Yale-New Haven Teachers Institute®

Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
2002 Volume V: Food, Environmental Quality and Health

Introduction

The food we eat affects our health and the quality of our environment in surprising ways. It provides essential nutrients necessary for health and life itself, but may also convey hazardous biological and chemical contaminants. One of the more important lessons in food chain ecology grew from the world's experience with nuclear weapons testing between 1945 and 1990. Nearly 2,000 weapons were exploded during that time, releasing nearly 200 radionuclides into the environment. At the time this testing began during World War II, very little was known about the persistence and fate of these isotopes. Gradually scientists realized that fallout did not settle quickly within several hundreds of miles of the explosions. Instead, debris and fine particles were often carried high into the atmosphere and were blown with the winds in different directions at different altitudes, settling to earth when they encountered rain. The larger tests pressed the radioactive particles high into the stratosphere, where they encircled the globe taking decades to settle to the earth's surface. When they finally settled, scientists were again surprised to find that the particles washed into the streams, rivers, ponds, lakes and the oceans. They built up in the top layers of soil, unless plowed more deeply. And they were absorbed by trees, grasses, lichen and many crops, especially pasture grasses and grains. By 1953 the Atomic Energy Commission recognized the potential for strontium 90 and cesium 137-two long lived and dangerous isotopes-to accumulate in grazing mammals, released into their milk. This was the primary pathway of exposure for most people on the planet. By 1955, it was clear that mothers were passing radioactive strontium to their infants in breast milk.

The history of pesticides is remarkably similar. DDT, aldrin, dieldrin, chlordane, toxaphene and many other pesticides were designed in the 1940's, and were rapidly deployed to protect both crops and the humans from disease carrying insects. By 1970, nearly 70,000 pesticide products had been licensed by the U.S. government. And nearly 200 billion pounds of pesticides were released to the environment, primarily to protect food crops during the 20th century. DDT was first found in dog's milk in 1945, in cow's milk in 1948, and human milk in 1951. Its persistence and movement in food chains was remarkably similar to that of other chlorinated pesticides, and the radionuclides. Many of the chlorinated pesticides produced tumors in laboratory animals, and led to their eventual ban several decades following intense use. These chemicals contaminated much of the earth's surface, as many would volatilize, enter global atmospheric circulation, and rain down thousands of miles from where they were released. Pesticide residues are now detectable in the tissues of every human on earth. Many of the chemicals cross the placenta, circulate in rapidly growing fetal tissues, and some are released via lactation. The youngest among us tend to be the most susceptible to their effects, again a story similar to the history of radionuclides. Rapid formation of organs, the skeleton, and other tissues make pregnant women, fetuses, infants and young children especially vulnerable to chemicals that can damage genetic material, cause cells to reproduce uncontrollably, or behave like hormones that are important for normal growth, development and reproduction.

Our seminar considered these histories, among others such as microbial contamination in food, mercury in marine food chains, artificial flavors and fragrances, water contamination, and genetic engineering of foods and animals. By comparing these cases, we learned that those promoting new chemical or biological technologies rarely understand their environmental or health implications. The producers' primary goal is to gain government approval to move new products to marketplace as quickly as possible. As food markets are global, this creates an enormous burden for government to track and regulate the extraordinary diversity of contaminants and deliberate additives in the international food supply. Few governments have the financial capacity to test thoroughly for chemical residues or biological contaminants. One measure of the scale of the problem is the fact that EPA has adopted more than 10,000 separate limits for pesticides in foods, creating an enormous detective problem to monitor and enforce. In the U.S. alone last year nearly 76 million cases of food poisoning were estimated by the Centers for Disease Control and Prevention.

Wealthy nations face distinctive nutritional problems tied to diets high in fat, sugar and salt. Americans tend to eat more processed than fresh foods; more meat and fewer grains, fruits and vegetables. These habits are well correlated with patterns of cardiovascular disease, hypertension, and obesity. Our class considered alternative methods to encourage healthier diets especially among school-aged children. These included curricular innovation, which you will see in the pages following this introduction. Several teachers will administer dietary surveys to their students to make them more conscious of their dietary habits. We recognized that powerful institutional forces shape dietary patterns, and these will not be changed easily. For example, genetically modified corn introduced only 6 years ago now constitutes nearly 50% of the corn planted in the U.S. Since we have no labeling requirement, those who wish to avoid it (due to concerns over the absence of toxicity testing, allergies, or loss of biological diversity) have no way to recognize it. And it is apparent that the fast food industry is increasingly shaping the tastes and diets of children through their marketing efforts directed to very young children.

All of the teachers in the seminar were thoughtful and vigorous contributors to debates over what is truly worth worrying about, and the need for curricular innovation that somehow integrates available knowledge of ecology, medicine, and public health. Most of the teachers are involved in the sciences, but all recognized the important contributions of the humanitiesespecially historyand the social sciences to better understand the origin of the problems described above. A brief summary of the teachers' units follows.

