

Career Pathways: Health and Biosciences

AN EDUCATOR'S GUIDE

Developments in medicine and biotechnology have rapidly changed the way we live, work, learn and play — and Connecticut is a hub of research, economic activity and high-growth jobs in these fields. New England hosts the greatest concentration of health care industries in the country, with Connecticut ranking fifth in the nation in total health care employment concentration. In fact, the state's technology and science workforce and assets rank among the top 10 in the country.

In addition to state-of-the-art hospitals and research institutions, Connecticut is home to major pharmaceutical companies, biomedical manufacturers and leaders in health care product development. Collectively, these companies employ tens of thousands of workers and spend more than \$6 billion on operations annually within the state.

So, what does this mean to students?

As these businesses look to expand and become more profitable — moving from research into development, manufacturing and commercialization — they will continue to seek talented young professionals to help them grow. And as a large percentage of the population ages, demands for health management products and services will create even greater occupational growth and advancement in the field. Current workforce shortage areas include nursing, home health care and bioscience.

The purpose of this guide is to spark students' interest in allied health, biotechnology, medicine, nursing and bioscience and expand their knowledge of educational requirements for occupations in these fields. In it, you will find reproducible worksheets and multidisciplinary activities suitable for middle- and high-school students. Activities are aligned with national and state standards in content areas that emphasize science, technology and language arts, and they are easily adaptable to match various skill levels and abilities.

We urge you to use the enclosed poster and DVD to supplement the activities in this guide and enhance class discussions about careers in health care and biosciences. For further information, please contact Mary deManbey, program manager for the CBIA Education Foundation, at mary.demanbey@cbia.com.

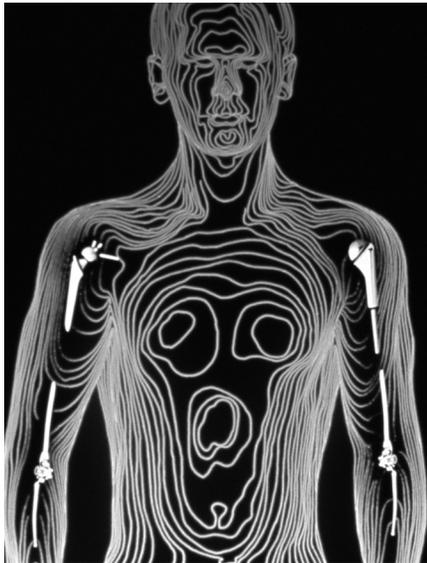


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Career Pathways: Health and Biosciences

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Health and Bioscience Careers: An Overview

Do you have a natural curiosity? A way with people or animals? A desire to help others and care for those in need?

Are you good at science? Solving problems? Looking at situations objectively?

If any of these qualities describe you, consider exploring some of the many careers in the health and biosciences industry.

What is health and biosciences?

The health and biosciences industry actually covers many different fields, including medicine, clinical/allied health, chemical production, medical instrument manufacture and veterinary medicine.

People employed in health and biosciences often have very different jobs and work in very different settings. Consider radiologic technologist Jenna Scoville, whose patients come in through the emergency room at Connecticut Children's Medical Center. Or pediatric occupational therapist Lauren Coughlin, who teaches children with developmental challenges how to play. Or forensic scientist Eric Carita, who processes DNA evidence in criminal investigations.



To learn more about health and biosciences and hear what other young, working professionals in Connecticut have to say about the field, watch the "Overview" section of the enclosed DVD *Career Pathways: Health and Biosciences*.

What kind of person do I have to be?

Exactly who you are. The great thing about health and biosciences is that it's so diverse. People of every type, interest and ability can find a home in this growing and exciting field.

In general, to be successful in health care, you need:

- compassion and a desire to help people
- good interpersonal ("people") skills
- attention to detail
- the ability to analyze problems
- the ability to communicate clearly
- the ability to be flexible and adapt to change

To be successful in a bioscience career, you must be:

- curious and inquisitive
- objective, unbiased and open-minded
- attentive to detail
- knowledgeable about scientific principles and methods
- analytical and good at solving problems
- able to communicate clearly
- flexible and willing to adopt (or develop!) new technologies

What training do I need for a career in health and biosciences?

Jobs in the health and bioscience fields are on the rise in Connecticut and range from those requiring minimal postsecondary education, such as nurse aides and medical assistants, to those with highly advanced degrees, such as physicians and dentists. As employment in medical, pharmaceutical and medical instrument research and development increases in Connecticut, research workers with two to six years of postsecondary training are in high demand. Here are the minimum requirements for various occupations across the educational continuum. For more information, see the enclosed DVD.

- **High-school diploma/special certification** (up to 12 months' training after high school): cardiovascular technologist, certified nurse aide, emergency medical technician, histologic technician, massage therapist, medical assistant, medical secretary, paramedic, pharmacy technician, phlebotomist
- **Associate's degree or equivalent** (1-2 years): clinical laboratory technician, dental hygienist, dietetic technician, licensed practical nurse, medical coder, optician, perfusionist, radiation therapist, respiratory therapist, surgical technologist, veterinary technician
- **Bachelor's or equivalent** (4 years): athletic trainer, biochemist, cytogenetics technologist, environmental health specialist, fitness specialist, molecular genetic technologist, nursing home administrator, nutritionist, pathologist's assistant, registered nurse, research associate, sanitarian
- **Master's or equivalent** (5-6 years): advanced practice registered nurse, art therapist, audiologist, biomedical engineer, biostatistician, epidemiologist, health care administrator/manager, industrial hygienist, occupational therapist, pharmacist, physical therapist, physician assistant, speech-language pathologist
- **First Professional Degree/Doctorate** (8+ years): biochemist, dentist, physician, senior scientist, veterinarian

How can I start preparing in high school?

