BMS 505/CNSE 503
BIOLOGICAL BASIS OF PUBLIC HEALTH
FALL, 2010
SYLLABUS

Location and meeting times: M/W 10:30 am – 11:50 pm, Location (??)

Course Directors:

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Course Description:

This course is designed to introduce students with no or minimal formal training in biological sciences an overview of the field with an emphasis on its application to significant public health problems. This course focuses on providing the details and background necessary for a basic understanding of biological knowledge and the technology that surrounds it. The primary emphasis of this course is to provide the necessary information to individuals with diverse backgrounds so that they have a good working knowledge of biomedical sciences and how it influences our lives and shapes public health. This course will provide an introduction to the field of biomedical sciences through discussion of disorders of public health relevance, including infectious and transmissible vectors, genetic disease and chronic disorders. Students will also be exposed to the expanding realm of nanoscience and nanotechnology and their implications for the fields of medical technology, the biomedical sciences, and public health. Concepts of laboratory methods including quality control, normal ranges, and universal precautions and data interpretation are described. Prerequisite: One semester of college science, e.g., biology, chemistry, physics or a comparable course.

Learning objectives for BMS505:

- **You will be able to describe the role of biomedical sciences in the ecological model of public health.**
- **You will learn to understand and communicate basic biological and genetic terminologies.**
- **You will learn to about emerging biological technologies and how they can be applied to diagnosis and prevention of human disease.**
- **You will learn to identify the political, legal, social, ethical and economic issues associated with integrating basic biology into public health.**
- **You will learn where to locate and how to acquire accurate and practical biological information that impacts public health issues.**
- **You will be able to describe the role of the New York State Department of Health and the Wadsworth Laboratories in the control of infectious and genetic diseases in New York State.**
- **You will be able to explain the use of laboratory procedures for understanding and diagnosing selected infectious diseases and genetic conditions.**
- **You will learn to identify policy alternatives for controlling selected infectious diseases and describe the fiscal, ethical, legal, social, and political implications of each option.**
- **You will be able to describe the Human Genome Project and discuss its implications for public health, including medical, economic, ethical, legal, social, and political factors.**
- **You will be able to describe existing and proposed programs in newborn, carrier, and cancer screening, and discuss pros and cons of each program, including medical, economic, ethical, legal, social, and political factors.**
- **You will have a basic understanding of biologically and medically relevant advances in nanotechnology.**

- **You will understand and be able to discuss some of the major positive and negative implications of nanotechnology in the field of medicine and public health.**

Public Health Biology Competencies for BMS505:

1. **Specify the role of the immune system in population health.**
2. **Describe how behavior alters human biology.**
3. **Identify the ethical, social and legal issues implied by public health biology.**
4. **Explain the biological and molecular basis of public health.**
5. **Explain the role of biology in the ecological model of population-based health.**
6. **Explain how genetics and genomics affect disease processes and public health policy and practice.**
7. **Articulate how biological, chemical and physical agents affect human health.**
8. **Apply biological principles to development and implementation of disease prevention, control, or management programs.**
9. **Apply evidence-based biological and molecular concepts to inform public health laws, policies, and regulations.**
10. **Integrate general biological and molecular concepts into public health**

Public Health Biology Illustrative Competencies for BMS505: The ability to incorporate public health biology – the biological and molecular context of public health into public health practice.

1. Specify the role of the immune system in population health.

a) Explain what a vaccine is and why we have effective vaccines for some infectious disease but not all.
b) Explain the function of the immune system.
c) Identify immune responses to pathogens, manipulation of immune response for vaccines or immunotherapy, and failure or aberrant immune responses.
d) Explain the biological principles and vaccination strategies that allowed smallpox eradication.
e) Describe the role, benefits, and limitations of vaccines in assuring the health of populations.

2. Describe how behavior alters human biology.

a) Relate basic principles of cell biology, biochemistry, and genetics to problems in mental health.
b) Describe the influences of environment and human physiology on behavioral health, including: genetics, substance use, family, culture, ethnicity, trauma, cognition, and developmental status.
c) Relate biological and genetic changes resulting from smoking.
d) Analyze the interaction of genetics, lifestyle, and the environment in the health of a population.

3. Identify the ethical, social and legal issues implied by public health biology.

a) Assess the pros and cons of using individual information in the design, implementation, and evaluation of public health activities and initiatives.
b) Discuss the biological underpinnings and public health issues of drug interactions in diverse populations.

