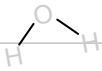
LAB NOTES©

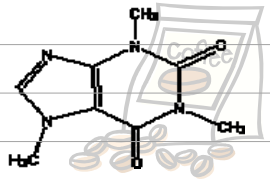
LABORATORY ANIMALS AND BIOLOGY

A Collaborative Educational Outreach Initiative of **EAST MEETS WEST** *in the Heartland®*

The Foundation of Health & Wellness

We have all heard the old sayings: "*You are what you eat*" or "*an apple a day keeps the doctor away*." What you eat DOES have a profound effect on your health. Your *diet*—the food you consume each day—is the foundation of your health. Not only can eating the right foods keep you healthy today, it can also prevent or reduce health problems from appearing in the future.





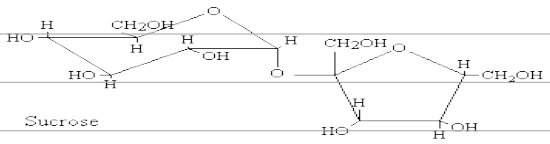
caffeine

NU·TRI·TION

noo trísh'n

NUTRITION ... 1. [N] The scientific study of food and drink (especially in humans) 2. [N] a source of materials to nourish the body 3. [N] (physiology) the organic process of nourishing or being nourished; the processes by which an organism assimilates food and uses it for growth and maintenance.

In times past, many sailors on long journeys died from *scurvy*, a vitamin deficiency disease. Before it was studied and became better understood in the 18th century, scurvy, whose symptoms vary widely, was often mistaken for asthma, leprosy, syphilis, dysentery and madness. The explorer Vasco de Gama lost two-thirds of his crew to the disease while making his way to India in 1499 and in 1520, Ferdinand Magellan lost more than 80% of his crew while crossing the Pacific Ocean. Fifteenth-century Florentine merchant and part-time explorer, Amerigo Vespucci (for whom America is named) was in charge of stocking food for Columbus's ships in 1492. He loaded ample quantities of pickles on the Niña, Pinta, and Santa Maria, helping to prevent scurvy out-breaks on the historic voyage across the Atlantic. Vespucci wasn't aware why pickles helped sailors, but we now know they are rich in vitamin C. While the cause of scurvy was not understood back then, it was discovered that adding fresh limes to the ship's food supply seemed to help the sailors' resistance to scurvy, and fewer died. In fact, this is why English sailors were often called "limeys" – because they ate limes. It was later learned through scientific experimentation that the lack of vitamins, particularly vitamin C, caused scurvy, and that the vitamin C the sailors got from eating limes was what helped prevent the disease.



Sucrose

scur·vy

skúrvee

noun

disease caused by vitamin deficiency: a disease caused by insufficient vitamin C, the symptoms of which include spongy gums, loosening of the teeth, and bleeding into the skin and mucous membranes

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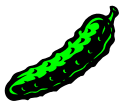
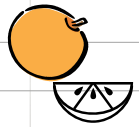


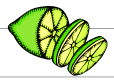
[1]nu·tri·ent
nóotree ənt
adjective
nourishing: providing nourishment
[2]nutrient
noun
(*plural* nu·tri·ents)
nourishing substance: a substance that provides nourishment, e.g. the minerals that a plant takes from the soil or the constituents in food that keep a human body healthy and help it to grow

Continued from page 1

The existence of *nutrients* in food that are essential for survival had been discovered. As the connections were established between other important vitamins and nutrients in what we ate or didn't eat and illness and disease, the role of nutrition in health was seen as equally important as hygiene, medicines, and *lifestyle*. This issue of **LAB *Notes*©** will talk about nutrition and food science and its role in health and disease.



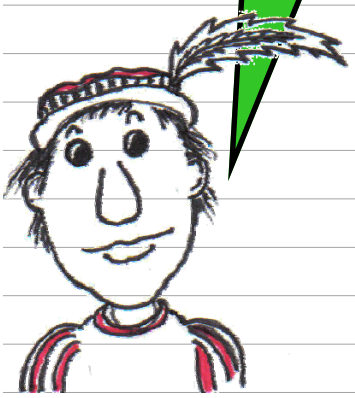
NOTE: To read Lind's report following his experiment, go to http://www.people.virginia.edu/rjh9u/scurvy.html.



FOOD BYTE,

Vitamin C is also known as ascorbic acid, an antioxidant. Today, ascorbic acid is used as a preservative in most packaged foods.

Interested in the science of Vitamin C? Go to www.cbn.com/health/news/vitaminc.asp



A Simple Experiment on Scurvy

In 1747, as the HMS Salisbury sailed from England to the Plymouth Colony, the ship's physician, James Lind, performed a simple experiment to determine what might be effective as a cure for scurvy.

On May 20, 1747, Lind divided 12 sick men into six groups of two each. All 12 shared a common diet for breakfast, lunch and dinner but each group received a different supplement as follows:

- **1 quart of apple juice daily**
- **25 drops of elixir vitriol (sulfuric acid and aromatics)**
- **Two spoonfuls of vinegar three times a day**
- **A concoction of herbs and spices**
- **Half-pint of sea water daily**
- **Two oranges and one lemon daily**