A rewarding career in health and biosciences starts with a good education, and the choices you make in high-school coursework can lay a solid foundation. Your academic training should include algebra I and II, geometry, physics, precalculus, computer technology, biology and chemistry with labs, and anatomy and physiology. In addition, calculus, psychology, public health, statistics and probability and advanced placement courses in biology, chemistry, English and physics will round out your college preparation. Many opportunities also exist for graduates skilled in management, administration, social services, marketing, world languages and business operations.



What about extracurricular activities and training?

There are many skills you can develop and settings you can work in now to prepare yourself for a career in health and biosciences. These include:

- volunteering at a health care facility
- CPR (cardiopulmonary resuscitation) certification
- EMT (Emergency Medical Technician) or First Responder training
- Science fairs/competitions
- Laboratory internships

TEACHER REPRODUCIBLE: Use this three-page worksheet to introduce students to the variety of career opportunities, job duties, and work environments in health and biosciences.

National Education Standards: NS.9-12.6, 7. Personal and social perspectives; science as a human endeavor. **Connecticut Curriculum Connections:** Technology 2, 3: Technological impacts; career awareness.

Who's Who in Health and Biosciences?

Health and biosciences covers a broad spectrum of fields and a wide variety of jobs within them. Many are in research, predictive and forensic science, and product development. Others involve direct patient care. Though they can differ greatly in terms of specific duties, there is also a great deal of overlap among these jobs.

Read the following descriptions. Unscramble the letters and use context clues to figure out what type of health practitioner or biomedical/biosciences professional is being described. The first one is done for you.



1. NURSES **SENURS** treat patients and educate them, their families and the public about managing and preventing illness and injuries. They record medical histories and symptoms, help perform diagnostic tests and analyze results, establish a plan of care and administer treatment. They might also run general health screenings, immunization clinics and blood drives. These professionals constitute the largest health care occupation, representing 2.5 million jobs, with another 587,000 jobs projected over the 2006–2016 period.
2. _____ **CARDIOLIGO** _____ **SCHOOLETTINGS** take X-rays and administer nonradioactive materials into patients' bloodstreams for diagnostic purposes. Some specialize in mammograms (to check for breast cancer), CT (computed tomography) scans or MRI (magnetic resonance imaging).
3. _____ **PAYCHARM technicians** help prepare prescribed medications by counting tablets; pouring, weighing, measuring or mixing substances; labeling bottles; and pricing prescriptions. They must also verify that prescriptions are complete and accurate.
4. _____ **BOTCHIMESSI** study the chemical composition of living things, analyzing the complex chemical combinations and reactions involved in metabolism, reproduction and growth. They do most of their work in biotechnology, helping various companies meet their business goals by developing marketable drugs, treatments and tests; increasing crop yields; or creating biofuels.
5. _____ **CECINGTOOTHYSTOLS** study human cells under a microscope to identify changes or abnormalities in shape, size or color that could indicate cancer or other diseases.
6. _____ **ISAYPINCH** _____ **SATSSAINTS** examine, diagnose and treat patients under the supervision of physicians and surgeons. They take a patient's medical history, interpret lab tests and X-rays, and treat injuries with sutures (stitches), splints and casts. They may also prescribe some medications. In rural and inner city clinics, these medical professionals are often the principal care providers.

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7. _____ **EVERYTRAIN technologists** perform laboratory and clinical procedures on animals. Under the supervision of licensed veterinarians, they might do urinalysis and blood counts and develop X-rays.
8. _____ **LADENT** _____ **GENISISTHY** clean and examine patients' teeth and gums, take X-ray images, record the presence of diseases or abnormalities, and teach patients good oral hygiene.
9. _____ **SPYNICHIAS** and _____ **GROUSENS** examine patients; obtain medical histories; order, perform and interpret tests to diagnose illness and injury; prescribe and administer treatment; and counsel patients on diet, hygiene and preventive health care. They may be primary care providers (internal, general, pediatric or family medicine) or specialists — for example in orthopedics (musculoskeletal disorders), psychiatry (mental illness), oncology (cancer), anesthesiology (administering of sedatives or analgesic drugs to block pain or consciousness), ophthalmology (eyes), otolaryngology (ears, nose and throat), dermatology (skin), and many others.
10. _____ **RESUN** _____ **IDEAS** are specially certified to help care for ill, injured and disabled individuals at home and in hospitals and convalescent facilities. They often work with patients who need long-term care, and their jobs can be physically demanding, requiring heavy lifting and many hours of standing or walking. The specific care they give can include helping patients eat, dress, walk, bathe, take their medicines, and get into and out of bed; monitoring patients' temperature, pulse and blood pressure; making beds; changing bandages; and assisting with braces, ventilators (breathing machines) and artificial limbs.
11. _____ **GLAUSRIC** _____ **GHOSTENCLOTIS** help prepare the operating room by setting up surgical instruments and equipment, sterile drapes, and sterile solutions. They get patients ready for surgery by washing, shaving and disinfecting incision sites and helping position patients on the operating table. During surgery, they pass instruments; hold retractors; cut stitches; help apply dressings; operate lights or suction machines; count sponges, needles and other supplies; and handle lab specimens.
12. _____ **EENCYGERM** _____ **DIECLAM** _____ **NICECHAINST** and _____ **DIMASCAPE** save lives in cases as varied as automobile accidents, heart attacks, slips and falls, and gunshot wounds. They assess the nature of a patient's condition, monitor vital signs, transport the sick or injured to a medical facility, and administer emergency medical care as needed. Some work as part of a helicopter's flight crew to transport critically ill or injured patients to trauma centers.
13. _____ **LASICO** _____ **SKEWORR** help people of all ages cope with personal and family issues, including disability, illness, domestic violence or conflicts, inadequate housing, unemployment, teen pregnancy, work-related stress, or alcohol/drug abuse. Many specialize in a particular population (such as children or teens) and advocate for improved services for the people they serve.
14. _____ **ARLAYROBOT technicians** perform tests, experiments and other laboratory tasks; analyze data; and interpret results. They maintain lab equipment and an inventory of supplies and might also write reports and calibrate instruments.



