

# Biotechnology: Social and Environmental Issues

Urban & Environmental Policy & Planning  
Instructor: S. Krinsky

UEP 222 Sp 09  
Wed 1:30-4PM

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## Course Objectives

The course examines the social and environmental impacts of the new developments in biotechnology in the areas of agriculture, medicine, and human reproduction. There are no science prerequisites; students will gain a basic scientific/technical literacy pertaining to the biological concepts associated with the new developments in genetic engineering. There will be discussions and critical analyses of the contributions of science to public policy and the role of values in science. Topics include: history of the recombinant DNA controversy, genetically engineered plants and microorganisms, biodiversity, bovine growth hormone, transgenic animals, genetically modified food, human genetic engineering/eugenics, cloning, DNA identification, privacy, DNA databases, and genetic discrimination; behavioral genetics; forensic DNA, the Human Genome Project, the cloning debate; globalization and patenting of genes and life forms.

The social controversies surrounding research, medical applications, and products of biotechnology will be viewed through the perspectives of different stakeholders and alternative frameworks of analysis highlighting religious and secular values and ideology, risk assessment, sustainable development, environmental ethics, the "scientific imperative," the precautionary principle, and cultural norms.

## Course Readings:

The following required books have been ordered in the Tufts Book Store.

S. Krinsky and P. Shorett. *Rights and Liberties in the Biotech Age*.

H.I. Miller and G. Conko. *The Frankenfood Myth*. Praeger, 2004.

R. Hubbard and E. Wald. *The Gene Myth*

Jeffrey M. Smith. *Genetic Roulette: The Documented Health Risks of Genetically Engineered Foods*. Yes! Books, 2007.

Other articles will be available on Blackboard

## Jan. 16: Session 1

### Introduction: Origins of Genetic Engineering in Science & Technology

Discovery of gene transplantation research; recombinant DNA. Relationship between science and societal issues. Social and environmental impacts of the new genetics. How value issues, politics, and science intersect. Why genetics has been such a socially sensitive issue.

Video: NOVA *The Gene Engineers*; circa 1977.

**Jan 23. Monday Schedule**

**Jan. 30: Session 2.**

**Historical Roots: The Recombinant DNA Controversy**

Early scientific concerns about genetic engineering; Gordon Conference letter; 1975 Asilomar Conference; NIH Guidelines for rDNA research; Cambridge, MA genetics controversy; citizens roles in science and technology.

**Readings:**

T.F Lee. Ch. 1 Enter the genes. In: *Gene Future* [B]

R. Hubbard and E. Wald. Ch. 4. A brief look at genetics. *Exploding the Gene Myth*.

S. Krimsky. Ch. 1. A troublesome experiment. In: *Genetic Alchemy*, pp. 24-38. [B]

S. Krimsky. Ch. 12. Regulating recombinant DNA research. In: *Controversy: Politics of Technical Decisions*. D. Nelkin, ed., pp. 219-248.

Paul Berg and Maxine Singer. The recombinant DNA controversy: twenty years later. *Biotechnology* 13:1132-1134 (October 1995). [B]

Video: Cambridge rDNA controversy, 1976,

**Feb. 6: Session 3**

**Commercialization of Genetic Technology**

Rise of industrial genetics; agricultural and pharmaceutical applications; patenting of life forms and gene sequences; forensic and DNA identification; industry-university relations; community reactions.

Video: *Significant Hazards: The Somerville DNA Debate*

**Readings**

S. Krimsky. The Cultural Significance of the Genetic Revolution. In: *Biotechnics and Society*, Ch.1, pp. 1-17. [B]

S. Krimsky. Ch. 4. Knowledge as Property. In: *Science in the Private Interest*. Rowman & Littlefield, 2003. [B]

Leon Kass, Ch. 5. Patenting life, **pp. 128-153**. *Toward a More Natural Science* [B]

R. Hubbard and E. Wald. Ch. 9, pp. 117-127. Genes for sale. In: *Exploding the Gene Myth*. Beacon Press.

*Rights and Liberties*; Part II. Life Patents. Chapters 3, 4 & 5.. Part IV Indigenous People, Ch. 9, 10, and 11.

#### **Feb. 13: Session 4**

##### **Agricultural Applications I: Ice-Minus Bacteria**

The first field release of a genetically engineered microorganism (GEM), called ice minus, to prevent frost damage; role of ice nucleating organisms; assessing the ecological risks of ice minus; media reaction to ice minus; public response to modifying the soil bacterial flora EPA's regulatory role.

Video: Ice Minus Field Tests

##### **Readings**

S. Krimsky. The birth of synthetic biology and the genetic mode of production. In: *Genetically Engineered Crops: Interim Policies, Uncertain Legislation*, Iain E.P. Taylor, ed. Haworth Press, 2007. [B]

S. Krimsky. Ch. 8. Debates over deliberate release: Disciplinary fault lines. *Biotechnics and Society*. Praeger 1991, pp. 133-151. [B]

J. Rissler and M. Mellon. *Ecological Risks of Engineered Crops*. MIT Press, 1996, pp. 9-70 [B]

*Frankenfood Myth*. Prologue, Foreword, & Ch. 1

*Genetic Roulette*, Sec. 1 pp.22-61.