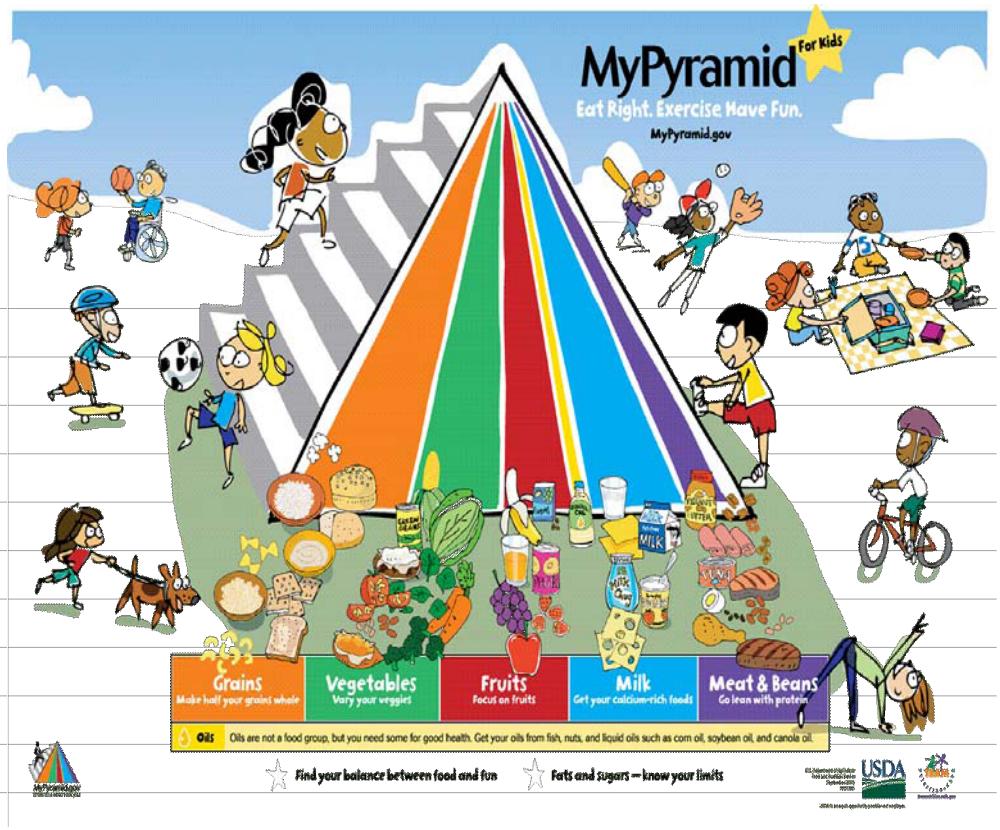
The two men who ate the oranges and lemon recovered in six days. One returned to duty and the other was appointed as nurse to the remaining sick sailors. The two men who drank apple cider improved but were not well enough to work. None of the others showed any improvement.

Mr. Lind concluded that something in the citrus fruit was counteracting the cause of the scurvy disease, so he gave citrus fruits to all the other men and observed that all were cured of the disease.

Source: Website of Robert J. Huskey, Professor Emeritus of Biology, University of Virginia, 2003.

[1]chem·i·cal
kémmik'l
adjective
1 : of, relating to, used in, or produced by chemistry
2 : acting or operated or produced by chemicals

[2]chemical
noun
: a substance (as an element or compound) obtained from a chemical process or used to get a chemical result



FOOD BYTE

The average human body contains enough: iron to make a 3 inch nail, sulfur to kill all fleas on an average dog, carbon to make 900 pencils, potassium to fire a toy cannon, fat to make 7 bars of soap, phosphorous to make 2,200 match heads and water to fill a ten-gallon tank.

A PRIMER IN NUTRITION AND FOOD SCIENCE

Food science refers to study of the production, processing, distribution, preparation, evaluation, and utilization of food. Food scientists study the composition and properties of *food components* and the *chemical changes* they undergo during handling, processing, and storage. A food scientist must know about chemistry and biochemistry, agriculture, botany and zoology, among many other things, in order to study and modify or create food.

food
'füd
noun
1 a : material consisting essentially of protein, carbohydrate, and fat used in the body of an organism to sustain growth, repair, and vital processes and to furnish energy; *also* : such food together with supplementary substances (as minerals, vitamins, and condiments)

[1]com·po·nent
kəm pōnənt
noun
: a part or element of something <*components* of an electric circuit>
<*components* of a meal>

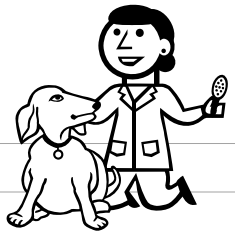
Looking at the shelves in a grocery store is an excellent way to see nutrition, food science, and technology in action. Almost all of the foods we eat are the result of work by food scientists and nutritionists. Some food scientists engage in basic research, discovering new food sources; analyzing food content to determine levels of vitamins, fat, sugar, or protein; or searching for substitutes for harmful or undesirable additives, such as nitrites. Others create and refine the flavors, colors, and textures and, in many cases, work to create "*low carb*" or "*low fat*" versions of already favorite foods. In addition, they use physics, chemistry, biology, and *biotechnology* to "design" or create new foods and to enhance the traditional ways of processing foods, such as baking, blanching, preserving, canning, drying, evaporation, and *pasteurization*. Some of the information about nutrients learned by food scientists can be found on the food label.

Continued on page 4

pas·teur·i·za·tion

pàscheri záysh'n
noun

the process of heating a liquid (as milk) to a temperature high enough and keeping it at that temperature long enough to kill many objectionable germs and then cooling it rapidly without causing a major change in its chemical composition



A PRIMER IN NUTRITION AND FOOD SCIENCE *Continued from page 3*

Other food scientists enforce government regulations, inspecting food-processing areas and ensuring that sanitation, safety, quality, and waste management standards are met. Food technologists generally work in product development, applying the findings from food science research to the selection, preservation, processing, packaging, distribution, and use of safe, nutritious and wholesome food.

Agricultural and food scientists also are a very important part of controlling our food supply. They assist in maintaining agricultural productivity and the safety of the food supply by studying farm crops and animals, by developing ways to improve crop yield (for example, how many ears of corn one plant grows) and by extending the shelf life of products.