15. _____ **CHEESARR** _____ **SASSICOATE** most often collaborate with others on research. They can also work independently as principal investigators and may be responsible for identifying inventions that can be patented.
16. _____ **CAPISHLY** _____ **PATHSTIRES** help restore function, improve mobility, relieve pain, and prevent or limit permanent physical disabilities related to injuries or disease. Their patients include accident victims and individuals with lower-back pain, arthritis, heart disease, fractures, head injuries and cerebral palsy. Treatment often includes exercise to increase flexibility, range of motion, strength, balance, coordination and endurance. They use electrical stimulation, hot packs, cold compresses, ultrasound and deep-tissue massage to relieve pain, reduce swelling, and improve circulation and flexibility. They also teach patients to use assistive and adaptive devices, such as crutches, prostheses and wheelchairs.
17. _____ **CUCAOPTIONAL** _____ **HEARTPISTS** help patients with mentally, physically, developmentally or emotionally disabling conditions. They work on maintaining or improving patients' daily living and work skills — such as dressing, cooking, eating and using a computer. Their goal is to help clients lead more independent, productive and satisfying lives by improving their motor functions and reasoning abilities.
18. _____ **CLAIMED** _____ **SSAAINTTSS** work in doctors' offices, updating and filing patients' records, filling out insurance forms, and arranging for hospital admissions and lab services. Some perform administrative tasks: answering phones, greeting patients, scheduling appointments and handling billing. Others have clinical duties, such as recording vital signs, preparing patients for exams, drawing blood, performing basic laboratory tests, arranging exam room instruments and equipment and keeping waiting and examining rooms neat and clean.
19. _____ **IIDISTANCE** and _____ **TIRTIONUSNITS** plan food and nutrition programs, supervise meal preparation and serving, and manage food service systems for institutions such as hospitals and schools. They prevent and treat illnesses by promoting healthful eating habits and recommending dietary modifications.
20. _____ **SAMEGAS** _____ **TAPESHIRTS** can specialize in more than 80 kinds of massage, including Swedish massage, deep tissue massage, reflexology, acupressure, and sports and neuromuscular massage. Most specialize in several modalities, using different techniques, for example, for elderly clients, infants, pregnant women and athletes.
21. _____ **RORYPIRATES** _____ **HEATSTRIPS** evaluate, treat and care for patients with breathing or other cardiopulmonary disorders, including premature infants whose lungs are not fully developed; patients with chronic asthma, emphysema or cystic fibrosis; and those whose breathing has been compromised by disease, heart attack, stroke, drowning or shock. They test patients' lung capacity, measure pH and determine the concentration of oxygen and other gases in patients' blood. To treat patients, they use oxygen, aerosol mist and ventilators and perform chest physiotherapy to remove mucus from the lungs. In addition, they visit patients at home to inspect and clean breathing equipment and evaluate the home environment.



Source: U.S. Department of Labor

TEACHER REPRODUCIBLE: Volunteer work provides opportunities for students to gain real-world experience, community service credits, letters of recommendation for college, and personal satisfaction. Distribute this worksheet to interested students.

National Education Standards: NL-ENG.K-12.7, 8: Evaluating data. Connecticut Curriculum Connections: Health 8: Advocacy.

Get in Gear: Volunteer

In the fields of health and biosciences, volunteers provide direct assistance to patients, they support staff and families, and they help behind the scenes — for example, raising funds and public awareness. Read on for more about volunteering.

What You Do

Many young people volunteer as friendly visitors, bringing smiles and encouragement to nursing home residents or hospital patients. You could also:

- escort patients
- provide wheelchair service
- deliver flowers
- take photos of newborns
- work in hospital gift shops
- decorate halls for holidays
- serve as dietary aides
- coordinate the work of other volunteers, organizing orientations, recognition ceremonies, and get-togethers
- arrange prayer books for religious/spiritual services
- coordinate outings
- assist with chess, cards or bingo
- file and retrieve medical records
- transport lab specimens
- staff reception/information desks
- read to patients
- provide musical entertainment

- What You Accomplish**
- ✓ Improve the lives of others
 - ✓ Transform your own life
 - ✓ Solve problems
 - ✓ Connect to others
 - ✓ Become part of a team
 - ✓ Strengthen your community

- What You Give**
- ✓ Your time
 - ✓ Your talent
 - ✓ Your experience and skills
 - ✓ Your energy
 - ✓ Your compassion
 - ✓ Yourself



What You Get

- hands-on experience in a medical setting
- an inside look at health care careers
- a chance to fulfill school service-learning requirements
- new friendships and relationships
- community service credits for college
- better communication skills
- participation in special summer programs, outings and events
- self-confidence, a good work ethic and a chance to shine
- a multigenerational perspective, through interaction with peers, mature professionals and — depending on the health-care setting — children or older adults

Think about your own interests and qualities and what set of skills you bring to the job. Are you an artist? A musician? An athlete? Are you tech-savvy? Do you have good business or financial sense? People skills? Look at the volunteer categories below. Which of these opportunities might suit you best, and why?