#### **Feb. 20: Session 5**

##### **Agricultural Applications II: Synthetic Bovine Growth Hormone**

Synthetic bovine growth hormone is administered to cows to increase milk production; safety concerns; economic issues; scale effects on small farmers; consumer advocacy; farmer acceptance.

Video: Monsanto Corp on BGH; Documentary file (not aired).

##### **Readings**

S. Krimsky and R. Wrubel. Ch. 9, Animal growth hormones: The case of bovine somatotropin. In: *Agricultural Biotechnology & the Environment*. University of Illinois Press, 1996, pp. 166-190. [P]

Charles J. Grossman. Genetic engineering and the use of bovine somatotropin. *JAMA* 264:1028 (April 22, 1990). [P]

Council on Scientific Affairs, American Medical Association. Biotechnology and the American agricultural system. *JAMA* 265:1429-1436 (March 20, 1991). [P]

## **February 27: Session 6**

### **Agricultural Applications III: Herbicide and Insect Resistant Crops**

Increasing role of genetically engineered crops in agriculture; rise of the anti-GMO consumer movement; regulation of GMOs; roles of EPA, USDA, and FDA; labeling of food crops; allergenicity.

#### **Readings:**

National Research Council. *Environmental Effects of Transgenic Plants*. Ch. 2. Scientific assumptions and premises underpinning the regulation and oversight of environmental risks of transgenic plants. National Academy Press, 2002, pp. 52-100. [B]

*Frankenfood Myth*, Ch. 2 and 3.

J. Rissler and M. Mellon. *Ecological Risks of Engineered Crops*. MIT Press, 1996. Chapter 2-3, pp. 9-70. [B].

Richard Lewontin. Genes in the food! *The New York Review* June 21, 2001. [B]

*Rights and Liberties*, Part III, Genetically Engineered Food., Ch. 6, 7 and 8.

*Genetic Roulette*, Secs 2 & 3., pp. 63-107.

## **Mar. 5: Session 7**

### **Agricultural Applications IV: Transgenic Animals, Ethics & Policy Issues**

Commercial, research, and medical applications of transgenic animals; traits conferred through genetic engineering; ethical and theological considerations; the re-speciation of nature with transgenically endangered wildlife.

#### **Readings:**

S. Krinsky and R. Wrubel. Ch. 10. Transgenic animals. In: *Agricultural Biotechnology and the Environment*, pp. 191-211 [B].

B.E. Rollin. The "Frankenstein Thing": The moral impact of genetic engineering of agricultural animals on society and future science. In: *Agricultural Bioethics*, Ed. By S.M. Gendel, A.D. Kline, D.M. Warren, and F. Yates. Iowa State University Press, 1990, pp. 292-308. [B]

T.H. Howard, E.J. Homan and R.D. Bremel. Transgenic livestock: Regulation and science in a changing environment. *Journal of Animal Science*. Supplement E1-E11, 2001. [B]

*Genetic Roulette*, Sec. 4, pp. 109-171.

*Frankenfood Myth*, Ch. 4 and 5.

### **Mar. 12: Session 8**

#### **DNA Identification and Forensic Evidence**

Role of DNA as forensic evidence; dependability of the DNA “fingerprint;” controversy over DNA identification system; genetic discrimination and privacy; rights of incarcerated felons to exculpatory DNA tests.

#### **Readings:**

R. Hubbard and E. Wald. *Exploding the Gene Myth*, Ch. 11, DNA-based identification systems, privacy and civil liberties, pp. 143-157. [P]

Eric Lander, Ch. 9, DNA fingerprinting: science, law and the ultimate identifier. In: D.J. Kevles and L. Hood, *The Code of Codes*, pp. 191-210. [B]

*Rights and Liberties*, Part IX, Exculpatory DNA Evidence. Ch. 22-23.

T. Simoncelli and S. Krimsky. A new era of DNA collections: At what cost to civil liberties? *American Constitution Society of Law and Policy* 2007. [B]

Video ABC 20-20. “Genetic Fingerprinting” April 1, 1988.

### **March 15-23: Spring Break**

### **March 26: Session 9.**

#### **Human Genome Initiative: Genetic Screening & Privacy**

Role of pre-natal and post-natal genetic screening; contested issues on what should be screened; accuracy of screening tests; screening for abortion; adult screening to determine late onset diseases; ethics of screening.

#### **Readings:**

*Rights and Liberties*, Part VII. Genetic Privacy. Ch. 17-18. Part VIII. Genetic Discrimination. Ch. 19-21.

