

Contents

1. GENERAL INTRODUCTION

Definition and History. New Products and Techniques. Current Developments and Future Priorities. Molecular Engineering. DNA Sequencing Strategies. Artificial Antibodies and Enzymes. Link Between Science and Technology. Evolution and Biotechnology. Economics and Ecology. Risks and Hazards.

2. SCOPE AND IMPORTANCE

Introduction. Food Processing. Enzyme Technology. Biocontrol Agents. Microbes. Animal Nutrition and Health. Vaccines. Genetic Manipulation. Germplasm Improvement and Conservation. Biomanufacturing. Agricultural Biotechnology. *In Vitro* Culture. Improvement of Animal Health. Intellectual Property Protection in Plant Genetic Engineering. Application of Enzyme-enriched Transgenic Seeds in Animal Feed. Agrobiotechnologies and Their Social Benefits. The Future of Biotechnology.

3. BIOTECHNOLOGY AND DEVELOPING COUNTRIES

Introduction. Substitution of Traditional Commodities. Industrialization of Agriculture. Privatization of Knowledge and Technology. Effects on People and the Environment. Some Poverty-related Issues. Plant Biotechnologies for Developing Countries. Commercialization of Biotechnology in a Developing Economy. Joint Venture and Technology Transfer. Potential for Development. Biotechnology for Sustainable Development.

4. RECOMBINANT DNA TECHNOLOGY

Genetic Engineering. Restriction Enzymes. Summary of Gene Cloning. Engineering Novel Restriction Endonucleases. Plant Genetic Engineering. Genetic Transformation. Gene Transfers. Genetic Engineering of Mammalian Cells. Transfer of Genes to Humans. Gene Transfers in Animal Cells.

5. PLANT BIOTECHNOLOGY

95-146

Introduction. Tissue Culture. Haploid Plants. Pollen Banks. Seed Banks and *Ex Situ* Conservation. Micropropagation and Disease-free Plants. Advantages of Clonal Propagation. Biolistic Microtargeting in Shoot Meristems. Cryopreservation of Plant Tissues. Transgenic Plants. Gene Silencing. Production and Use of Genetically Transformed Plants. Genetic Modification of Food Plants. Herbicide Resistance. Gene Transfer Technology for Trees. Cell Cultures : Production of Secondary Metabolites. Bioconversions. Biocatalytic Systems. Use of Transgenic Plants to Produce Novel Proteins and other Chemicals. Pharmaceuticals. Vaccine-producing Plants. Markets for Plant-derived Drugs.

6. AGRICULTURAL BIOTECHNOLOGY

147-212

Introduction. Potential and Promise. The First Products of Plant Biotechnology. The Second Wave. Priority Areas. Production of Vaccines in Plants. Trade and Export Potential. Agro-industrial Products. Biodiversity. Loss of Genetic Diversity. Biotechnology and Plant Breeding. Marine Aquaculture. Oilseed Biotechnology. Engineering of Oil Production in Rapeseed. Insect-resistant Oilseed Rape. Transgenic Crops. Transgenic Cereals. Worldwide Field Trials of Transgenic Plants. Ecological Risks of Transgenic Crops. Ecological Risks of Transgenic Crops in Global Markets. Herbicide-tolerant Crops. Rice. Maize. Tomato. Potato. Sweetpotato. Transgenic Fish. Biological Control. Biotechnological Use of Bt. Patenting of Bt. Biosensors. Toxin-resistant Transgenic Plants.

7. INDUSTRY AND FERMENTATIONS

213-251

Introduction. Bioreactors. Bubble-column Bioreactors. The Fermentation Process. Fermentation Industry. Solid State Fermentation. SSF in Industry. Bioprocess Engineering. Biotransformation. Enzyme Engineering. Enzyme Tailoring. High Pressure and Biotechnology. Microbes and Biotechnology. Culture Systems. Microbes and Ruminants. Industrial Uses of Microbial Polymers. Microbial Screening and Strain Improvement. Production of Chemicals by Microbial Fermentations. Downstream Processing.

8. ANIMAL BIOTECHNOLOGY

252-281

Introduction. Major Genes in Animal Breeding. Improvement of Animal Wealth. Biotechnology of Farm Animals. Genetic Engineering of Laboratory Animals. Animal Cell Technology. Animal Cell Cultures. Tissue Engineering. Genetic Modifications. Genetically-modified Organisms and New Imported Organisms. The Place of Genetically Engineered Animals in Society. Transgenic Cattle. Transgenic Goats. Transgenic Pigs. Transgenic Chickens. Transgenic Animals as

Bioreactors. Targeting Expression of Proteins to the Mammary Glands of Mice. Production of Human Interferon in Mouse Milk. Markets of Transgenic Animals. Products from Animal Cell Cultures. Pharmaceuticals from Transgenic Animals. Blood Substitute from Transgenic Pigs.

9. IMMUNOLOGY AND HEALTH CARE

282-339

Introduction. Body's Defences. Cytokines. T Cells. Monoclonal Antibodies. Animal Cell Bioreactors. Catalytic Antibodies (Abzymes). Biotechnology and Medicine. Biodiagnostics. Immunodiagnosis of HIV Infection. Vaccines. Transmission-blocking Vaccine. Hi-tech Insulin. Autoimmunity. Human Health Care. Health Care Needs and Drug Policies. Drug Design. Drug Delivery. Antisense Drugs. Immunotherapy of Cancer. Apoptosis.

10. ENERGY AND ENVIRONMENT

340-371

Introduction. Renewable Crops for Fuel. Anaerobic Digestion (Biogas Production). Solar Cookers. Anaerobic Technology and Climate Protection. Renewable Energy Technology in India. Composting of Wastes. Anaerobic Treatment of Waste and Wastewater. Bioremediation. Hydrogen. Biosensors. Environmental Risks of Genetically-engineered Crops.

11. REGULATORY ISSUES IN BIOTECHNOLOGY

372-388

Biosafety. Biosafe Transportation. Development of Non-disruptive Biomarkers for GMOs. Intellectual Property Rights. Genetic Resources in the Third World. Status and Implications of IPR. Protecting Biotechnological Inventions. Protection of Plant Varieties. Plant-variety Rights and Patents. Life Patenting: the United States Example. Stimulating Private Sector Activity. Patent Protection in Developing Countries.

Questions

389

Hints to Answers

390-391

Glossary

392-400

Bibliography

401-415

Index

417-424