Some agricultural and food scientists also use biotechnology to manipulate the genetic material of plants and crops, attempting to make organisms more productive or resistant to disease. A good example is tomatoes: a food scientist must figure out the best way to grow and treat the tomatoes so they will continue to ripen and arrive at the supermarket fresh and ripe.

bi·o·tech·nol·o·gy

bì ō tek nólləjee
noun

practical use of biological processes: the use of biological processes in industrial production. Early examples of biotechnology include the making of cheese, wine, and beer, while later developments include vaccine and insulin production.

Associated with food sciences is the field of *animal science*. Animal scientists work to develop better, more efficient ways of producing and processing meat, poultry, eggs, and milk. Dairy scientists, poultry scientists, animal breeders, and other scientists in related fields study the genetics, nutrition, reproduction, growth, and development of domestic farm animals. Some animal scientists inspect and grade livestock food products for the government, purchase livestock, or work in technical sales or marketing. As consultants, animal scientists advise agricultural producers on how to upgrade animal housing facilities properly, lower mortality rates, handle waste matter or increase production of animal products, such as milk or eggs.

FOOD LABEL

NUTRITION FACTS

Serving Size

Servings Per Container

Amount Per Serving

Calories **Calories from Fat**

% Daily Value*

Total Fat
Saturated Fat
Cholesterol
Sodium
Total Carbohydrate
Dietary Fiber
Sugars
Protein

Vitamin A Vitamin C
Calcium Iron

*Percent Daily Values are based on 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

	Calories	2,000	2,500
Total Fat	Less than		
Sat Fat	Less than		
Cholesterol	Less than		
Sodium	Less than		
Total Carbohydrate			
Dietary Fiber			

Calories per gram:
Fat . Carbohydrate . Protein

Next time you are in a supermarket, check out the labels on various foods (including pet foods!) and learn more nutrition facts.

Which items are the MOST common on most nutrition labels for Processed or Packaged food?

Did YOU Know?

Biotechnology is now being used to benefit both producers of food and consumers. A few applications of biotechnology to food production are:

- ⇒ Cheese-making involves the action of *enzymes* from *microbes*. Chymosin, an enzyme from calves' stomachs, is an example of an enzyme that promotes curdling of milk for cheese production. Scientists can insert the chymosin gene into yeast, allowing for production of this enzyme in large quantities for use by cheese producers.
- ⇒ Potatoes have been engineered for resistance to the Colorado potato beetle. Genes from a soil bacterium which produces its own insecticide have been introduced into potatoes, providing them with some immunity to specific insect pests. Known as the New Leaf Potato, it is now on grocery store shelves.

en·zyme

'en-"zIm
noun
any of various complex proteins produced by living cells that bring about or speed up reactions (as in the digestion of food) without being permanently altered

FOOD BYTE
As in humans, obesity in our cats and dogs can actually cause disease, make some diseases much worse, cause joint damage and shorten their lives.

NUTRITION AND HEALTH: HOW FOOD AFFECTS HEALTH

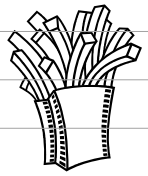
There was a time when vitamin deficiency diseases were widespread. Today, in the U.S. and some other countries, the opposite problem exists. Instead of not eating enough foods, many people take in too much food. But even though we are eating more, we do not always make the best food choices. Consuming highly processed foods (pizza pockets, frozen chicken nuggets), fast foods (burger and fries), and convenience foods (candy bars, potato chips) often displaces fruits, vegetables, and whole grains from our diets and results in higher caloric, sugar, fat, and sodium intake with few important nutrients.

Increased food intake and poor food choices have contributed to more than 15% of all U.S. school age children becoming obese or overweight. Once a teen is overweight there is a 70% chance he or she will stay overweight as an adult. Why do we care about overweight and obesity rates in children? Because research has proven there is a strong relationship between obesity and medical problems such as diabetes, heart disease, high blood pressure and cancer.

mi·crobe

'mI-"krOb
noun

mi·cro·or·gan·ism
"mI-krO-'or-g&-"niz-&m
noun
an organism (as a bacterium) of microscopic or less than microscopic size



The types of oils we eat can also influence our cholesterol levels. Cholesterol is the means by which our bodies transport fats throughout the blood. If our cholesterol levels become too high, our blood vessels become clogged, decreasing blood flow to the heart. This may result in a heart attack. Monounsaturated fats found in peanuts and avocados, and omega-3 fats found in salmon, walnuts, and canola oil generally improve our cholesterol levels. High intakes of saturated fats, such as butter and bacon, worsen our cholesterol levels.

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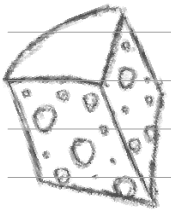
FOOD BYTE

Understanding the relationship between food and our genes is key to promoting healthy living and preventing chronic illness.

Nutrition & Health *Continued from page 5*



While we do not usually think of cancer and excess fat as being linked, they are. Being obese increases a person's risk for several types of cancer, including kidney, colon and breast cancers. This is due in part to excess fat resulting in increased hormone levels that promote cancer growth. Experts recommend establishing healthy eating and physical activity habits while we are still young so obesity and the risk of cancer are reduced.

To eat right, we need plenty of fruits and vegetables, at least 5 servings per day. We also want to eat lots of whole grains such as oatmeal, whole-wheat bread or whole-wheat spaghetti. By eating these foods, we get the vitamins and minerals our bodies need to function properly, but we can avoid eating too many calories, fat, sugar, and salt found in processed or fast foods. We also get lots of fiber that helps to keep our colon healthy. It is also important to make good fat choices. The fats found in peanuts, avocados and walnuts are heart-healthy choices. Limiting salt intake also helps keep us healthy.

