**the future is yours –
*get ready!***

Career Options in Scientific and Technical Fields

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and Technical fields**

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**Brookhaven National Laboratory
Upton, New York 11973**

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A Word About BNL

First-time visitors to Brookhaven National Laboratory notice the rolling lawns bordered by deep woods, the gentle sprawl of buildings and parking lots, and, certainly, the distinctive outlines of several of the large research facilities.

The site is large -- 5,265 acres. And 3,300 employees interact with a nearly equal number of guest researchers and students who come to work at BNL during the course of a year, drawn by the Laboratory's unique facilities and expert staff.

Established in 1947 on Long Island, New York, on the site of the former Army Camp Upton, BNL is a world-renowned scientific research institution that carries out basic and applied research in the physical, biomedical and environmental sciences and in selected energy technologies. The Laboratory is managed by Associated Universities, Inc., under contract with the U.S. Department of Energy.

Your Career

Choosing a career is one of the most important and difficult decisions you will have to make in your life.

One reason is that there is a bewildering variety of careers. For example, just one reference book listed at the back of this brochure gives detailed descriptions of about 250 occupations and summarizes another 80 of them!

Thankfully, it is a decision you do not have to make right now. But, you should begin to think about it.

We at BNL want to help you along the way. We hope this brochure will start you thinking about a career, if you have not begun to do so. We provide you with information that will help you match your talents, your special skills and your interests with possible fields of study.

Since BNL is a scientific research center, it is no accident that the examples we give are mostly scientific in nature. If, as a result of reading this brochure, a career in science seems more exciting to you, so much the better. The United States of America needs an increasing supply of well-trained scientists, engineers and technicians to compete with the rest of the industrialized world.

We encourage you to talk to your parents and career guidance counselors in school. Examine whatever resource material is available in your school and local libraries, and try to match your interests and talents with possible occupations. In the Resource Materials section of this brochure, you will find a short list of books on careers, which we hope will help you in this quest.

The future is yours. Get ready!

Choosing a Career

What is a career? In practical terms, it is the kind of work you will be doing as an adult to support yourself and your family. But it goes beyond just being a job. It implies something you have worked hard to prepare for while attending a university or professional school, a trade school, or by serving as an apprentice. With time, you will continue to develop your skills in your field, your standing among your peers will grow and, quite possibly, so will the financial rewards! Obviously, it is something that demands a lot of thought.

One of the first steps you should take as you think about your career is ask yourself what kinds of things you enjoy doing and also what you are good at. (Sometimes, the two are not the same.) You might never have analyzed yourself in this way!

When you can answer these questions with some confidence, browse through the following list, which associates certain interests and abilities with possible professions and occupations.

As you read through this booklet, certain terms may be new to you. Don't just skip over them. Head for your dictionary, or ask your friends, parents or teachers what they mean.

⇒ **INDUSTRIAL**

(interest in using mechanical skills and knowledge of machines to perform complex activities)

industrial supervisor
laboratory supervisor
welder

food production worker
glass cutter

printing press operator
sewing machine operator

estimator

control inspector
tester

⇒ **SCIENTIFIC**

(interest in discovering, collecting and analyzing information about the natural world and applying scientific research findings to problems in medicine, the life sciences and the natural sciences)

astronomer	animal scientist
chemist	anthropologist
computer applications engineer	biochemist
environmental analyst	biologist
geographer	biomedical engineer
geologist	botanist
mathematician	
meteorologist	
physicist	
dietician	radiologist
food technologist	speech pathologist
geneticist	surgeon
soil conservationist	veterinarian
zoologist	
chiropractor	color specialist
dentist	embalmer
doctor	film laboratory technician
psychiatrist	lab technician
	pharmacist

⇒ **PLANTS AND ANIMALS**

(interest in working with plants and animals, usually outdoors)

rancher	farmer
beekeeper	horticulturist
animal caretaker	landscaper
animal trainer	forester
animal breeder	logger
wildlife agent	forest firefighter
fisher	tree surgeon

⇒ MECHANICAL

(applying or planning to apply mechanical principles to practical situations by use of machine or hand tools)

aeronautical engineer	auto body repairer or customizer
chemical engineer	auto mechanic
electronics engineer	sheet metal worker
industrial engineer	
landscape architect	plumber
laser technician	pipe fitter
manufacturing engineer	
marine engineer	aircraft mechanic
mechanical engineer	electrician
tool designer	sound technician
nuclear engineer	dental lab technician
petroleum engineer	
	optician
construction supervisor	
maintenance supervisor	gunsmith
	tool grinder
boat builder	
house builder	air conditioning mechanic
carpenter	farm equipment mechanic
cabinetmaker	locksmith
furniture finisher	
architect	appliance repairer
estimator	
drafter	biomedical technician
land surveyor	camera repairer
	electromechanical technician
air traffic controller	
navigator	instrument maker
radio/TV transmitter operator	
	instrument repairer
boat captain	
flying instructor	heavy equipment operator
pilot	miner
shipmate	oil well driller
test pilot	offset printing press operator
stonecutter	
gem cutter	

Now that you have some ideas about you want to do, the next list, which is far from complete, shows you the kinds of jobs available to people who have studied beyond high school.