Accounting • Administration • Central supply • Cafeteria • Companionship • Fundraising • Gift shop • Laboratory • Materials management • Medical records • Music program • Physical therapy • Recreation/entertainment • Rehabilitation • Religious services • Respiratory care • Wheelchair/transport • Youth council

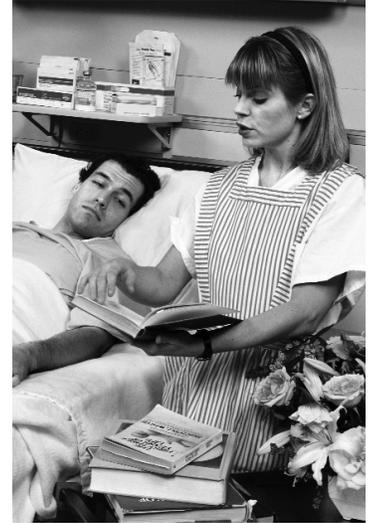
TEACHER REPRODUCIBLE: Use this worksheet in conjunction with "Get in Gear: Volunteer," page 8.

National Education Standards: NL-ENG.K-12.7, 8: Evaluating data; research skills. Connecticut Curriculum Connections: Health 8: Advocacy.

Awesome Auxiliaries

Did you know that hospital volunteers were once commonly known as **"candy stripers,"** because of their red-and-white-striped uniforms? Candy stripers originated as a high-school civics project in 1944.

If you're considering a medical career, get an inside look at the field by doing some volunteer work. Medical volunteers are needed throughout your community — at nursing homes, hospitals, rehabilitation centers, and other skilled-care facilities. Here's how to get started.



Take the lead.

Talk to your parents, teachers and neighbors to find out where volunteer opportunities exist. Check your local paper. Choose an issue you feel strongly about and see how you can get involved.

What are some health issues affecting your community? List them here.

Do your homework.

In addition to filling out an **application** form and completing an **orientation** and **interview**, there are often **age restrictions** and certain other conditions you must meet before volunteering in a health care setting. Some facilities require that volunteers be at least 15 years old and have a parent's or guardian's signed permission. Many require proof of **vaccinations** (for example, against TB, or tuberculosis). Some seek a commitment of a specified number of hours, weeks or months. Others ask for an essay explaining why you want to volunteer.

Think of a setting in which you might like to volunteer. On a separate page, write a five-paragraph essay explaining why you want to contribute your time there. Include an introduction, supporting details and a conclusion. Make sure the essay states your interest, sums up your strengths and reflects your personality.

United we stand for something.

Involve your friends and family. Ask your school about group opportunities. Your class, club, band or sports team, for example, can stage a performance at a nursing home. You can help organize and publicize a walkathon, concert fundraiser, blood drive or other event. **Jot down some possibilities:**

TEACHER REPRODUCIBLE: As an extension, have students choose a career not featured in the DVD and create their own “day-in-the-life” profile in the form of a short video or journal entry.

National Education Standards: NL-ENG.K-12.8, 11, 12: Research skills; participating in society; language skills. **Connecticut Curriculum Connections:** Technology 2, 3: Technological impacts; career awareness.

A Day in the Life

Careers in health and biosciences span a range of responsibilities, and employees work in a variety of settings — including hospitals, schools, nursing homes, rehabilitation centers, corporate or government laboratories, and private homes.

As a cardiology nurse at Hartford Hospital, Asamoah Anane calls himself the quarterback of his unit. Rachel Kroe, a pharmaceutical scientist at Boehringer Ingelheim, says she never works alone. And even though Eric Carita investigates crime scenes, he’s never actually at the scene, never carries a gun, and never solves a case in just one day.

Complete the following statements with something you know (or believe to be true) about each job — for example, the main duties or personal qualities essential to the job. After watching the DVD *Career Pathways: Health and Biosciences*, decide whether your first statement is true (T) or false (F). Then write something new that you learned about each position.



- An occupational therapist ...** _____

- A radiologic technologist ...** _____

- A pharmaceutical scientist ...** _____

- A forensics investigator ...** _____

- A clinical research assistant ...** _____

- A nurse ...** _____

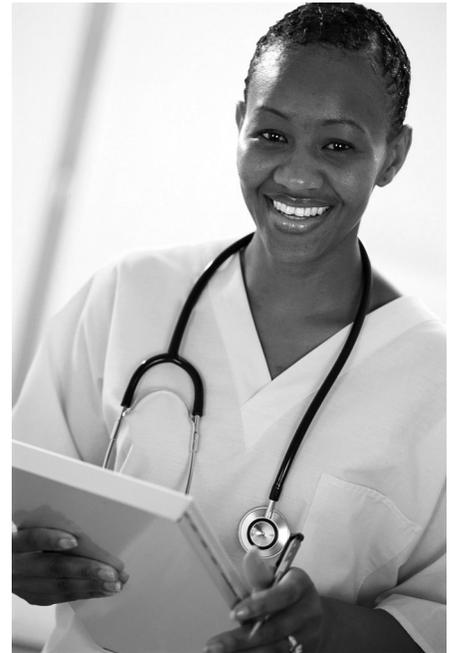
TEACHER REPRODUCIBLE: As a supplement to this lesson, invite a professional from the health care or biosciences industry to be a guest speaker in your classroom.

National Education Standards: NS.9-12.6, 7: Personal and social perspectives; science as a human endeavor. NL-ENG.K-12.8, 11, 12: Research skills; participating in society; language skills. **Connecticut Curriculum Connections:** Technology 2, 3: Technological impacts; career awareness.

Field Report

Choose any profession within the field of health and biosciences. (A few are suggested at the bottom; feel free to explore others). Use this worksheet to guide you in researching and writing a two-page report on the career you have selected. Be sure to draw your information from at least two different types of sources. Good sources of information include the Internet, books, classified advertisements and interviews with medical professionals.