Remember, too, that good nutrition goes hand-in-hand with physical activity, particularly when it comes to preventing obesity. Only one out of every 2 kids age 12 to 21 exercises regularly. While sometimes it can be hard to get going, exercise has many benefits besides keeping us lean. Exercise makes us feel better, builds stronger bones, makes muscles stronger and more flexible, improves our overall appearance, and keeps us healthy. Good nutrition, when combined with daily physical activity, proper amounts of sleep, and other healthy habits help to keep us healthy for a lifetime!

Milk is also being fortified but with Vitamin D to prevent rickets. Rickets is a very serious disease that can lead to deformities and breaks in the bones as well as painful spasms in your muscles.

gen·o·type

jénnə tìp
(*plural* gen·o·types)

noun

1. genetic makeup: the genetic makeup of an organism, as opposed to its physical characteristics phenotype

2. genetic group: a group of organisms that share a similar genetic makeup

JEANS

FOOD AND YOUR GENES

As we have seen, poor nutrition can be a contributing risk factor for many diseases. This is truer in some people than others because of people's individual genetic makeup. Understanding the relationship between food and our genes is key to promoting healthy living and preventing chronic illness. Scientists working in the field of nutritional genomics, or *nutrigenomics*, look for a deeper understanding at a molecular level of how dietary chemicals (*otherwise known as FOOD*!) can affect health by altering a person's genes.

With a better understanding of how food affects our genes, scientists and health care providers can work together to prevent or cure chronic disease by developing dietary guidelines for individuals based on knowledge of their personal nutritional needs, which can be determined from their nutritional status and their *genotype*. In this way, the field of nutrigenomics is paving the way for a new era of "*personalized nutrition*,"

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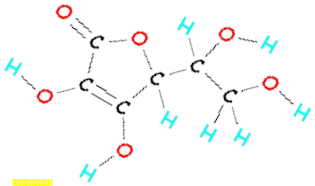

Iron is an integral part of many proteins and enzymes that maintain good health. In humans, iron is an essential component of proteins involved in oxygen transport. It is also essential for the regulation of cell growth and differentiation.

Zinc supports a healthy immune system and is needed for wound healing, helps maintain your sense of taste and smell, and is needed for DNA synthesis.

Food & Your Genes Continued from page 6

in which a person's ideal diet can be matched with his or her unique genetic makeup.

Thanks to the Human Genome Project, we now know that all people share nearly all human genetic information. In fact, any two people share 99.9% of their DNA. The small differences in human genetic variation that do exist, however, are responsible for diversity, including visible traits such as hair and skin colors and body type. Some of the traits involved in human genetic variation, however, are not visible to the eye. These include many medically important variations, such as susceptibility to disease. Studies in nutrigenomics may lead to changes in currently-accepted dietary guidelines in the future.

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Vitamin B_{12} is also called cobalamin because it contains the metal cobalt. This vitamin helps maintain healthy nerve cells and red blood cells.

The major biologic function of vitamin D is to maintain normal blood levels of calcium and phosphorus. By promoting calcium absorption, vitamin D helps to form and maintain strong bones.

THE CHOICE OF VEGETARIANISM

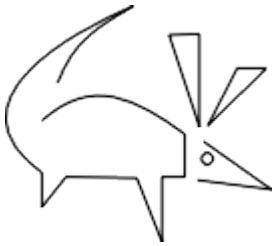
Vegetarian diets have become increasingly popular. Most dietitians and other medical experts agree that a vegetarian diet can be healthy if structured properly. Some examples of vegetarian diets are:

- ⇒ ovo vegetarian (*eats eggs, but no meat*)
- ⇒ lacto-ovo vegetarian (*eats dairy/eggs, but no meat*)
- ⇒ lacto vegetarian (*eats dairy, but no eggs or meat*)
- ⇒ vegan (*eats only food from plant sources*)

Young people following a vegetarian diet should eat a variety of foods that provide enough calories and nutrients to allow them to grow normally. If you are following a vegetarian diet, you must be especially careful to take in enough of certain vitamins and minerals. The nutrients of possible concern for vegetarians are:

vitamin B_{12} vitamin D calcium protein iron zinc

A vegetarian diet can be a healthy choice for both children and adults if properly planned and adequate nutrients are eaten. Be aware of potential nutritional deficiencies in the diet and plan for how to account for them. There are many resources to help you plan healthy menus, including your doctor or a registered dietician. *Go to the American Dietetic Association website* http://www.eatright.org/Public/ *for further information.*



Both the human and mouse *genomes* have now been sequenced, revealing surprising genetic relatedness between people and mice that allows scientists to understand many important concepts in human physiology by studying these rodents.

NUTRITION AND FOOD SCIENCE

The Role of Animals

Laboratory animal science is the area of study that specializes in the care and study of animals used in research and teaching. Animals are a critical part of bio-medical research and teaching for many reasons. Before scientists can develop ways to treat health problems in humans and in animals, they need to understand the problem. Researchers use animals to do this and to discover or create more effective methods for diagnosing (*deciding what is making a person or animal sick*) and treating diseases that affect both humans and animals, and then to assure the safety of these new medical treatments. Scientists continue to look for ways to reduce the numbers of animals needed to obtain valid results, refine experimental techniques, and replace animals with other research methods whenever feasible.

a·nat·o·my

ə náttəmee
(*plural* a·nat·o·mies)
noun

1. study of structure of body: the branch of science that studies the physical structure of animals, plants, and other organisms 2. physical structure of organism: the physical structure, especially the internal structure, of an animal, plant, or other organism, or of any of its parts 3. book about anatomy: a book or other written work about the physical structure of animals, plants, or other organisms 4. body: the human body (*informal*) 5. analysis: a detailed analysis of something

phys·i·ol·o·gy

fizzee ólləjee

noun

1. study of functioning of living things: the branch of biology that deals with the internal workings of living things, including functions such as metabolism, respiration, and reproduction, rather than with their shape or structure 2. body's internal processes: the way a particular body or organism works

Determining how nutrition affects health and disease has been challenging for scientists because people are not good experimental subjects for many of the studies that are needed. For one thing, each individual person has a unique genetic makeup and for another, it is nearly impossible to control environmental effects and behaviors when studying people. Scientists have turned to animal models of health and disease to study nutrition because with animals, genetic variation and environmental factors can be controlled.

