

## CONTENTS

### VOLUME XIII

**Social, Educational and Political Aspects of Biotechnology - An Overview and an Appraisal of Biotechnology in a Changing World** 1

Colin Ratledge, *University of Hull, UK*

1. Science and the Public
2. Biotechnology and the Public
3. Biotechnology and Genetically Modified Crops
4. GM Foods and the Media
5. GM Foods: The Lessons Learnt
6. Biotechnology and its Impact on the Public Understanding of Science
7. Biotechnology and the Ethics of Gene Therapy, Animal Cloning and Gene Manipulation in Humans

**Some Social, Educational and Political Aspects of Biotechnology** 19

Ian A. Pownall, *University of Hull, UK*

1. Introduction
2. The Developing Country Identity
3. Analyzing the Impact of Biotechnology
4. Methodological Approaches and Competing Discourses
5. Rhetoricism and Debate
6. The diplomacy model and environmental discourses
7. An international Political Economic Discourse
8. Conclusion

**Public Policy Responses to Biotechnology** 47

Peter Rieder, *Swiss Federal Institute of Technology (ETH), Switzerland*  
Philipp Aerni, *University of Harvard, USA*

1. Introduction
2. Challenges for the Biotechnology Industry
3. Reasons for the Lack of Public Acceptance
4. Some theoretical considerations regarding public confidence
5. Public Policy Issues related to Biotechnology
6. Some Reflections on Future Public Policy Towards Biotechnology

**Inventions, Patents and Morality** 71

Darryl R. Johnson Macer, *Unesco, Thailand*

1. Introduction
2. Intellectual Property Protection
3. Ethical and Moral Issues
4. Moral Arguments Supporting Patenting
5. Ethical Arguments Against Patenting
6. Rewarding Historical Innovation
7. Morality Exclusion of Patents
8. Conclusions and Predictions

**The Regulation of Genetically Modified Food**

89

Sue Mayer, *Gene Watch UK, UK*

1. Introduction
2. Process versus product regulation and the risks of GMOs
  - 2.1. The risks of genetically modified organisms to the environment
  - 2.2. The risks of genetically modified organisms to the human health
  - 2.3. Discussion
3. Regulating the Laboratory Use of GMOs
  - 3.1. U.S.A.
  - 3.2. Europe
  - 3.3. Discussion
4. Regulating the Release of GMOs to the Environment
  - 4.1. U.S.A.
  - 4.2. Europe
  - 4.3. Rest of the World
  - 4.4. The Cartagena Protocol on Biosafety
  - 4.5. Discussion
5. GM Food Safety Regulations
  - 5.1. U.S.A.
  - 5.2. Europe
  - 5.3. Discussion
6. Labelling
  - 6.1. U.S.A.
  - 6.2. Europe
  - 6.3. Discussion
7. Trade and GM food regulations
8. Conclusions

**Biotechnology Education**

107

Gustavo Viniestra-Gonzalez, *Universidad Autonoma Metropolitana - Iztapalapa, México*

1. Introduction
  - 1.1. General Considerations
  - 1.2. The Importance of Basic Knowledge in The Twenty-First Century
  - 1.3. Definition and Scope of Biotechnology
  - 1.4. The Practical Link between Basic Science and Biotechnology
  - 1.5. Relations between Higher Education, Technological Innovation and Economic Development
2. Teaching the Basic Principles of Biotechnology
  - 2.1. Qualitative vs. Quantitative Principles of Biotechnology
  - 2.2. How to Teach Scientific Principles: Basic vs. Applied Approaches
  - 2.3. Allometry: A General Scale-up Principle of Biology
  - 2.4. Computers and Functional Scientific Illiteracy
3. Teaching the Skills of Biotechnology
  - 3.1. Bioprocess Engineering, a New Trend in Biotechnology
  - 3.2. Skills for Scaling-up or Scaling-down Bioprocesses
  - 3.3. Bioprocess Engineering in Developing Countries
  - 3.4. Bioprocess Engineering for Fine Products
  - 3.5. Qualitative vs. Quantitative Skills in Biotechnology
  - 3.6. The Importance of Reasoning and Common Sense
  - 3.7. Academic and on-the Job Training
  - 3.8. The Need to Teach Skills on Computation and Informatics
  - 3.9. Integration of Skills
4. Teaching Values and Attitudes in Biotechnology
  - 4.1. The Importance of Values and Attitudes in Biotechnology Education
  - 4.2. The Issues of Technology as a Sensible or a Dangerous Path for Development
  - 4.3. How to Teach Values and Attitudes

