



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute  
2007 Volume V: Health and the Human Machine

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## Introduction

Humans eat, drink, and breathe to bring into their bodies the raw materials for growth, repair, and generation of the energy necessary for life and the actions that bring pleasure to life. This seminar provided an overview of human nutrition and the operation of the human body from the perspective of biomedical engineering. From a simple mechanical viewpoint, the human body is an elegant machine that requires inputs for sustained operation. What are the processes responsible for input of nutrients and raw materials? How are molecular nutrients extracted from ingested materials? How are these processes controlled?

The human machine requires food and water for continued operation. But the relationship between the food intake and human health is complex and poorly understood. Some things are clear: whole foods that we ingest get broken down to components such as amino acids and sugars, which the body uses to synthesize new proteins and to generate or store energy. Protein synthesis, energy generation, and metabolic processes occur in cells throughout the body; hence all of these processes are related to the circulation of molecules in the body. This seminar discussed these issues and attempted to establish some general descriptions of the ways our bodies are changed by what we allow to enter them.

The issues of food intake, nutrition, and human health are becoming increasingly important in the U.S. The Centers for Disease Control and Prevention (CDC) report a dramatic increase in obesity in the U.S. over the period from 1985 to 2005. In addition, diseases related to environmental exposure to toxins and pollutants are widespread and still rising. For example, asthma among children has increased to epidemic proportions, accounting for one in six of all visits to pediatric emergency rooms in the U.S. And disorders of metabolism, such as diabetes, create tremendous challenges for many individuals in the U.S. and other nations.

Specifically, the seminar covered the following topics:

1. Introduction to Human Physiology--viewing the human body as a complex, and sometimes fragile, machine
2. Respiratory Physiology--structure of the lungs, anatomy of breathing, and oxygen uptake
3. Heart Physiology--structure of the heart and vessels
4. Nutrition--body mechanisms for control of weight, obesity, vitamins (and diseases caused by deficiencies)
5. Diabetes--the chemical and anatomical changes that result from this disease, as well as ways to treat the disease
6. Infectious disease--a discussion of communicable diseases including STDs that focused on the anatomical routes of infection

## 7. Biomechanics--how the human body performs in the physical world.

The discussions were supplemented with drafts of chapters from a book in progress, *Biomedical Engineering: Bridging Medicine and Technology*, by myself and Veronique Tran. The textbook is scheduled for publication soon.

The Fellows prepared curriculum units that covered the breadth of human physiology. The range of material was impressive, as well as the range of grade levels that the seminar produced units to satisfy.

This volume includes units from a team of four teachers working together at the same middle school to bring valuable health information into their classrooms. Two of these projects focused on nutrition: Amy Migliore-Dest prepared a unit on the use of pop art techniques to teach about human nutrition called "Using Pop Art Imagery to Inspire Healthy Eating" and Crecia C. Swaim prepared a unit for French students that teaches about nutritional content of foods called "À Votre Santé: A French-Language Unit on Nutrition." These nutrition units are paired with two units on cardiovascular health and obesity; Grace Malangone prepared a unit on "Adolescent Obesity and Susceptibility to Disease" and Marisa Ferrarese prepared a unit on maintaining good cardiovascular health called "Fit for Our Future."

Nutrition was a subject of two of the other units in this volume. Shannon E. Oneto prepared a unit on nutritional information for elementary school students, which also includes an important primer on the sources of nutrients in foods, called "Eating the Rainbow: A Student's Guide to Healthy Foods That Grow." Karen A. Beitler prepared a unit for high school students on the timely issue of genetic modification of foods called "Genetically Engineered Food: Altering the Blueprint."

Sara E. Thomas prepared a unit on the use of graphic design techniques to teach high school students about nutrition, smoking, and body image called "Advertising for Healthy Habits." Wendy Decter prepared a unit for high school students that capitalizes on interest in crime scene analysis to teach about cardiovascular physiology called "Cardiac Arrest! Using Forensics to Investigate Cardiovascular Anatomy and Function."

Three of the units focused on infectious diseases, discussing mechanisms of infection and how they influence physiology and the progress of disease. Heidi A. Everett prepared a unit called "Human Papillomavirus: Investigating the Prevention, Transmission, and Treatments of a Viral Infection." Melanie Laputka prepared a unit for world language students called "HIV/AIDS in Our Spanish-Speaking Community and the World." Rosey Rawle-Pitter prepared a unit on "Infectious Diseases: Hepatitis B and Tuberculosis." These units were all prepared for high school students.

Finally, this volume includes a unit for elementary school students that provides information to help students understand the impact of disabilities on students in their classrooms. Melanie Wolf prepared this unit, called "Understanding and Supporting Our Peers with Cognitive Challenges."

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