Rodents, such as rats and mice, have been valuable partners in the study of nutrition. Their short life span and reproductive cycle, as well as the vast understanding of their genetic makeup, *anatomy* and *physiology* that scientists have developed over many decades of study, make them particularly useful in trying to understand how nutrition affects health. In addition, both the human and mouse *genomes* have now been sequenced, revealing surprising genetic relatedness between people and mice that allows scientists to understand many important concepts in human physiology by studying mice. Nutrition scientists have long used strains of mice and rats to analyze the effects of diet on health. Over the past decade, experimental methods based on comparing genomes (a field called *comparative genomics*) have led to the identification of many genes regulated by diet that are involved in disease.

ge·nome

jée nòm
(*plural* ge·nomes)
noun

set of chromosomes: the full complement of genetic information that an organism inherits from its parents, especially the set of chromosomes and the genes they carry

Alternatives and The Three Rs

The development and validation of alternatives to animal models of research and the refinement of existing methods are a priority in nutrition and food science for scientific, humane, and economic reasons. Although many methods currently exist in nutrition research that do replace animals, many other research protocols require animals. It would be very hard to test a new pet food's taste and nutrition on a computer! Researchers in all forms of biomedical research, however, seek to use alternatives to animal models whenever possible.

When speaking of "alternatives" we are referring to the "3 Rs" concept that was first presented in 1959 publication, *Principles of Humane Experimental Technique*, by W.M.S. Russell and R.L. Burch. The "3 Rs" are:

Refinement means alteration of existing procedures to minimize the discomfort they cause to animals. Use of new, more effective, analgesics or closer monitoring for signs of discomfort are examples.

Reduction refers to the use of fewer animals to obtain the same amount or more information. Improving and sharing statistical methods is an example of how we reduce animals.

Replacement refers to the use of methods that do not involve whole animals. Computer models or cell and tissues cultures are examples.

Source: **LAB *Notes*©:** *Toxicology*, Massachusetts Society for Medical Research, Inc., North Chelmsford, MA (2000)

Did You Know?

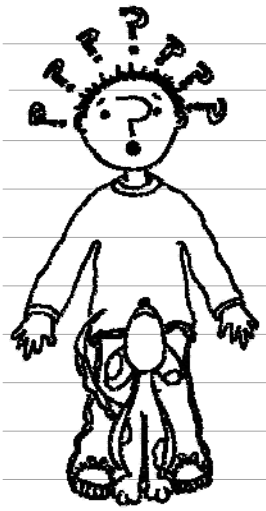
Genes represent only about 5% of the human genome. The complete role of all the non-coding sequences that make up the remaining 95% is today unknown, but researchers have nonetheless been able to assign functions to some of those sequences: some regulate DNA replication and transcription; others contribute to chromosomal structuring. The Human Genome Project, launched in the early 1990s, has succeeded in completing the draft of the DNA sequence of our entire genome. Sequencing a genome is the first step taken by researchers in the field of genomics.

FOOD FOR THOUGHT:

Nutrition Research Benefits People and Animals

Skeptical about health claims made on food and supplement products?

Nutrition research is sorting out these claims so that we can be better informed and make better decisions about what we put in our bodies.



The food we eat should provide all of the nutritional components necessary for healthy body organs and systems to perform optimally and in harmony with each other. A properly functioning body does an amazing job at preventing disease and healing itself. To do this, it requires the energy and nutrients provided by a well-balanced diet. The scientific study of food and nutrition has brought healthier and longer lives to both people and animals by providing knowledge about the importance of nutrients and their role in a balanced diet.

Good nutrition can prevent disease and disability. Scientific research using animal and non-animal models informs us what good nutrition is.

Much is now known about the role of animal and plant products and other nutrients in a healthy human diet. Milk is full of essential nutrients and other compounds that support growth and development, protect against toxins and disease-causing organisms, and stimulate immune functions. Children's learning and intellectual development have been linked to dietary protein. We know that young women need extra calcium early to offset osteoporosis later in life. People who exercise a great deal need dietary iron. Older people with decreased appetites need larger amounts of zinc and other micronutrients. Foods rich in Omega-3 fatty acids yield multiple benefits for the health-conscious, and people with compromised immune systems need iron, zinc and other minerals.

Scientists have known for a long time that rats, mice and worms that eat very little live longer than those with normal diets, leading to extensive and ongoing research on people. These studies suggest that careful calorie regulation can help us to avoid potential health problems associated with aging and possibly even extend the human life span.

A growing consensus of scientists are acknowledging that certain food components, such as the anti-oxidants vitamins C and E, can sometimes be effective weapons against disease. Soy consumption has been associated with lowered rates of many types of cancer, reducing the effects of menopause on women, and other benefits. Bioflavonoids, found in apples, onions, tea and red wine, may protect against cardiovascular disease by reducing the risk of blood clots.