4. Explain the biological and molecular basis of public health.

a) Explain the biological and molecular characteristics of cancer, heart disease, stroke, aging, and other chronic diseases.
b) Integrate general biological and molecular principles into public health problems such as infectious disease, disease susceptibility, drug resistance, and assisted reproduction.
c) Explain the relationships among nutrition, physical activity, and health.

5. Explain the role of biology in the ecological model of population-based health.

a) Discuss the biology of major determinants of national and global public health, e.g. smoking, obesity, malnutrition.
b) Relate the biological factors with other components of the ecological model for emerging infections in the global environment.

6. Explain how genetics and genomics affect disease processes and public health policy and practice.

a) Define the basic terms, vocabulary, and underlying principles associated with genetics and genomics.
b) Integrate traditional approaches in genetics with genomic and proteomic approaches.
c) Determine the role of genetic factors in the susceptibility to and progression of disease.

d) Discuss cancer as a genetic disease.
e) Explain the genetic changes that are key in generating emerging infectious diseases such as avian flu.

7. Articulate how biological, chemical, and physical agents affect human health.

a) Describe human molecular, cellular, and physiological interactions with exogenous agents.
b) Discuss environmental factors affecting expression of determinates of susceptibility to disease during development.
c) Describe the various ways by which chemicals can directly or indirectly affect human health.
d) Discuss the effects of chemicals on the ecosystem, for example global warming and the ozone layer.

8. Apply biological principles to development and implementation of disease prevention, control, or management of programs.

a) Assess biological principles of public health laboratory tests.
b) Describe the ecological principles of disease and how these principles affect the likelihood of control.
c) Assess factors that affect accessibility, adequacy, and safety of the food supply and the relationship to the assessment and analysis of community food systems.

9. Apply evidence-based biological and molecular concepts to inform public health laws, policies, and regulations.

a) Determine appropriate use of data, statistical methods, and laboratory procedures for problem identification and resolution, and program planning, implementation and evaluation.
b) Discuss population dynamics in terms of reproduction, assisted reproduction, fecundity, selection, allele frequencies, fitness and evolution.
c) Discuss the principles of cell biology and development underlying the potential and controversy surrounding stem cells.

10. Integrate general biological and molecular concepts into public health.

a) Discuss the evolution of concepts about health and the cause of disease.
b) Discuss the multiple factors that influence infectious disease epidemics.
c) Integrate biological approaches to air, food, and water safety.

Evaluation:

Exams: (2) 90% (45% each)
Exams are closed book, in class, multiple choice and/or essay answer.

Term Paper: 10%
A 3-5 page paper describing life as a microorganism from the perspective of the bug and how it causes human disease will be required of each student.

Grading Scale:

A = 93-100, A- = 90-92
B+ = 87-89, B = 83-88, B- = 80-82
C+ = 77-79, C = 73-78, C- = 70-72
D+ = 67-69, D = 63-68, D- = 60-62
E = 0-59

Note 1: The "earned" grade of "E" is treated mathematically as a "30".

Note 2: Plagiarism without proper citation from any and all sources will result in a grade of “E” for the course. Consult the Graduate Student Bulletins or the Course Instructors if you have any questions.

Attendance Policy: Participation in the course is expected and may be considered in the final grade if necessary.

Lecture Schedule

Lecture 1 – August 30, 2010—Overview of class (Tenenbaum, Salkin, Chaturvedi)

- Course structure, testing, grading and term paper

Lecture 2 – September 1, 2010— Basics in Genetics (Tenenbaum)

- History of Genetics

- Introduction to DNA

********** NO CLASS SEPTEMBER 6, 2010 (Labor Day)**********

Lecture 3 – September 8, 2010— Basics in Genetics (Tenenbaum)
- Chromosomes, Genes, RNA, and Proteins
- Basis of Genetic Mutations

Lecture 4 – September 13, 2010— How genetics is used in Public Health (Tenenbaum)
- Examples of Genetic Diseases Affecting Public Health
- Eugenics
- The Ethics of Genetics
- Integrating Genetics/Genomics into Public Health
- Disease Prevention

Lecture 5 – September 15, 2010— Genomics in Public Health I (Tenenbaum)
- History of the Human Genome Project
- How was the Human Genome Sequenced?
- Genomic Terminologies
- Cancer Genomics
- The Future of Genomics

Lecture 6 – September 20, 2010— Genomics in Public Health II (Tenenbaum)
- How was the Human Genome Sequenced?
- Genomic Terminologies
- Cancer Genomics
- The Future of Genomics
- Genetically Modified Foods
- Genetic Engineering and Gene Therapy

Lecture 7 – September 22, 2010— Molecular Biology in Public Health (Tenenbaum)
- Recombinant Gene Technology
- The Central Dogma
- Molecular Biology Tools

Lecture 8 – September 27, 2010— Inheritance and Newborn Screening (Caggana)
- Types of disease-causing changes in genes
- Technologies to study DNA gene variation.