CAREER OPTIONS

People holding degrees in science or engineering may work for a corporation, e.g. IBM, GE, DuPont, or GM, either in a research lab or in a manufacturing facility. Or they may work in a government or privately sponsored lab, e.g. Brookhaven, or at a university, teaching and/or doing research.

The level of work depends on the academic qualifications. Holders of doctoral degrees tend to be the heads and senior members of research groups, and are the ones who prepare proposals for research projects and seek the funds to carry out these projects. They also advise all levels of government on matters related to science and technology. University and college faculties are overwhelmingly staffed by holders of doctoral degrees.

Holders of master's, bachelor's and associate's degrees work alongside Ph.D.s, and are vital to the success of their projects. The nature of the work they do depends on their level of training and experience. It can be standardized, such as testing medical specimens in a hospital, or as complex as designing a one-of-a-kind piece of equipment for an experiment.

Teaching, particularly at the elementary, secondary and vocational levels, is an option common to all of the disciplines described below and one that you should consider. The nurturing of our future scientists, engineers and technicians begins in the first grade or even earlier.

BIOLOGY

Study of living organisms and how they relate to their environment. Some specialties are:

aquatic - study plants and animals living in water.

biochemistry - study the chemical composition of living things; the chemistry of life processes, metabolism, reproduction, heredity.

botany - study plants and their environment; identify and classify plants; structure and function of plant parts; plant diseases.

microbiology - study microscopic organisms such as bacteria, viruses and fungi.

zoology - study various aspects of animal life - origin, behavior, diseases and life processes.

CHEMISTRY

Search for new knowledge about substances and ways to put them to practical use, such as in synthetic fibers, drugs, adhesives and lubricants. Discoveries in chemistry have led to advances in medicine, agriculture, energy conservation and pollution control. Specialties include:

analytical chemistry - determine the structure, composition and nature of substances; develop new analytical techniques, e.g. for monitoring water and air pollution.

biochemistry - see *Biology* above.

inorganic chemistry - study of compounds mainly consisting of elements other than carbon.

organic chemistry - study the chemistry of carbon compounds; has led to the discovery of new drugs, plastics and fertilizers.

physical chemistry - study the physical properties of atoms and molecules; understanding chemical reactions.

PHYSICS and ASTRONOMY

Study the basic laws describing phenomena such as gravity, electromagnetism and nuclear interactions; use observation, experimentation and mathematics to describe the universe and the interaction between matter and energy. Discoveries in physics have led to advances in such fields as nuclear energy, communications and medical instrumentation. Some subfields are:

condensed matter - study of solids and liquids.

elementary particles - study of the basic constituents of matter.

health - effects of radiation on living things.

nuclear/atomic/molecular - study of structure, properties and interactions of nuclei/atoms/molecules.

plasma - study of plasmas, which are 'gases' of ions and electrons.

biophysics and **chemical physics**, for example, combine physics with another discipline.

MATHEMATICS, STATISTICS and ACTUARIAL SCIENCE

Search for new mathematical principles; use mathematics to solve practical problems in business, science, engineering and other areas. Statisticians apply statistical methods to interpret data in such areas as economics, engineering or human behavior, and devise methods to obtain accurate information about people by sampling only small groups. Actuaries assemble and analyze information to determine probabilities for death, illness, injury, accidents, etc., on which insurance companies base their premiums.

MEDICINE

Diagnose, treat and work to prevent illness and disease.

Dentist - diagnoses and treats diseases and abnormalities of the teeth, gums and supporting bones. Some specialties are:

endodontics - root canal therapy.

oral pathology - treating diseases of the mouth.

orthodontics - straightening of teeth.

pedodontics - children's dentistry.

Physician - performs medical examinations, diagnoses illness, treats those suffering from injury or disease, and advises patients on maintaining good health. Specialties include:

epidemiology - study occurrence, spread and control of disease.

family practice - general practice.

medical - internal medicine, pediatrics, geriatrics, obstetrics, ophthalmology, etc.

pathology - the nature of diseases and the changes they produce.

surgery - general, orthopedic, neurosurgery, cardiovascular, etc.