5. General Discussion
  - 5.1. The Need for Integration in Biotechnology Education
  - 5.2. Integration in Undergraduate Programs
  - 5.3. Integration in Graduate Programs
  - 5.4. A Brief Note on Scientific Cooperation

### **Biotechnology in Rural Area**

143

Li Kangmin, *Asian Pacific Regional Research and Training Center for Integrated Fish Farming, China*

1. Introduction
2. Advanced Biotechnological Achievements Applied in Rural Areas
  - 2.1. Gene Engineering
  - 2.2. Transgenic Cotton
  - 2.3. Transgenic Rice
  - 2.4. Transgenic Rape-Seed
  - 2.5. Transgenic Fish
  - 2.6. Transgenic Animal and Bio-Pharmaceuticals
3. Conventional Biotechnology as Practiced in Rural Areas
  - 3.1. Rice Heterosis Exploitation
  - 3.2. Induced Breeding of Fish
  - 3.3. Fish Hybridization
  - 3.4. Integrated Bio - Systems (IBS)
    - 3.4.1. Integrated Bio Systems Using Organic Matter in Multi -Trophic Levels in Food Chain in Material Cycle/Recycle and Energy Flow
      - 3.4.1.1. Biogas-digester subsystem
        - 3.4.1.1.1. Why Develop Biogas?
        - 3.4.1.1.2. Biogas Producing Processes
        - 3.4.1.1.3. Many Uses of Biogas
        - 3.4.1.1.4. Uses of Bio-Slurry and Bio-Sludge
        - 3.4.1.1.5. Biogas, The Basis of Eco-Economy
      - 3.4.1.2. Constraints and Prospects
      - 3.4.1.3. Earthworm Culture Subsystem
      - 3.4.1.4. Mushroom Cultivation Subsystem
    - 3.4.2. Integrated Biomass Systems Using Mutualism Principles
      - 3.4.2.1. Inter-cropping to apply the principle of Allelopathy
      - 3.4.2.2. Stereo Agriculture – Vertical Stratified Agriculture (Pond Dike System)
    - 3.4.3. Integrated Biomass Systems Using Genetically Engineered Bacteria
    - 3.4.4. Integrated Biomass Systems Using Bio Extraction of Bio Resources
      - 3.4.4.1. Enzyme Agents
      - 3.4.4.2. Mono Cell Protein
      - 3.4.4.3. Disease Resistant Crop Yield-Increasing Agent
  - 3.5. Biological Control
4. Socioeconomic, Political and Cultural Impacts on Biotechnology
  - 4.1. Economic Systems and Biotechnology
  - 4.2. Bio-Diversity and Biotechnology
  - 4.3. Pharmaceutical biotechnology and traditional Chinese culture
  - 4.4. Qinghaosu
  - 4.5. Urbanization and Biotechnology
  - 4.6. Ethical Principles and Biotechnology

### **Art Biotechnology and the Culture of Peace**

179

Edgar J. DaSilva, *International Scientific Council for Island Development, France*

1. Introduction
2. Biotechnology - Ancestral Art and Culture
  - 2.1. Fermentation technology and art

- 2.2. Fermented foods and culture
- 3. Zero-Emission Biotechnology and Environmental Art
- 4. Microbes and Cultural Heritage
- 5. Biotechnology and Art
  - 5.1. Biotechnology and cover art
  - 5.2. Bioart
  - 5.3. Making the invisible visible and conservation of microbial heritage
  - 5.4. Biotechnology in Literature, Cinema and TV
  - 5.5. Medicine and art
  - 5.6. Music and microbes
- 6. Education and art
- 7. The Dark Side of Biotechnology - Culture and Peace
- 8. The Developing Countries and Biotech Art
- 9. Concluding Remarks

**Index** **229**

**About EOLSS** **233**