FACT

Manufacturing food for companion animals requires a commitment to research and safety. Pet food manufacturers have made decades of extensive studies to incorporate the latest advances in pet nutrition into companion animal foods. A key source of nutritional information for pet food manufacturers is the National Research Council Guidelines published by the National Academy of Sciences. These guidelines detail the basic nutritional requirements of dogs and cats and give clear guidance on the essential nutrients they require.

Extensive research by pet food manufacturers over many years has shown that foods must:

- ⇒ be tasty and aromatic
- ⇒ be readily digestible so nutrients can be absorbed
- ⇒ contain nutrients in the right proportion and quality
- ⇒ be compatible with an animal's metabolism

Continued on page 11

Why do dogs sometimes eat poop?
If a dog is not receiving well-balanced nutrition, eating feces is an instinctive way for it to supplement its supply of essential nutrients.

Research into animal physiology, immune systems, neuroscience, stress, biology, infectious diseases, and other areas is improving food health and animal well-being. How we raise animals for food in 50 years will be as different as today's food animal production is from that of 50 years ago. This is expected to have important health benefits for both food animals and their human and animal consumers.

Innovative nutrition and pet care products are helping companion animals live longer, healthier lives. Science has shown us, for example, that young animals have different nutritional requirements than adult animals. They need extra protein to help their muscles grow and additional minerals, such as calcium and phosphorous, to build strong bones. Pet food manufacturers have been among the leaders of nutrition research for animals. Today specific pet food formulations can be found for young, adult, aging and ill companion animals.

path·o·gen
páthəjən
(*plural* path·o·gens)
noun
agent of disease: something that can cause disease, e.g. a bacterium or a virus

mu·tate
myoo táyt
change: to undergo mutation, or make something undergo mutation

mu·ta·tion
myoo táysh'n
noun
change in genetic material: a random change in a gene or chromosome resulting in a new trait or characteristic that can be inherited. Mutation can be a source of beneficial genetic variation, or it can be neutral or harmful in effect.

Many endangered species have also been the beneficiaries of nutrition research. Zoos, which house and breed endangered species as part of broader conservation efforts, work hard to meet the daily dietary needs of their many and diverse species. Nutrition research, in large part using animal models, has made possible the availability of appropriate diets for individual species. This serves as a form of preventive medicine for zoo animals, improving their well-being and longevity and laying the foundation for more effective species reproduction and conservation.

WHAT YOU EAT CAN MAKE YOU SICK!

Food-borne diseases are infections that can be caused by eating foods or drinking liquids that are contaminated. Infected foods contain microbes or pathogens that are capable of poisoning our body. Scientists have identified more than 250 different disease-causing microbes. Because food-borne illness is caused by contamination, 100 percent of food-borne diseases CAN be prevented if you handle your food and drinks the proper way, such as adequate cooking, temperature, boiling, and other approaches, including hand washing. While 95% of Americans say they wash their hands after using the bathroom, observations show that only 67% really do.

Food intoxications are food-borne illnesses that come from consuming foods that contain toxins or poisons. Food infections are food-borne illnesses caused by eating food that has organisms that grow and cause illness after they enter the human body. Molds and other fungi cause some of these.

Because pathogens often change (mutate), scientists and researchers must continuously conduct laboratory work to study food borne pathogens, and the way these interact with humans and animal health. Such research has been very successful and will continue to be so. One hundred years ago,

Continued on page 12

What You Eat CAN Make You Sick! *Continued from page 11*

diseases such as typhoid fever, tuberculosis, and cholera were very common food borne illnesses.

Today, food-borne diseases are very rare because of improvements in food care, such as pasteurization of milk, canning and the disinfection of water sources. Scientists are focusing on new forms of food-borne diseases; animal models for research are key to this process. Rodents are one animal model that is critical to such research and scientists conduct studies by observing how animals react to food pathogens, and then to explore the effects of drugs and antimicrobial producers work in treating the infections. This research will allow scientists, doctors and veterinarians to better understand how to prevent future infections from food-borne illnesses, and to create medications to control and treat food pathogens once infection has occurred.

Sources
1. http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodborneinfections_g.htm
2. OSERA's Playbook for the Infection game
3. U.S. Department of Labor, Bureau of Labor Statistics, Occupational Outlook Handbook

Try some of these activities about food-borne illnesses!

How long would it take for one bacterium to divide into one billion bacteria? Can you see how easily just a little contamination can cause a big problem? Check out http://www.microbe.org/microbes/reproduction.asp

Test your hand-washing know-how at: www.microbe.org/washup/Wash_Up.asp.

Learn more about how to investigate an outbreak and how to enter the Disease Detectives event in the Science Olympiad at: http://www.cdc.gov/excite/olympiad.htm.

See also, "Teen Science Classes Serve Up Lessons in Food Safety," *FDA Consumer Magazine* http://www.fda.gov/fdac/features/2002/102_teen.html

A food-borne illness is simply a sickness a person gets from eating contaminated food. Many contaminants are in the form of a harmful bacteria being present.

ovalbumin

ov·al·bu·min
noun
òvvəl byóomən, ȍvəl byóomən

part of egg white: the main crystalline protein or albumin found in egg whites

FOOD and YOUR Immune System

Suppose you were eating your favorite peanut butter and jelly sandwich and could not breathe or began throwing up? Could you have eaten "bad" jelly or maybe the bread was not fresh? What if you were allergic to peanuts or some other type of food? For almost 4 million children and adults in the United States have food allergies, this scene is played out too often.

Many kids have allergies to foods, but why? And what is being done to help them? In order to solve this mystery, scientists have to understand why allergic reactions occur and what triggers them in some people and not in others.

