MODULE II

Social and Environmental Impacts of Biotechnology

Trends in Modern Biotechnology and Impacts on Developing Countries

Lecture 1

INTRODUCTION TO THE MODULE

The lecture will discuss biotechnology with an STS perspective. General overview of the module will be provided with focus on biotechnology in agriculture and food concentrating mainly on the politics. Various areas of applications of biotechnology, actors involved, institutional mechanisms, developed and developing country policies, risk assessment and regulations will be introduced. The prospects of biotechnology for developing countries with specific reference to plant agriculture will be discussed.

Basic References:

- Gözen, A., From Green Revolution to Plant Biotechnology. Technological Change in the Agriculture of Turkey, University of Amsterdam, MRC, Kocaeli, 1997

- Brenner, C., Integrating Biotechnology in Agriculture. Incentives, Constraints and Country Experiences, OECD, Paris, 1996

- OECD, "Modern Biotechnolgy and Agricultural Markets: A Discussion of Selected Issues", Working Paper on Agricultural Policies and Markets, Paris, 2000

Additional Readings:

- OECD, Biotechnology. Economic and Wider Impacts, Paris, 1989

- OECD, Biotechnology, Agriculture and Food, Paris, 1992

Lecture 2

INTRODUCTION TO GENETICS AND BIOTECHNOLOGY: HOW TO, WHY?

This lecture will start with basic information about DNA, genes, the genetic code and briefly cover the short history of genetic research. The major improvements, the 'dreams' and the 'nightmares' of the genetic technologies will be discussed. The 'ideals' of nature will be compared to the ideals of human societies. This will be connected to rapid developments in the field and the kind of ethical questions along with it. What is genetic equality?

Bioethical issues regarding human cloning, stem cell research, the danger of re-birth of eugenics and the possible consequences of genetic screening will be discussed. Will genetic screening save lives or will it create discrimination at work place? Or will genetic screening cause sexual discrimination before birth? What is the importance of non-directive genetic counselling? Public concerns on genetic research and the media approaches will also be discussed.

Can genetic research be used for dangerous political trends such as nationalism? Can it create a second eugenics era?

The threat of biological weapons and their history will be discussed. On the other hand, also the paranoia of biological weapons as a negative influence on the publication and distribution of scientific research will be analysed.

Basic References:

Alcamo IE (1996) DNA technology: The awesome skill, WCB Publishers

Russo E, Cove D (1998) Genetic Engineering: Dreams and nightmares, Oxford University Press

Suzuki D., Knutdson P. (1989) Genethics: The ethics of engineering life, New Data Enterprises Ltd.

Buchanan A., Brock DW, Daniels N, Wikler D (2000) From chance to choice: Genetics and Justice, Cambridge University Press.

Mahowald MB, Verp MS, Anderson RR (1998) Genetic Counselling: Clinical and Ethical Issues. Annual Review of Genetics, 32, p. 547-59.

Appleyard B (1999) Brave New Worlds, Harper Collins

Lecture 3

BIOETHICAL PERSPECTIVES AND INTERNATIONAL REGULATIONS ON RECOMBINANT DNA TECHNOLOGY

The first part of the lecture will continue focusing on the major problems of bioethics: A feminist approach to reproductive rights regarding genetic applications will be a part of the lecture: Is genetic research gender-free? *In vitro* fertilization, genetic screening tests are practices performed through women's bodies: Women's choice or obligation?

This second part of the lecture will focus on the regulatory policies of recombinant DNA research/technology and applications in Europe and United States and policy-making process. The patenting issues of genetically engineered products or special organisms will also be discussed.

Are genetically modified crops another name for colonizing? What is the situation and risks in developing countries in connection with multi-national companies? How is GM forced upon farmers and the hungry? Is eco-tourism another name for genetic smuggling?

Basic References:

Suzuki D., Knutdson P. (1989) Genethics: The ethics of engineering life, New Data Enterprises Ltd.

Buchanan A., Brock DW, Daniels N, Wikler D (2000) From chance to choice: Genetics and Justice, Cambridge University Press.

Mahowald MB, Verp MS, Anderson RR (1998) Genetic Counselling: Clinical and Ethical Issues. Annual Review of Genetics, 32, p. 547-59.

Mahowald MB (2001) Genes, Women and Equality, Oxford University Press

Lecture 4

APPLICATIONS OF BIOTECHNOLOGY IN ENVIRONMENTAL POLLUTION CONTROL

This part of the module will focus on the applications of biotechnology in environmental pollution control. In this context, biological treatment processes that employ aerobic and anaerobic decomposers to breakdown the organic matter will be introduced. Biotechnological treatment mechanisms related to oxidation ponds, activated sludge processes, trickling filters, biodiscs and anaerobic digestors (applied to wastewaters); and sanitary landfills and composting (applied to solid wastes) will be summarized. The future of new research approaches in environmental biotechnology involving the development of genetically engineered microorganisms will be discussed.