Lecture 9 - September 29, 2010 - Population Genetics; IVF/PGD Programs (Caggana/Tenenbaum)
- Comparison of sickle disease and Tay-Sachs disease
- Screening tests and how to judge them from a clinical and public health standpoint
- Using cystic fibrosis and breast cancer as models.

Lecture 10 – October 4, 2010— Genetics and Cancer (?)
- Molecular genetics of cancer
- The role of biomarkers in cancer screening
- Detection of cancer
- Cancer Epidemiology

Lecture 11 - October 6, 2010 – Immunology and Host Immunity (Susan Wong)
- Innate immunity

- Acquired immunity
- Antibodies
- T-Cells
- Host immune response

Lecture 12– October 11, 2009— Germ Theory and Infectious Diseases (Tenenbaum)

- Koch's Postulates
- Infectious disease
- Antibiotics
- Major milestones in the history of microbiology
- General properties of microorganisms
- Pathogenicity and virulence

**********EXAM 1—OCTOBER 13, 2010**********

Lecture 13 – October 18, 2010—General Virology/Diagnostics (Karen Duss)

- Overview of the area of virology
- Tools used in the diagnosis of viral infections

Lecture 14 – October 20, 2010—Virology/Emerging Diseases (Karen Duss)

- SARS
- H1N1 (Swine Flu)

Lecture 15 – October 25, 2010—HIV (Clay-Stephens)

- Prevention and intervention challenges
- Legal, social, cultural, political, religious, behavioral, regulatory, scientific and medical norms and beliefs
- Epidemiologic overview and timeline
- Case definitions and classification hierarchy
- Immunologic and systems pathology

Lecture 16 – October 27, 2010—Bacteriology (Kimberley Musser)

- Pathogenic bacteria causing foodborne and waterborne diseases
- Bacterial Disease Outbreaks

Lecture 17 – November 1, 2010—Mycobacteriology (Vincent Euscuyer)

- *Mycobacterium tuberculosis* Epidemiology, diagnosis
- Antimicrobial drug resistance

Lecture 18 – November 3, 2010 Medical Mycology (Salkin or Chaturvedi or both)

- Pathogenic fungi causing primary and hospital acquired infections
- Relationship of fungi to public health

Lecture 19 – November 8, 2010— Biohazardous /Medical Waste (Salkin)

- Discussion of biohazardous waste
- Methods of treatment
- Relationship to public health

Lecture 20 – November 10, 2010 — Chronic Diseases - Neurodegenerative (Chaturvedi)

Lecture 21 – November 15, 2010—Chronic Diseases- Diabetes (Hosler)

Lecture 22– November 17, 2010—Chronic Diseases - Cardiovascular (Chaturvedi)

Lecture 23 – November 22, 2010— Parasitology (Madison-Antenucci)

- Parasites causing bloodborne and waterborne diseases
- Parasitic disease outbreaks

****************************NOTE – No lecture on Wed. Nov. 24, 2010**************************

Lecture 24 – November 29, 2010— Nanotoxicology/Nanomedicine (?)

- Biomedical nanotechnology
- Nanotoxicology
- Nanomedicine
- Novel nanotechnology applications in medicine and public health.

Lecture 25 – December 1, 2010— Nanotechnology (?)

- Bionanofabrication/Biomimetics
- Nanofabrication
- Nanobiotechnology

Lecture 26 – December 6, 2010— Nanotechnology and Biological Sciences (?)

- Advances in Nanobiotechnology
- Biosensors
- Nanoscale Cell-Surface Interactions
- Cell Signaling in Defined Microenvironments

Lecture 27 – December 8, 2010—Nanotechnology Based Stem Cell and Cancer Research (?)

- Biomedical nanotechnology
- Stem cell nanotechnology
- Nanon tissue engineering
- Nano Cancer technology

BIOETHICS/ MEDICAL ETHICS

****TERM PAPER DUE, DECEMBER 6, 2010**

**************************EXAM #2—FINAL EXAMINATION - December 10 – 17, 2010***************************

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