In most of us, our immune system ignores the foods we eat. But for some, the immune system mistakenly identifies a specific food or component of food as a harmful substance. The immune system then triggers the production of antibodies to fight the food and those antibodies release chemicals into your bloodstream, which results in an allergic reaction, making you sick or worse!

Scientists have found that animals and humans share more than 200 illnesses, including food allergies. Because of this, scientists have monitored food allergies in laboratory mice in order to learn more about how food allergies occur and how to prevent them in humans and in animals. Mice are given small amounts of *ovalbumin*, a harmless protein found in eggs. After a period of time, the mice become allergic to the protein. Next, the scientists gave the mice specially coated pellets of ovalbumin. Since the special coating allowed the pellets to survive the digestive juices inside the stomach, the scientists could observe the reactions triggered by the immune system of the mice. By learning how the immune system in mice reacts to food allergies, scientists hope to develop a means to allow more kids to eat peanut butter and other foods without worrying about such reactions.

TEST YOUR NUTRITION KNOW-HOW

These websites have more nutrition activities to test your NUTRITION KNOW-HOW:

Food Safety Activities, U.S. Food & Drug Administration

http://www.cfsan.fda.gov/~dms/educate.html

MyPyramid.gov

http://www.mypyramid.gov/

Nutrition Activities, from Child Nutrition Services

http://www.midlandisd.net/district/student_service/CNS/nutrition_activities.html

Nutrition Activities for Kids, from MealsMatter

http://mealsmatter.org/CookingForFamily/Activities/index.aspx

Nutrition Explorations

http://www.nutritionexplorations.org/kids/activities-main.asp

Nutrition Fun for Kids

http://nutritionforkids.com/kidactivities.htm

Nutrition Activities & Games, from Jefferson County Public Schools

http://www.jefferson.k12.ky.us/Departments/NutritionServices/education/activities/

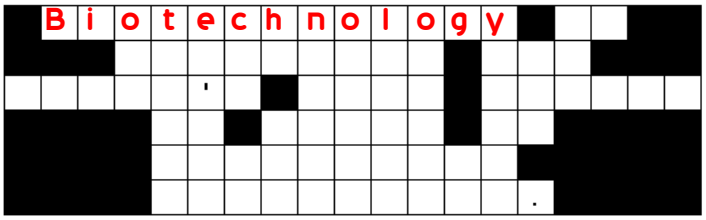
Unscramble these glossary words and fill in the blocks at the bottom to access its words of wisdom!

TINNITRUO	4	
ZEYMEN	40 14	
SINMAIVT	22 33 11	
BALOTRAYOR LAMSINA	38 8 23	30 41
VURSYC	17	
NERTUNTI	2 34 31	
FODO	15 19	
LIHCAMCE	13 37	
GEOBOTHYICOLN	6 27	
SIONITREUMGCN	9 25 42	
ZEPTOTIRSANAUI	7	
SIRMAGCOOMINR	16	
PEOGEYNT	3	
RIOCETUND	36 35 5	
TEFNIENERM	26 39 28 18	
CEPRANTELME	12	
MYTOANA	29 24 20	
YLPISOYGOH	32 10	
TINRITNUSTOI	1 21	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

27	28	29	30	31	32	33	34	35	W	36	37	38	39	40	41	42

This is a main idea located on page 5. →



Answers:

Double Puzzle: Nutrition is the foundation of health and wellness.

Fallen Phrase: Biotechnology is enhancing the world's food supply by increasing production.

INTRODUCING MS. TANJA CUTTING . . .

A background in nutrition science can provide the basis for a wide range of interesting careers. Registered dietitian and nutritionist, Tanja Cutting, answers some questions about her education and experiences working as a dietitian in South Dakota. If you are considering a career in nutrition science, visit the career-related links listed at the end of the interview for valuable information.

Thank you, Ms. Cutting, for speaking with us about your career. What is your educational background?

Actually, my undergraduate degree is in American History. I received my master's degree in Nutrition from Pennsylvania State University and did my dietetic internship at Vanderbilt University Medical Center.

Can you describe any formative experiences that shaped your decision to pursue a career in nutrition science?

There wasn't one person whom I met and then said to myself, I would like to have that job. My interest in nutrition was sparked by the fact that I was a distance runner and wanted to do something that was related to physical activity. I came across nutrition as a profession in a book I found at the local library. The minute I read the information related to being a dietitian, I knew that this is what I wanted to do.

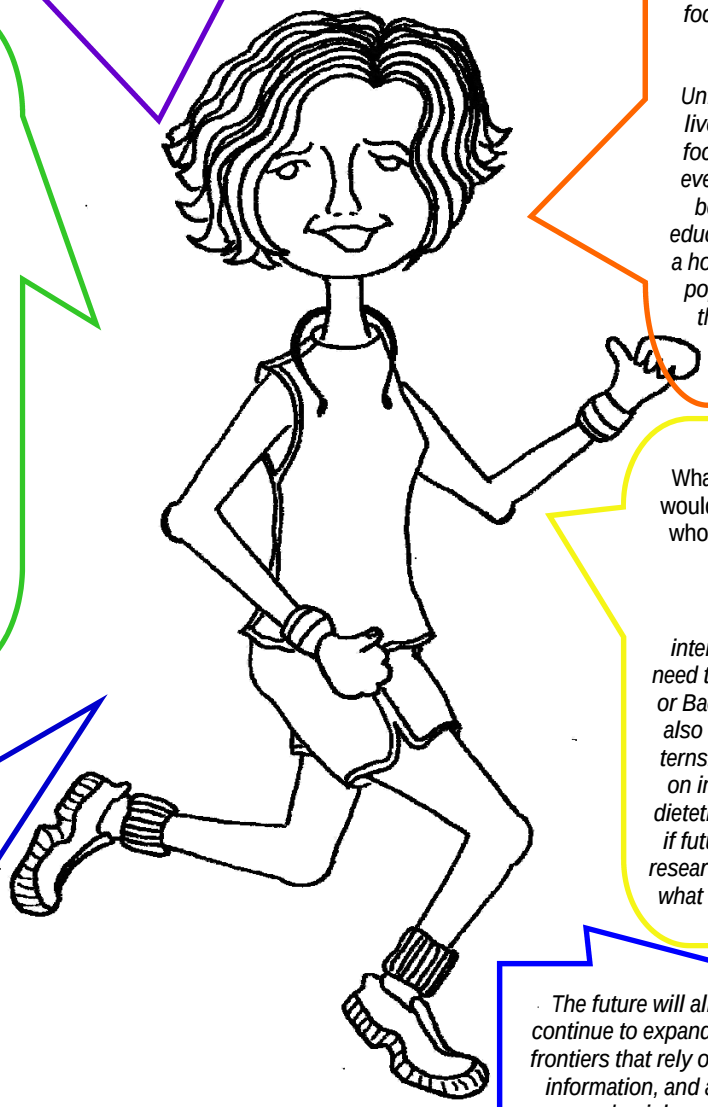
What have been your career milestones to date?