*Genetic Engineering: Opposing Viewpoints*. Ch. 2, Viewpoints 3-4: Ted Peters, Genetic screening is ethically problematic, pp. 74-82; Walter Glannon, Genetic screening can be ethical, pp. 83-89. [B]

*Exploding the Gene Myth*, Ch. 3, The new genetics: testing, screening and choice, pp. 23-38.

Nancy Wexler. Clairvoyance and caution: repercussions from the human genome project. Ch. 10. In: *The Code of Codes*, D.J. Kevles and L. Hood, eds., pp. 211-243. [B]

Marcy Darnovsky. Revising sex selection. *GeneWatch*. Jan.-Feb. 2004., pp. 3-5. [B]

Video: WGBH, *The Human Genome*, June 11, 1992.

Audio: WBUR (Audio Tape) David Baron, Dwarfism Genetic Test. Jan. 11, 1995.

## **Apr. 2 Session 10**

### **Human Somatic Cell Gene Therapy**

Genetic alteration of somatic cells; Jesse Gelsinger case; ethics and policy of clinical uses of genetic modification; enhancement and genetic modification.

#### **Reading**

*Biotechnics and Society*, Ch. 9. Human genetic engineering: new ethical frontiers, pp. 155-180. [B]

W. French Anderson. Genetic engineering and our humanness. *Human Gene Therapy* 5:755-760 (1994). [B]

C. Crofts and S. Krimsky. Emergence of scientific and commercial R&D infrastructure for human gene therapy. *Human Gene Therapy* 16:169-177 (February 2005).  
<http://www.tufts.edu/~skrimsky/PDF/HGT%20Infrastrudcture.PDF>

Video: NBC: Dateline; Jesse Gelsinger case, September 20, 2002.

## **Apr. 9: Session 11**

### **Genetics and Race**

What genes have to tell us about racial groupings; Is the concept of race grounded in science? Can medical conclusions be drawn from research that uses racial categories?

#### **Readings**

Richard S. Cooper, Jay S. Kaufman and Ryk Ward Race and genetics. *New England Journal of Medicine* 348:1166-1170 (March 20, 2003).

E.G. Burchard, E. Ziv and N. Coyle et al. The importance of race and ethnic background in biomedical research and clinical practice. *New England Journal of Medicine* 348:1170-1175 (March 20, 2003).

## **Apr. 16: Session 12**

### **Genetic Modification of the Human Germ Line**

Prospects for altering the inherited traits of humans; arguments behind alteration of the human germ line; corrective genetic alteration vs. enhancement; criticisms of eugenics.

#### **Readings**

Nelson A. Wivel and LeRoy Walters. Germ-line gene modification and disease prevention: some medical and ethical perspectives. *Science* 262:533-538 (October 22, 1993). [B]

Troy Duster. The hidden eugenic potential of germ-line interventions. Ch. 10, pp. 156-178. In: *Designing our Dependants* A.R. Chapman and M.S. Frankel, eds. [B]

Kenneth W. Culver. Gene repair, genomics and human germ-line modification. Ch. 6, pp. 77-91 In: *Designing our Dependants* [B]

Christopher H. Evans. Germ line gene therapy. Ch. 7, pp. 93-101. In: *Designing Our Dependants*. [B]

Pilar N. Ossorio. Inheritable genetic modifications. Ch. 16, pp. 252-271. In: *Designing Our Dependants*. [B]

Mario R. Capecchi, Human germline gene therapy, pp. 31-42; ; Lee M. Silver, Reprogenetics, pp. 57-71. In: *Engineering the Human Germline*, ed. By Gregory Stock and John Campbell. [B]

Council for Responsible Genetics. Position Paper on human germ-line manipulation. *Human Gene Therapy* 4:35-37 (1993). [B]

*Genetic Engineering: Opposing Viewpoints*. Oliver Morton, Genetic engineering of humans is ethical, pp. 55-63. Bernard Gert, Genetic engineering of humans is largely unethical, pp. 64-73. [B]

*Rights and Liberties*, Part VI. Eugenics, Ch. 15-16.

## **April 23: Session 13**

### **Human Behavioral Genetics and Genetic Reductionism**

Genes and deviant human behavior; sociobiology; critique of genetic reductionism: “gay genes;” “criminal genes.” The XYY affair.

#### **Readings**

*Exploding the Gene Myth*, Chapter. 7, “Inherited tendencies”: Behavior, pp. 93-107.

Jon Beckwith, *Making Genes, Making Waves*. Ch.8-9; The myth of the criminal chromosome; pp.116-134; It's the devil in your DNA, pp. 135-152. [B]

R.C. Lewontin. All in the genes. In: *Biology as Ideology*, pp. 17-38.. [B]

Peter McGuffin, Brien Riley, Robert Plomin. Toward behavioral genomics. *Science* 291:1232 (February 16, 2001). [B]

### **Assignments**

Class participation:	10
1 essay 3-5 pages:	15
1 debate brief: 5-7 pages	15
Prospectus of paper	10
Commentary of a student's draft paper	10
Final paper	<u>40</u>
	100 points



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