1. Which career have you chosen to research?
2. Give a brief history of this profession.
3. How many people are employed in this profession nationwide? Statewide?
4. Are people in this profession known by different titles? Have they gone by different titles historically? If so, what are (or what have been) some of the names for this position? Are any titles considered preferable to others? If so, why?
5. Where do these professionals most often work? Describe the typical setting or environment.
6. What are the main responsibilities of the job? What distinguishes this job from other health and biosciences careers?
7. What are the education requirements for this profession?
8. What is the salary range?
9. What personal characteristics, interests or attributes would be a good match for this career?
10. What types of instruments or technology do these professionals use?
11. What are some *atypical* roles or *nontraditional* work settings for people in this profession?
12. Would you consider training for and working in this career? Why or why not?



Audiologist • Bioethicist • Biochemist • Biostatistician • Cell biologist • Cytogenetic technologist • Clinical research associate • Dental assistant • Dental hygienist • Dentist • Dialysis therapy technologist • Emergency medical technician • Epidemiologist • Family practitioner • Forensic scientist • Geneticist • Health and safety officer • Home health aide • Internist • Laboratory technologist • Molecular biologist • Nurse practitioner • Nutritionist • Occupational therapist • Patient care technician • Pharmacologist • Psychologist • Quality assurance technician • Registered nurse • Social worker • Speech pathologist • Toxicologist • Ultrasound technician

TEACHER REPRODUCIBLE: Encourage students to share their findings and compare notes in class. Lead a discussion about why facts might be changed, omitted or overlooked in TV dramas and what impact that could have.

National Education Standards: NL-ENG.K-12.7: Evaluating data. **Connecticut Curriculum Connections:** Arts/theater 6, 7: Connections; analysis, criticism, and meaning.

Trauma ... or Drama?

Have you ever watched a TV medical drama — such as *ER*, *House*, *General Hospital*, *Grey’s Anatomy* or *CSI* — and wondered how close to (or far from) reality the plot, props, scenes and characters are? TV writers, producers and directors do their best to tell stories responsibly, and they get a lot of help and advice from real-life medical experts and consultants. Still, TV shows don’t always accurately portray the roles and responsibilities of doctors, nurses, forensic investigators and others.



Watch a medical/science TV drama. Write some observations in the spaces below. Take note of procedures, details (props, costumes, setting) or dialogue you suspect might be “made for TV” and not necessarily a reflection of the real medical workplace. Do some detective work and fact-checking. Compared with the way things really work, were the scenes you observed on target, off the mark or somewhere in between?

Name of show _____

Date/episode _____

Observations _____

Extension: Hollywood, Health & Society (HH&S) is an organization that provides accurate, timely information to TV writers, producers and other entertainment industry professionals about health issues. Its goal is to present TV viewers with reliable health information and a realistic portrayal of the medical field. Why is that important? Recent surveys indicate that more than half of primetime and daytime drama viewers reported learning something about diseases or disease prevention from shows they watched, and one-third took action as a result of a TV broadcast.

Learn more about the work of HH&S — especially its Sentinel for Health Award. Which television shows have won this award, and why? See www.learcenter.org/html/projects/?cm=hhs.

TEACHER REPRODUCIBLE: Have students present one of their projects (timeline, backstory, essay) in class.

National Education Standards: NS.9-12.6, 7. **Connecticut Curriculum Connections:** Science 10.1,10.2: Structure and function; science and technology in society. Social studies 2: Understanding of major historical events, issues, and trends and science and technology in order to understand how the world came to be the way it is. Visual arts 1, 2, 3: Understand, select and apply media; elements and organizational principles of art; and range of subject matter, symbols and ideas.

Medical Milestones

- Choose 10 medical discoveries or developments from the following list. Research and **briefly** summarize (in one or two sentences) the relevance of each. Design a timeline based on the selections you've made.

Acupuncture	Contact lens	Hearing aid	Pap test
Adhesive tape	Cortisone	Heart-lung machine	Pasteurization
Ambulance	Curare	Hydrogen peroxide	Rh factor
Amniocentesis	Cyclosporine	Ibuprofen	Schick test
Anticoagulant	Defibrillator	Incubator	Skin grafts
Antihistamine	Dental drill	Insulin	Steroids
Antisepsis	Dental fillings	Interferon	Stethoscope
Apgar score	Dentures	In-vitro fertilization	Streptomycin
Arthroscope	Dialysis machine	Iodine	Syringe
Artificial limbs and joints	Digitalis	Iron lung	Thermometer
Aspirin	DPT vaccine	Kidney transplant	Thiamine
Autoclave	Electrocardiograph	Laparoscopic surgery	Tracheotomy
Barium	Electroencephalogram	Lithium	Tuberculin test
Blood pressure meter	Endoscope	Mammography	Ultrasound
Blood transfusion	Epinephrine	Microscope	Vitamin A
Caesarean section	Ether	Morphine	Vitamin B ₁₂
Cataract surgery	Eyeglasses	Niacin	Vitamin C
Chemotherapy	Finsen light	Nitrous oxide	Vitamin D
Chloroform	Fluoride	Open-heart surgery	Vitamin E
Chromatography	Gene therapy	Ophthalmoscope	Vitamin K
Cloning	Genetic code	Orthodontics	
Codeine	Genetic engineering	Pacemaker	

- Gene splicing, cloning, space travel, waterbeds ... many modern commodities and capabilities appeared in science fiction long before becoming realities. Think of a medical milestone we have **not** yet reached. Use the space at the end of your timeline to describe it. Assign a year when you predict that dream might become a reality.
- The stories behind medical discoveries are often fascinating, funny, deeply touching or very personal. Many treatments and discoveries have been accidental, the byproducts of research into other problems. Choose a medical discovery and research how it happened. Illustrate your findings in a comic strip, poster or PowerPoint presentation.
- Choose a medical product or health discovery and write a brief essay (three to five paragraphs) describing how your life would have been different without it.

