Biotechnology: Social and Environmental Issues

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


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


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

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


*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


**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:**  

Frankenfood Myth, Ch. 2 and 3.


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


**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:**


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]


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:


*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.


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]


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


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


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]


*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
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]


**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: 40

100 points
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