Abie Benitez designed a thoughtful and innovative curriculum unit for kindergarteners who will explore basic questions such as: how plants grow, their need for water and sun, why children need food, the source of common foods, and basics of nutrition and taste. What is especially interesting about Abie's unit is her commitment to teach students about responsibility and how choices to consume healthy foods will benefit them directly as well as the environment. She will teach her unit to dual language students (Spanish and English) and the unit includes a variety of pedagogical strategies tailored to their strengths and needs. She will encourage students to recognize how the environment may affect the food they eat, and how their dietary choices influence environmental quality, especially trends toward increasing use of synthetic chemicals in agriculture.

Ray Brooks designed an important unit for students in grades 6-8 that will help them develop more competitive science fair projects. It is structured to teach students to think logically and critically while exploring health risks associated with agriculture, food processing, and diet. Students will study food-borne illnesses, as well as pesticide residues in foods. By tracking those foods most likely to contain pesticide residues, students will learn how best to minimize their exposure. This unit will also help students to better understand the importance of statistics and probability to estimate and compare risks.

Jennifer Chisholm created an exceptional unit for students between grades 5-8. New Haven does not have formal health curriculum for grades K-12, and this unit is designed to teach students the relations among diet, nutrition, and wellness. Jennifer will encourage students to take control over their diets and health. She will separate students by sex and age, and explore the effects of diet on body image and self esteem. Parents will be encouraged to better understand key concepts in the unit by receiving a student authored newsletter, and attending a school fair featuring healthy food. She also plans to offer physical activities after school for parents, staff, and students in an effort to link the concepts of diet, exercise, and health.

Judy Dixon teaches 5th grade science and geography and designed a unit that will inspire students to better understand the relations between aquatic environments and fisheries. The “hands on” approach to teaching science is evident in her plan, as students will cultivate their own fish, go on field trips, and study the special problem of mercury accumulation in species such as tuna, swordfish and shark that pose dietary hazards to children and pregnant women. Judy will also teach students about “acceptable intake” of contaminants such as mercury, a concept that underlies more than ten thousand separate food safety regulations. These limits provide the basis for government warnings or “fish advisories.” Judy’s product is an outstanding example of the potential to integrate basic concepts of ecology, especially food chain dynamics, with the study of diet and human health.

Mary Jones teaches 6th grade science, and will concentrate on defining a health promoting diet. She plans to teach students how to purchase and prepare healthy foods. Students will explore whether vegetarianism is a healthier lifestyle, acquaint students with the strengths and limits of the government’s food pyramid recommendations and labeling efforts. The strength of Mary’s method is to allow students to see opposing viewpoints, and then decide what constitutes a sensible and health-promoting diet. She will examine the environmental and health risks associated with beef production and consumption, and the special problem of pesticides and food safety. Her unit also will include a food intake diary, in an effort to make students more conscious of the foods they consume.

Joe Lewis is a middle school science teacher, and has created an outstanding unit to develop environmental science fair projects. He provides conceptual and practical advice to those who teach science and train students to enter the fairs. His unit will meet New Haven Public School Performance Standards regarding scientific inquiry. He will focus on scientific method and teach this through two experiments, one exploring the effects of earthworms on plant growth, and another examining the effects of pesticides on earthworms.

Roberta Mazzucco completed a unit entitled: You Are What You Eat: How Food Quality Affects Your Health, designed for 3rd grade students. Students will also prepare a food diary, explore cultural variation in dietary patterns, the foundations of nutrition, the diversity of international sources of food, how food is processed, and how its quality is affected. The unit will also include a cooking experiment and taste testing. This unit is crisply organized, and covers many food safety issues in with precision and excellent documentation.

Joanne Pompano teaches blind or visually impaired 9th-12th grade students. She will examine the growth and development of the visual system, and the relations between diet and visual health. The importance of prenatal care will be stressed. She will review the most common diseases of the visual system that may be exacerbated by certain dietary patterns. She also briefly reviews the literature on visual system birth defects that have been associated with prenatal pesticide exposures. This unit is scientifically accurate and should be widely read by teachers of visually impaired students.

Jacqueline Porter is a 6th-8th grade special education teacher of science and life science. She writes about food-borne diseases caused by E. coli O157:H7, Salmonella, and Campylobacter. Students will learn to

recognize who is especially susceptible to these illnesses-pregnant women, children, the elderly and those with other illnesses, and the most common sources of contamination. Importantly, students will learn how they may best avoid microbial contaminants. The scale of food-borne illness in the U.S. is staggering76 million cases each yearwith the severity increasing as bacteria develop increased resistance to antibiotics. Jacqueline's contribution should be required reading for science teachers in the U.S.

Gwendolyn Robinson teaches 7th and 8th grade science, and has created a curriculum unit that explores the health benefits of vegetarianism. She suggests a different food pyramid than the one promoted by the U.S. Department of Agriculture. She recommends: a diet high in fresh fruits, vegetables and grains; washing fruits and vegetables to remove pesticides and other residues; increasing water intake; buying organic foods when possible; and learning to become a critical interpreter of labels. Gwen's criticism of the government's recommended diet, their allowance of pesticide residues, and the inadequacies of labeling are all well directed. She has provided many interesting and important lessons that will examine these questions in detail, and help students judge for themselves.

Together these units are the wonderful fruit of an exceptionally rewarding seminar. The teachers were consistently thoughtful, engaging, argumentative, and inspiring. For this I thank them.

John Wargo