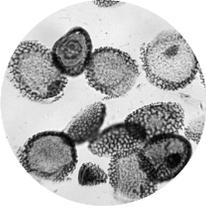
TEACHER REPRODUCIBLE: As an extension, have students share facts or anecdotes related to these historical periods. Examples might include ads, articles and artifacts found on the Internet.

National Education Standards: NS.9-12.6, 7. **Connecticut Curriculum Connections:** Science 10.1,10.2: Structure and function; science and technology in society. Social studies 2: Understanding of major historical events, issues, and trends and science and technology in order to understand how the world came to be the way it is; locate events and people on a time line.

Pioneers in Medicine: 1799 to Present

Some of the pioneers in the history of modern medicine — and their significant discoveries and developments — are identified below, but not in chronological order. Can you match each one to the correct spot on the timeline? The first one is done for you.

1799 Anesthetic properties of laughing gas discovered



Apgar score
 Developed by pediatrician-anesthesiologist Virginia Apgar, this test assesses the health of infants immediately after birth and helps determine whether they are in distress and need urgent medical care.

1799 Louis Pasteur unveils a rabies vaccine
 This single discovery paved the way for every other vaccine, saving millions of lives.

SARS virus discovered
 Dr. Carlo Urbani identified severe acute respiratory syndrome (SARS), a new, dangerously contagious disease. His early warning to the World Health Organization touched off a massive response, likely saving millions of lives worldwide.

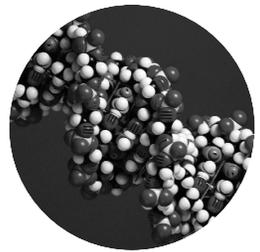
1882

First surgery using anesthesia, with ether
 Anesthetics and analgesics revolutionized surgery. They remain one of the most vivid examples of modern medicine's capacity to diminish human suffering.



1842

Discovery of DNA structure
 DNA testing has made it possible to develop genetically targeted drugs, unlock the nature of infectious agents, detect genetic diseases in newborns, and analyze patients' blood types before surgery.



Antibiotics
 Many infections that were once deadly are now easily treatable. Alexander Fleming was the first to report on penicillin's potential to kill bacteria. Mass production in the United States during World War II gave soldiers greater protection against wound infections and made antibiotics more affordable and available.

1885

Protein crystallography
 The science of protein crystallography was established by Dorothy Crowfoot Hodgkin, who later won the 1964 Nobel Prize in chemistry for her work. Using X-ray techniques, she determined the structures of important molecules and biochemical substances, including cholesterol, vitamins B-12 and D, penicillin, and insulin.

Cause of AIDS (HIV) virus discovered

1895

Discovery of the health risks of smoking, including the link to lung cancer

Two landmark studies in one decade led to a growing body of evidence about the harmful effects of tobacco. A follow-up report on these findings, published by the U.S. Surgeon General, led to a gradual decline in the percentage of people smoking and dying of tobacco-related disease and provided the impetus for warning labels and bans on certain advertising.

Tissue culture

Tissue culture refers to growing cells from humans, plants and animals in vitro, separate from their organisms. It provides a medium on which to test drugs and grow viruses for experimentation. Lab-created tissue cultures have played a role in 18 out of the last 52 Nobel prizes for medicine.

Discovery of how HIV "stealth protein" crosses hard-to-penetrate cell membranes

Led by physics and bioengineering professor Gerard Wong, a team at the University of Illinois figured out exactly what properties of the TAT protein (found in the HIV virus) make it a good vehicle for transporting therapeutic drugs and molecules into cells.