Veterinarian - treats sick and injured animals, and works to prevent the outbreak and spread of animal diseases, some of which can be transmitted to humans.

ALLIED HEALTH

Work alongside doctors to care for the sick, help the disabled and improve the general health of a community.

Nurse (registered)

Works under doctors' supervision to provide direct patient care in hospitals, nursing homes, or private homes. Assists in surgical and diagnostic procedures, trains other staff members.

Dietician - plans diets to meet special needs.

Nurse Practitioner, Midwife, Anesthetist - with additional training beyond RNs, performs tasks otherwise performed by physicians.

Pharmacist - dispenses drugs and medicines prescribed by health practitioners.

Physician Assistant - performs many of the more routine tasks of physicians such as taking medical histories and doing routine examinations.

Therapist - helps injured, physically and mentally disabled, or emotionally disturbed patients recover or cope with their disabilities.

COMPUTER SCIENCE

The possibilities are limitless, as computers have permeated all aspects of modern life -- science and technology, information processing, communications, and even graphic arts and music. There are designers of hardware and software; systems analysts and programmers; computer scientists, who do research into computer languages, more efficient ways of solving complex problems, and design technologies for faster micro-processors and memory chips.

ENGINEERING, ARCHITECTURE and SURVEYING

Architecture

Provide analysis, design, layout and estimates for building construction or modification, and monitors construction. Do research in energy conservation designs, and in the use of new materials and construction techniques.

Aerospace

Design, develop, test and help produce aircraft, missiles and spacecraft. Develop new technologies for commercial aviation, space exploration and defense systems in the areas of navigational guidance, structural design, instrumentation and communication, and production methods.

Chemical

Work on large-scale production of chemicals; design equipment and plants and evaluate methods of manufacturing chemical products.

Civil

Design and construct roads, bridges and tunnels; water supply and sewage systems; systems for combatting coastal erosion and for flood control. Some specialties are sanitary, transportation and highway engineering.

Electrical and Electronics

Design, develop, test and supervise manufacturing of electrical and electronic equipment, such as power generating plants, electric motors, radar, computers and consumer electronic goods. Specialties include power distribution, integrated circuits, computers and communications.

Industrial

Determine the most effective ways to use people, machines, materials and energy in an organization, be it an office or a factory. Apply mathematical analysis to solve organizational or production problems. Develop systems to help with financial planning and cost control. Among engineers, are the most involved with people and the most likely to become managers.

Mechanical

Concerned with the use, production and transmission of mechanical power and heat as in engines and turbines, refrigeration and air-conditioning equipment, robots and industrial production equipment. Some specialties are heating, ventilating and air-conditioning, motor vehicles, and energy conversion systems.

Nuclear

Design, develop, monitor and operate nuclear power plants. Work on nuclear fuel cycles (production, handling, use and safe disposal), industrial and medical uses for radioactive materials, and risk assessment.

Surveying

Establish official land and water boundaries; provide descriptions of land for legal documents, such as deeds and leases. Collect information for and prepare maps and charts. Work in close cooperation with civil engineers and architects. Specialties are land, geodetic and marine surveying, and map editing.

TECHNOLOGISTS and TECHNICIANS

Perform much of the detailed technical work in engineering, scientific, library, medical and other professional activities. Focus on practical aspects such as operating and maintaining complex equipment, providing skilled help with research, design and testing, and actually making the end products of the activity. Work includes using testing and measuring equipment, making detailed drawings, programming computers or machine tools, and operating specialized equipment, as in an air traffic control tower. Some specialties are:

Computer Programming

Write programs to process data, solve problems or do some other task. Work from outlines prepared by systems analysts or on their own. Work in all areas where computers are used - business, science and engineering. Systems programmers work on the software that controls the operation of computer systems.

Drafting

Prepare detailed drawings based on rough sketches made by the supervising professional such as a scientist, engineer or architect. Drafters are increasingly using computer-aided design in their work.

Electrical and Electronics

Develop, manufacture and service equipment and systems such as radios, radar, sonar, computers, television, and measurement and control devices. Use sophisticated measuring and diagnostic equipment, which they must thoroughly understand.

Engineering

Assist in research and development, manufacturing, sales and customer service. In research, set up equipment, prepare experiments, record and analyze results with computers. In manufacturing, devise and run product quality tests, prepare materials specifications, supervise production workers.

Science

Assist scientists in research and development or production-related tasks. In research and development, construct or maintain

experimental equipment, and record and analyze data. In production, follow directions of a professional to perform tests to ensure quality control. May specialize in agriculture, biotechnology, chemistry, nuclear, mathematics, etc.