Basic References:

- P. A. Vesilind, J. J. Peirce & R. F. Weiner, *Environmental Pollution and Control*, 3rd edition, Butterworth Heinmann, 1990, pp 104-112, 169-173.

- P. ReVelle & C. ReVelle, *The Global Environment-Securing a Sustainable Future*, Jones and Bartlett Publishers, 1992, pp. 308-310, 400-401.

- D. G. Kaufman & C. M. Franz, *Biosphere 2000-Protecting our Global Environment*, Harper Collins College Publishers, 1993, pp. 306-308, 429-432, 435- 436.

Lecture 5

AGRICULTURAL APPLICATIONS OF TRANSGENIC CROPS AND GM INGREDIENTS IN FOOD

After a brief summary of the potential and beneficial contributions of genetically modified agricultural products to world food production, the kinds of GM food products already available on the markets, their possible risks with regard to food safety and unpredictable environmental hazards (ie.the feared transfer of toxins or allergens and unintended negative effects on non-target species) in the long term, as well as the ethical aspects involved in producing and trading these products will be discussed.

Basic References:

1. Proponent Article: "The Impact Of Genetic Modification Of Human Foods In The 21st Century: A Review", by Stella G. Uzogara, . Biotechnology Advances 18 (2000) pages 179–206.
2. Opponent Article: "Ten Reasons Why Biotechnology Will Not Ensure Food Security, Protect The Environment And Reduce Poverty In The Developing World" By Miguel A. Altieri & Peter Rosset1, *Agbioforum – Volume 2, Number 3 & 4, 1999, Pages 155-162.*
3."Regulations For Genetically Modified (GM) Foods: Ethical And Safety Issues", Review Prepared by A. Karaali, 2nd World Engineering Congress, ,22-25 July 2002, Sarawak, Malaysia, pages 111-118.

Lecture 6

BIOSAFETY, HEALTH IMPLICATIONS OF GM FOODS AND CONSUMER CONCERNS

The similarities and differences in public perceptions and consumer attitudes for GM foods,drinks and food ingredients in different countries will be discussed, specifically comparing the promotional "substantial equivalence" approach of US authorities with the "precautionary" approach of EU countries on labelling requirements for meeting the "right to know" of consumers. Furthermore, concerning health issues, even though there is no current evidence to suggest that the GM technologies used to produce food are inherently harmful, since genetic modification is a rather young science , the need to continue research to improve scientific understanding in this area (especially taking into consideration the potential nutritional imbalances or allergic effects) will be stressed, explaining the scientific risk analyses and safety measures being carried out .

Basic References:

1.“Health Implications Of Genetically Modified Foods”, Review prepared by L. Donaldson and R. May, 1999.

2.The EU-US Biotechnology Consultative Forum Final Report, 2000.

Lecture 7

INTERNATIONAL ORGANIZATION POSITIONS on GM FOODS THE CARTAGENA PROTOCOL and INTELLECTUAL PROPERTY RIGHTS ISSUES

The need to take steps to rebuild trust concerning GM foods among the various actors, particularly governments, industry, scientists, regulatory agencies and the public has resulted in preparation and publication of "position papers" on GM food safety by objective scientific international bodies like OECD, WHO and FAO. The first international agreement on this subject -the Cartagena Protocol- as well as the reports prepared by consultative groups of these international organisations to identify common ground on whether and how applications of GM technologies in the food and crops sector serve the needs of society will be discussed, specifically focusing on their individual perspectives on the safety of GM crops now in use for food, the environmental impacts, trade and developmental effects, ethical and societal concerns.

Views on how GM technology can be democratically managed (to the benefit of the needy and not solely to the advantage of specific profit groups holding vital political, economic and technological power), as well as the current system of intellectual property rights (patents, plant breeders' rights, copyrights, trademarks etc.) and similar barriers to the ready transfer of modern biotechnologies will be discussed..

Basic References:

1."Genetically Modified Organisms, Consumers, Food Safety And The Environment", FAO Ethics Series 2, Rome 2001.

2."Invention Or Contrivance? Biotechnology, Intellectual Property Rights& Regulation" ,byMichael Lane, 1996. http://www.acephale.org/bio-safety/IoC-indx.htm

Additional Readings:

1. The OECD Conference Notes on the Scientific and HealthAspects of Genetically Modified Foods, Edinburgh, March 2000.

2. "Ethıcal Aspects Of Agricultural Biotechnology", Ed. David Bennet, European Federation of Biotechnology Task Group, 1999.