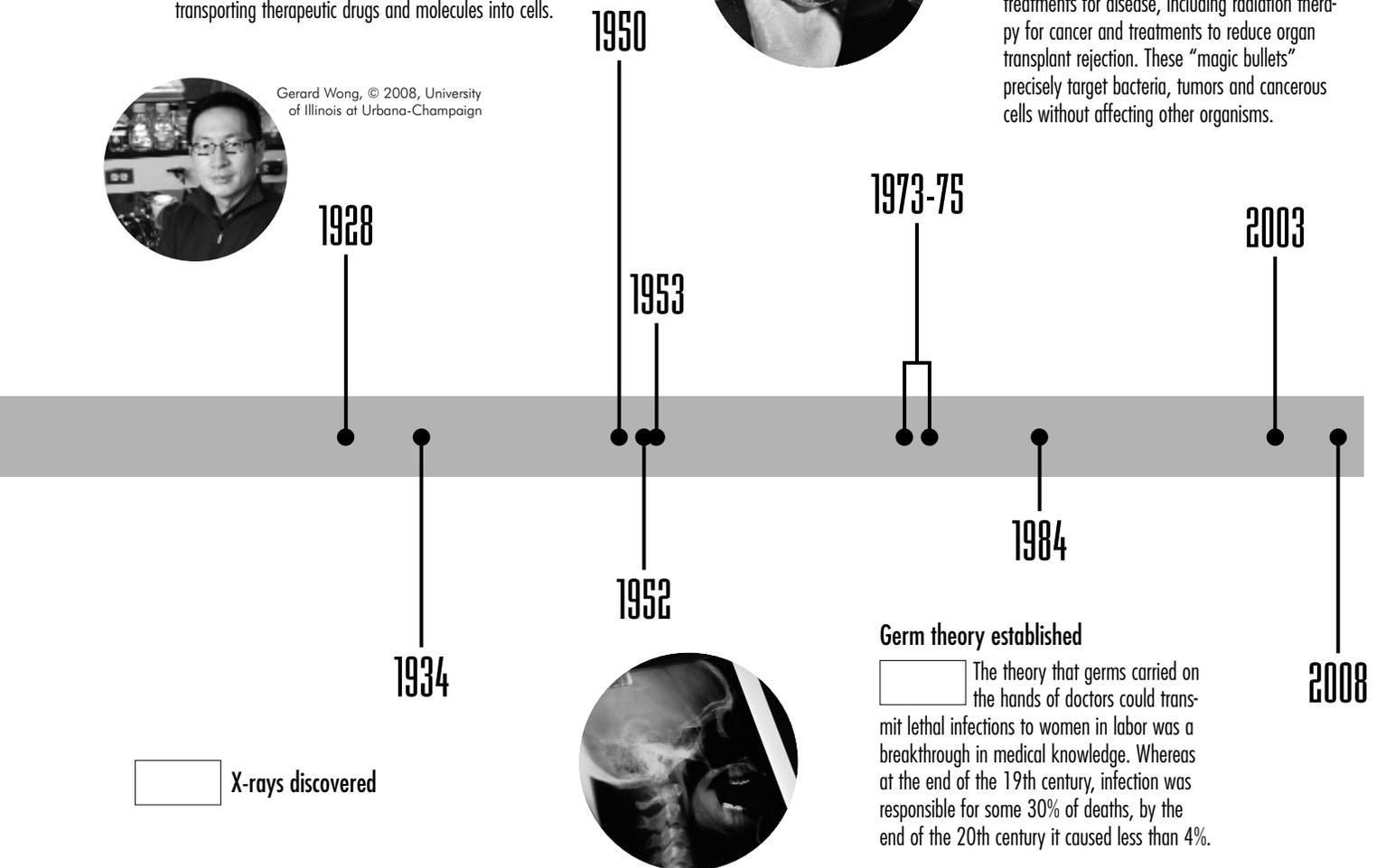


Monoclonal antibodies

The production of monoclonal antibodies (mAbs) that our immune system will not reject has led to dramatic new treatments for disease, including radiation therapy for cancer and treatments to reduce organ transplant rejection. These "magic bullets" precisely target bacteria, tumors and cancerous cells without affecting other organisms.



Gerard Wong, © 2008, University of Illinois at Urbana-Champaign



X-rays discovered



Germ theory established

The theory that germs carried on the hands of doctors could transmit lethal infections to women in labor was a breakthrough in medical knowledge. Whereas at the end of the 19th century, infection was responsible for some 30% of deaths, by the end of the 20th century it caused less than 4%.

Extension: Though women have made important contributions in science and medicine, they have had to campaign hard for the right to be admitted into medical school and to work alongside men as researchers and physicians. In their struggle, many have confronted social, racial and gender-based restrictions and discrimination. Their achievements in health and bioscience have often gone unacknowledged and unrewarded. Research a pioneering woman in the field. Prepare and present a biographical sketch about her.

TEACHER REPRODUCIBLE: As an extension, have students work in groups to create their own "quotables" or slogans about careers in health and biosciences. What would they emphasize, and how?

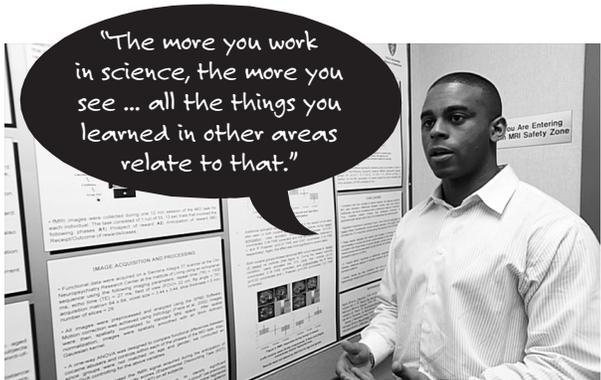
National Education Standards: NL-ENG.K-12.12: Applying language skills. **Connecticut Curriculum Connections:** Language arts 1.1, 3.1: Reading and responding; communicating with others.

Notable Quotables

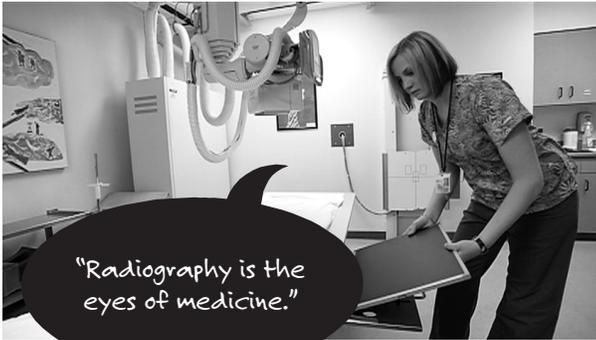
The DVD *Career Pathways: Health and Biosciences* profiles six young professionals in science and health care. Listen to their interviews. As a class, discuss important points or interesting comments that stand out for you.

Here are six of our favorites. After watching the DVD, explain what each person means by these words:









"Radiography is the eyes of medicine."



"If you make a plan and it doesn't necessarily go that way, it's OK."



"What it comes down to is, is the science good?"

TEACHER REPRODUCIBLE: Have students use an interactive graphic organizer, such as the Persuasion Map at www.readwritethink.org/materials/persuasion_map/, to outline their arguments. You may also wish to have them turn their persuasive essays into oral presentations.

National Education Standards: NL-ENG.K-12.5 Communication strategies. **Connecticut Curriculum Connections:** Social studies 13: Limited resources. Health 2, 8: Accessing health information; advocacy.

Make a Case for a Cure

In 1975, an unusual spike in childhood arthritis was reported in Connecticut, specifically in the towns of Lyme and Old Lyme. That year, Dr. Allen Steere and his group at Yale University saw 51 cases of “Lyme arthritis.”

In 1977, a certain kind of tick was linked to the transmission of Lyme disease. Not until 1984 did blood tests to check for Lyme disease become widely available in Connecticut. Finally, in the summer of 1988, extensive national media coverage of the disease — urged by the Lyme Disease Foundation — began with the broadcast of a story on ABC’s *20/20*.

