short peptides.

symbionfi An organism living in symbiosis, usually the smaller member of a symbiotic pair of dissimilar size.

Symbiosis The living together of two dissimilar organisms in mutually beneficial relationships.

Tariff: Charges levied on importers of a particular good by a government in return for granting access to the government's domestic markets, which may occur at the expense of domestic industry; sometimes high tariffs are used to discourage importation and protect domestic industry.

T-DNA Transfer DNA; that part of Ri or Ti plasmids that is transferred to the plant chromosome.

Technology transfe~ The movement of technical information and/or materials, used for producing a product or process, from one sector to another; most often refers to flow of information between public and private sectors or between countries.

Therapeutic= Pharmaceutical products used in the treatment of disease.

Thermophili~ Heat loving. Usually refers to microorganisms that are capable of surviving at elevated temperatures; this capability may make them more compatible with industrial biotechnology schemes.

Thmmbolytic enzymes: Enzymes such as streptokinase and urokinase that initiate the dissolution of blood clots.

Thrombosis: Blockage of blood vessels.

Ti plasmid: Plasmid from ***Agrobacterium tumefaciens*** used as a plant vector.

Totipotency The capacity of a higher organism cell to differentiate into an entire organism. A totipotent cell contains all the genetic information necessary for complete development.

Toxicity The ability of a substance to produce a harmful effect on an organism by physical contact, ingestion, or inhalation.

Toxim A substance, produced in some cases by diseasemausing micro-organisms, which is toxic to other living organisms.

Toxoid" Detoxified toxin, but with antigenic properties intact.

Trade secreti An invention used continuously by its holder in his or her business to maintain a competitive edge over other competitors who do not know or use it. Trade secrets are often used instead of patents to protect production information.

Transcription The synthesis of messenger RNA on

a DNA template; the resulting RNA sequence is complementary to the DNA sequence. This is the first step in gene expression. (See also *translation.)*

Transformation The introduction of new genetic information into a cell using naked DNA.

Transistor An active component of an electrical circuit consisting of semiconductor material to which at least three electrical contacts are made so that it acts as an amplifier, detector, or switch.

Translation: The process in which the genetic code contained in the nucleotide base sequence of messenger RNA directs the synthesis of a specific order of amino acids to produce a protein. This is the second step in gene expression. (See also *transcription.)*

Transposable element: Segment of DNA which moves from one location to another among or within chromosomes in possibly a predetermined fashion, causing genetic change; may be useful as a vector for manipulating DNA.

Trihalomethanes (THMs): Organic micropollutants and potential carcinogens, consisting of three halide elements attached to a single carbon atom; their destruction during water purification may be done biologically.

Turbid: Thick or opaque with matter in suspension.

Vaccine A suspension of attenuated or killed bacteria or viruses, or portions thereof, injected to produce active immunity. (See also *subunit vaccine.)*

Vecto~ DNA molecule used to introduce foreign DNA into host cells. Vectors include plasmids, bacteriophages (virus), and other forms of DNA. A vector must be capable of replicating autonomously and must have cloning sites for the introduction of foreign DNA.

Venture capital (venture capital funds): Money that is invested in companies with which a high level of risk is associated.

Viruw Any of a large group of submicroscopic agents infecting plants, animals, and bacteria and unable to reproduce outside the tissues of the host. A fully formed virus consists of nucleic acid (DNA or RNA) surrounded by a protein or protein and lipid coat.

Viscosity A measure of a liquid's resistance to flow.

Volatile organic compounds (VOCS): Group of toxic compounds found in ground water and that pose environmental hazards; their destruction during water purification may be done biologically.

Wild-type: The most frequently encountered phenotype in natural breeding populations.

Yeas& A fungus of the family Saccharomycetacea that is used especially in the making of alcoholic liquors and as leavening in baking. Yeast are also commonly used in bioprocesses.