3."WHO Strategy on Food Safety", by Karl Heinz Engel, and "Regulating Food Safety" by Catherine W. Carnevale, 2001.

4.Documents of Committee on Trade and Environment - Council for Trade-Related Aspects of Intellectual Property Rights - Statement by the World Intellectual Property Organization (WIPO) on "Intellectual Property, Biodiversity and Traditional Knowledge", 2000-2001

Lecture 8

BIOTECHNOLOGY IN THE DEVELOPING WORLD: ASIA, AFRICA, LATIN AMERICA

Biotechnology is the new generic technology that may open windows of opportunity for developing countries in their struggle for economic development. At the same time, this technology carries along many threats for such countries. The lecture will assess these opportunities and threats for developing countries. The concentration will be on agricultural biotechnology considering the dominance of the agricultural sector in their economies and the abundance of plant and animal genetic resources. The capabilities of some developing countries in biotechnology will be examined in comparison with the developed world. As such, the lecture will provide an overall understanding of developing country perspective with respect to biotechnology.

Basic References:

- Juma, C. and Konde, V., "Industrial Applications for Biotechnology: Opportunities for Developing Countries", *Environment*, Vol 44, No 6, July/ August 2002

- Pistorius, R. and van Wijk, J., The Exploitation of Plant Genetic Information, Print Partners Ipskamp, Amsterdam, 1999

- Zilinskas, R.A., "Biotechnology and the Third World: The Missing Link Between Research and Applications" in The Biotechnology Revolution? (Eds. Fransman, M., Junne, G. and Roobeek, A.), Blackwell, Cambridge, 1995

Additional Readings:

- Falconi, C.A., "Agricultural Biotechnology Research Capacity in Four Developing Countries", Briefing Paper 42, ISNAR, The Hague, December 1999

- Gözen, A., "Industrialisation Through Plant Biotechnology! An Assessment of Opportunities and Constraints in the Case of Turkey", Recent Advances in Biotechnology (Eds.Vardar-Sükan, F., Sükan, Ş.S.), NATO ASI Series, Kluwer Academic Publishers, Dordrecht, 1992

Lecture 9

POLICY MAKING FOR TECHNOLOGICAL CAPACITY BUILDING

Planning and targeting are important for firms and countries alike for biotechnology, with various techniques and applications serving different ends. Setting priorities in biotechnology is significantly important for developing countries with limited financial and scientific resources. Priorities must be set from buttom-up with all the technology actors involved. Both social and economic considerations must be made beside technical feasibilities. As such, strategic targets has to be decided with the concensus of the public at large. The concentration will be on agriculture as still a major sector of the economy in the developing world.

Basic References:

- Bunders, J.F.G. et.al., "An Integrated Approach to Biotechnology Development", in Biotechnology.Building on Farmers' Knowledge (Eds. Bunders, J., Haverkort, B. and Hiemstra, W.), MacMillan, London, 1996

- Cohen, J.I., "Biotechnology Priorities, Planning, and Policies. A Framework for Decision Making", Research Report 6, IBS-ISNAR, The Hague, 1994

- Levidov, L. and Marris, C., "Science and governance in Europe: Lessons from the Case of Agricultural Biotechnology", *Science and Public Policy*, Vol. 28, No. 5, October 2001

Additional Readings:

Acharya, R., The Emergence and Growth of Biotechnology, Edward Elgar Publishing Ltd., Cheltenham, 1990

SCHEDULE for MODULE II (2003/2004)

Social and Environmental Impacts of Biotechnology

(at 18:00- 21:00 hours)

March 2, Tuesday	Introduction to the Module	Lecture 1	Gözen
March 5, Friday	Introduction to genetics and biotechnology	Lecture 2	Dinçtürk
March 9, Tuesday	Bioethical Perspectives and International Regulations on Recombinant DNA Technology	Lecture 3	Dinçtürk
March 12, Friday	Applications in biotechnology in environmental pollution control	Lecture 4	Dinçtürk
March16, Tuesday	Agricultural applications of transgenic crops, and GM ingredients in foods	Lecture 5	Karaali
March 19, Friday	Biosafety, Health Implications of GM Foods and Consumer Concerns	Lecture 6	Karaali
March 23,Tuesday	International Organizantions Positions on GM Foods, The Cartagena Protocol and Intellectual Property Rights Issues	Lecture 7	Karaali
March 26, Friday	Biotechnology in the Developing World: Asia, Africa, Latin America	Lecture 8	Gözen
March 30, Tuesday	Policy Making for Technological Capacity Building	Lecture 9	Gözen