I have a strong background in pediatric nutrition, including obesity and body image issues. I have both a clinical and research background and even some community experience in this area — that is a bit unusual, as most dietitians tend to focus on one, maybe two, but not three areas.

Unfortunately, because I currently live in a rural area, I am unable to focus on pediatric nutrition. However, I am highly adaptable. I have become involved with diabetes education, currently working both at a hospital and with Native American populations. I plan to sit soon for the National Certified Diabetes Educator exam.

Describe a typical week in your professional life.

On Monday and Friday I provide diabetes education at Sioux Sans, an Indian Health Services facility working with Native Americans. Tuesday through Thursday I work at the regional hospital, again providing diabetes education for members of the community. Some weeks I do some additional consulting at the Pine Ridge Indian Reservation that is located two hours from my home. There, I work with dialysis patients who have kidney disease. During any given week, I might give a community presentation such as a cooking demonstration or attend a local school board meeting to help improve the nutrition quality of food served at area schools.



What coursework and/or degrees would you recommend for students who would like to pursue a career similar to yours?

At a minimum, students interested in becoming a dietitian need to receive their Bachelor of Arts or Bachelor of Science degree. They also need to complete a dietetic internship where they receive hands-on instruction in different areas of dietetics practice. It is also beneficial if future dietitians can garner some research experience because much of what we practice is evidence-based.

What do you expect the field of nutrition science to be like in 10 years, in terms of cutting-edge research and job opportunities?

Today, there are several arenas in which we can practice including public health and clinical sectors, as well as research opportunities in academic and corporate settings. A background in nutrition can serve as a starting point for several professions, including medicine, hospital administration, and even wellness, coaching, and journalism jobs.

The future will allow nutrition professionals to continue to expand in these arenas as well as new frontiers that rely on the dissemination of nutrition information, and are based in biochemistry and physiology as it relates to nutrients.

For additional information on nutrition and careers in nutrition science, visit:

Science and Our Food Supply: Investigating Food Safety From Farm to Table

http://www.nsta.org/288/

"The Biology of Food", The Science Teacher, NSTA October 2004, p. 30-34

http://www.nsta.org/

Bring Food Science into Your Middle & High School Classrooms from the US Food and Drug Administration's Center for Food Safety and Applied Nutrition

http://www.foodsafety.gov/~fsg/teach.html

For Kids, Teens, & Educators from Center for Food Safety and Applied Nutrition

http://www.cfsan.fda.gov/%7Edms/educate.html

Fast Foods Nutrition Fact Finder

http://www.olen.com/food/index.html

This is a place where students can gather data on fast food and compare it to a healthier meal.
USDA Nutrient Database

http://www.nal.usda.gov/fnic/foodcomp/

Over 5,000 food items are listed. Nutrient values are given for 100 gram proportions as well as two serving size proportions.

The Center for Nutrition Policy and Promotion of the USDA

http://www.usda.gov/cnpp/

http://www.usda.gov/news/usdakids/index.html
http://www.mypyramid.gov/kids/index.html

http://www.foodsafety.gov/~fsg/fsgkids.html

http://www.cdc.gov/global/kids.htm

US Food and Drug Administration

http://www.fda.gov/oc/opacom/kids/default.htm

North Carolina AHEC Health Careers
http://www.nchealthcareers.com/

http://science-education.nih.gov/LifeWorks.nsf/feature/index.htm

Animal Science Career Guide
http://www.khake.com/page10.html

Career Information
http://www.asas.org/career.htm

Bureau of Labor Statistics
http://www.bls.gov/oco/ocos046.htm

American Association for Laboratory Animal Science
http://www.aalas.org/resources/careers.asp

Tarleton State University
http://www.tarleton.edu/~ag/anscicareer.htm

Careers in Nutrition
http://www.dietitian.com/rds.html

http://nutrition.about.com/od/careersinnutrition/

http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/career.html

American Dietetic Association
http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/index.html

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CBRA/CSBR, Amanda Carson Banks, Ph.D., President, 1008 10th Street, PMB #328, Sacramento, California 95814
Email: abanks@ca-biomed.org, Telephone 916.558.1515

MSMR, Alan B Dittrich, Ph.D., President, 73 Princeton Street, Suite 311, North Chelmsford, Massachusetts 01863
Email: a.dittrich@msmr.org, Telephone 978.251.1556

OSERA, M. Sue Benford, Executive Director, 7652 Sawmill Road, #337, Dublin, OH 43016
Email: oseradirector@aol.com, Telephone 614.784.1961