Master of Chemical and Life Sciences Program  
College of Computer, Mathematical, and Natural Sciences

CLFS 609A: Special Topics: Food Safety and Genetically Modified Foods

This course includes all aspects of food safety and its regulation, with special emphasis on genetically modified foods. Relevant case studies will be discussed. The different types of genetically modified and designer foods, and how they are produced, are discussed first. Then the course concentrates on the traditional concerns of food safety and the response of our food regulation laws, with references to genetically modified organisms. The last part of the course deals with the real and perceived risks of genetically modified foods and the different impacts of these foods on the industrialized and third worlds, and the environment.

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Unit 1 – GM foods
Early examples of improvement of specific genetic traits using traditional breeding include maize, canola, food animals and seedless fruit. Genetically engineered proteins have been available for several years, including bovine somatotropin in milk. Agricultural modifications include improving yield, crop survival, growth rate and cloning in processing convenience. Nutriceuticals and dietary supplements are described. Some genetic changes in crops may serve only to facilitate industrial food processing, whereas other products may confer significant economic and societal benefit, such as resistance to frost, drought and salinity or improved nutritional components.

Module 1 Genetic Engineering in Foods
Products from Genetically Modified Organisms
- Chymosin
- Bovine Somatotrophin
- Lite Beer
- L-tryptophan

Module 2 Genetically Engineered Plants
- Herbicide Resistance
- Pest Resistance
- Environmental Tolerance
- Nutriceuticals
- Pharmaceuticals

Module 3 Transgenic Animals
- Transgenic Livestock
- Transgenic Fish
Unit 2 – Food Safety and the Law
The history of food safety legislation has evolved with technology to identify contaminants in the food supply. As society has changed so have the threats and the sensibilities of society. This unit provides an overview of the traditional hazards of microbiological, chemical, additive and filth contamination, and follows their regulation in statues at the federal, state and local levels, with a description of the jurisdiction of the various bodies involved. The diversity of society and increasing efforts to market to ethnic, cultural and philosophical minorities raises issues in aesthetic perception.

Module 4 Taming “The Jungle”
- The Pure Food and Drug Act of 1906
- The Federal Food, Drug and Cosmetic Act of 1938, as amended
- Making New Regulations

Module 5 The State of Food Today
- Adulteration
- Filth
- Microorganisms
- Chemicals and Other Additives
- Genetically Manipulated Organisms
- Ethnic Foods and Cultural Differences.

Module 6 The Statutory Basis for our Food Regulations
- The Food and Drug Administration
- The Centers for Disease Control and Prevention
- The United States Department of Agriculture
- The Environmental Protection Agency
- State and Local Agencies

Unit 3 - Microbiological Hazards in the Food Supply
Food-borne microbiological hazards exploit food vehicles to the extent of millions of cases per year. Examples of pathogens exploiting important weaknesses in agricultural, industrial, retail and domestic practices include Salmonella, E. coli, Hepatitis A, Vibrio vulnificus, Campylobacter, and Clostridium botulinum. A brief overview of these and other organisms will describe infectious doses, attack rates, and important intervention points, and will introduce the concepts of Hazard Analysis, Critical Control Point (HACCP).

Module 7 Microbiological Contamination
- Infectious Dose
- Attack Rate
- Sequelae
- Transmissibility
- Variability
- Food Matrix
- *Clostridium botulinum*
Module 8 Hazard Analysis of Critical Control Points

Module 9 Risk Assessment
  Case Study 1: *E. coli O157:H7*
  Case Study 2: *E. coli O157:H7*

Unit 4 - Chemical Hazards in the Food Supply
Pesticides, mercury, and aflatoxin enter the food supply in part due to human activity, so are they natural components of food? The sources and impacts of chemical contaminants are discussed. The importance of pesticides in agricultural production can easily be overlooked. Packaging, saccharin, aspartame, and putative carcinogenic additives to foods symbolize the risk-averse nature of parts of food regulation. This approach meets genetically manipulated foods in the “Precautionary Principle” and the Calgene Flavr-SavrTM tomato. The understanding of food additives is essential to understanding genetically manipulated foods. The statutory basis of labeling is introduced. The outcomes from classic litigation are discussed as paving the way for a new century of biotechnology regulation.

Module 10 Chemical Contaminants
  Pesticides
  Alar
  Mercury
  Fungal Toxins

Module 11 Food Processing
  Irradiation
  Packaging

Module 12 Allergens
  Overview of Immune Responses
  Food Allergies
  GM Foods

Module 13 The Delaney Clause
  Saccharin Study And Labeling Act

Module 14 Labeling
  Infant Formulae and Dietary Supplements
  GM Foods
Unit 5 Biotechnology: Benefits, Risks and Public Perception

Module 15 Health
Module 16 Environment

Module 17 The Industrialized World
   The World Health Organization

Module 18 The Developing World