In the fall of 1994, three years after federal funding for Lyme disease research and treatment became available, Alyssa Ciasullo, of Fairfield County, Connecticut, was bitten by a deer tick. Unfortunately, Lyme disease invaded her entire neurological system. Alyssa is a

very sick child. Once a gifted student, she now suffers from brain limitations that affect her cognitive abilities, and she experiences chronic pain and fatigue. At a time when she should be talking on the phone, laughing, full of boundless energy, and testing her wings, Alyssa’s wings have been clipped by Lyme disease.

Excerpted and adapted from *Many Faces of Lyme Disease*, www.lyme.org.

Alyssa is by no means the only young person who could have benefitted from early diagnosis and treatment, nor is she the only child whose family hopes for advances in health care and biomedical research. Today, hundreds of medical conditions compete for government funding, private research investment and public attention. Some are rare afflictions; others are widespread, affecting millions of people. Some are ultimately fatal; others are not — but might have profound effects on the quality of a person’s life.

How would you decide where to invest the greatest number of resources? Would you choose a little-known disease that is underfunded and poorly understood — but has devastating consequences on those affected? Would you choose an

illness that claims many lives? One that affects babies or young children? One that is more prevalent where you live or among members of your family?



Alyssa Ciasullo, © 2008, Lyme Disease Foundation

Think of a single health issue you would like to see addressed. What would it be? What should the health and biosciences profession do about it? Write a persuasive essay (at least five paragraphs) defending your choice. Remember, there are no right or wrong answers.

Health and Bioscience Careers Salary Guide

Health Care Occupations	Estimated Employment	Average Annual Wage
Dental Assistants	3,080	\$37,483
Dental Hygienists	2,870	\$69,636
Dentists, General	1,000	\$176,368
Dietitians and Nutritionists	550	\$60,572
Emergency Medical Technicians and Paramedics	2,670	\$35,866
Home Health Aides	11,200	\$27,084
Licensed Practical and Licensed Vocational Nurses	8,120	\$51,982
Medical and Clinical Laboratory Technicians	2,280	\$59,787
Medical Assistants	4,590	\$33,146
Medical Records and Health Information Technicians	1,320	\$38,148
Nurse Aides, Orderlies and Attendants	23,670	\$29,521
Occupational Therapists	1,810	\$69,482
Opticians, Dispensing	660	\$45,127
Pharmacists	2,530	\$99,597
Pharmacy Technicians	3,140	\$30,508
Physical Therapists	3,030	\$73,756
Physician Assistants	1,250	\$83,388
Physicians and Surgeons	1,700	\$137,518
Psychiatric Aides	1,130	\$28,138
Psychiatric Technicians	1,390	\$45,571
Radiologic Technologists and Technicians	2,400	\$55,812
Registered Nurses	34,710	\$66,291
Respiratory Therapists	1,150	\$56,236
Speech-Language Pathologists	1,520	\$74,509
Veterinarians	540	\$115,176
Veterinary Technologists and Technicians	1,010	\$34,741

Bioscience Occupations	Estimated Employment	Average Annual Wage
Biochemists and Biophysicists	900	\$85,267
Chemical Technicians	560	\$43,888
Chemists	850	\$71,619
Conservation Scientists	70	\$75,645
Environmental Scientists	740	\$63,143
Epidemiologists	120	\$73,921
Forensic Science Technicians	90	\$66,612
Life Science Technicians	240	\$47,987
Life Scientists	100	\$62,921
Materials Scientists	140	\$77,751
Medical Scientists	2,310	\$88,241
Physicists	340	\$78,288
Soil and Plant Scientists	120	\$74,819
Zoologists and Wildlife Biologists	100	\$72,589



Source: *Connecticut Occupational Employment & Wages, Statewide 2007*, Connecticut Department of Labor, Office of Research

Answer Key

Who's Who in Health and Biosciences?

(pages 5-7)

1. Nurses
2. Radiologic technologists
3. Pharmacy (technicians)
4. Biochemists
5. Cytotechnologists
6. Physician assistants
7. Veterinary (technologists)
8. Dental hygienists
9. Physicians and surgeons
10. Nurse aides
11. Surgical technologists
12. Emergency medical technicians (and) paramedics
13. Social workers
14. Laboratory (technicians)
15. Research associates
16. Physical therapists
17. Occupational therapists
18. Medical assistants
19. Dieticians (and) nutritionists
20. Massage therapists
21. Respiratory therapists

Pioneers in Medicine (pages 14-15)

Laughing gas (1799)

First surgery using anesthesia (1842)

Germ theory (1870)

Rabies vaccine (1882)

Tissue culture (1885)

X-rays (1895)

Antibiotics (1928)

Protein crystallography (1934)

Health risks of smoking (1950)

Apgar score (1952)

DNA (1953)

Monoclonal antibodies (1973-1975)

AIDS virus identified (1984)

SARS virus discovered (2003)

Mystery of HIV "stealth protein" unlocked (2008)

Resources

Connecticut Area Health Education Center,

ctahec.uhc.edu, www.healthcareersinct.com

Connecticut's Biobus, www.ctbiobus.org

Connecticut Business and Industry Association,

www.cbia.com

Connecticut Community Colleges, www.commnet.edu

Connecticut Department of Economic and Community Development,

www.ct.gov/ecd/site/default.asp (Click "Office of Bioscience")

Connecticut Department of Higher Education,

www.ctdhe.org

Connecticut Department of Public Health,

www.dph.state.ct.us

Connecticut Nurses Association,

www.ctnurses.org

Connecticut United for Research Excellence,

www.curenet.org

Health Occupations Students of America,

www.hosa.org

National Consortium on Health Science and Technology Education, www.nchste.org

Nursing Career Center of Connecticut,

www.thecenterforprofessionaldevelopment.org/nursingcenter.php