HEALTH TECHNOLOGISTS and TECHNICIANS

Work closely with physicians, dentists, and registered nurses in performing diagnosis, treatment, or laboratory procedures made possible by new equipment, very often computerized. There are many specialties and we list only a few.

Clinical Laboratory - perform tests on body tissue and fluids to assist in detecting, diagnosing and treating disease.

Dental Hygiene - provide treatment, such as taking X-rays or cleaning teeth, under dentists' direction.

Emergency Medicine (EMT) - provide medical treatment in the absence of a physician or registered nurse.

Nuclear Medicine - handling and administering radioactive drugs for diagnosis and treatment.

Licensed Practical Nursing - provide bedside care under supervision of doctors and registered nurses. May work in private homes.

APPRENTICESHIP PROGRAMS

Some occupations require apprenticeships, which are organized by trade unions and/or company management. They usually consist of classroom instruction and on-the-job supervision by a certified practitioner of the trade, and last for several years. Entry requirements are usually a high school or vocational school diploma or equivalent, and competency in math, physics and reading blueprints. Entry into some apprenticeship programs is very competitive.

Electrician

Installs and maintains electrical systems for lighting, climate control, communications equipment and machinery.

Machinist

Produces precision parts in numbers too small to automate. Reviews blueprints and job specifications, selects tools and materials, plan sequence of operations and then executes them. At BNL, for ex-

ample, the machine shops produce vacuum chambers, parts for magnets, mounting fixtures, etc. for use in experiments.

Plumber/Pipefitter

Installs residential plumbing and fixtures, water, waste disposal drainage and gas systems in buildings; piping for low- and high-pressure steam systems in the generation of electricity, and for heating and air-conditioning.

Tool and Die Maker

Produce tools, dies and special devices used in machinery for producing other goods, such as textiles, furniture, aircraft parts; precision molds for stamping metal parts. Computer-controlled equipment is increasingly being used by machinists and tool and die makers, hence, they are being required to be familiar with computers and programming these machines.

**Now that you have analyzed your likes and dislikes,
your abilities, and various occupations, all that remains
is to get ready for the future that is yours!
Good luck in your quest.**

HIGH SCHOOL PREPARATION

Generally speaking, high school preparation for college study in science and engineering requires you to take as much math (pre-calculus at least) and science as you can fit into your schedule. You also need a good foundation in English and an introduction to computing. At the very least, you should aim for Regents standards in these subjects, but even more desirable are good achievement and/or advanced placement scores.

If you are not familiar with these tests, ask your teachers about them.

Profiles

The following pages contain a collection of profiles of BNL employees who wanted to share with you how they chose and prepared for their careers, as well as give you a flavor of what they do at the Laboratory. You will find a wide spectrum of fields and job classifications.

You will notice that there is no fixed route that gets you to your career goal. Some people, on graduating from high school, enter college and continue their schooling, on a full-time basis without a break, emerging years later with a bachelor's, master's or doctoral degree. Others work for a few years after the first degree (B.A. or B.S.), by choice or out of necessity, before continuing with their formal education. Still others go through their formal higher education while holding down full-time jobs. The important point that is made over and over by these individuals is that you must stay the course and never lose sight of your objectives.

Elsewhere in this brochure, we profile a few of the students who have recently participated in the Laboratory's educational programs.

CRYSTAL Y. ALLEN

In the fifth grade, Crystal Y. Allen took the Introduction to Computers course, which is sponsored by Brookhaven National Laboratory. The thought of eventually working here at BNL never crossed her mind then. Now Allen is a Clerk Typist in the Supply & Materiel Division. One of Allen's duties is to maintain the library of manufacturer's catalogs that are used in purchasing equipment and supplies for the Laboratory. She also follows up with vendors to ensure delivery of material in a timely manner, calls in discrepancy notices to vendors on all inventory orders, and assists in quality-control procedures.

After high school, Allen obtained a B.S. in health and community service, planning to embark on a career in health services. Circumstances caused her to change her options toward the clerical field, however, and her high school courses in typing, word-processing and database management made the transition easier for her. Now, she will continue her study of computers to improve her overall clerical background.

Regarding careers, Allen feels that a student should be prepared to "take a few detours off of the road to success," but also stay focused on their goals. One particular saying that she believes people should follow is, "Your attitude controls your actions."

VINCENT J. CASTILLO

Vincent J. Castillo is a Physics Associate II in the Alternating Gradient Synchrotron (AGS) Department. Castillo is presently in the AGS instrumentation group, which designs, maintains and upgrades diagnostic equipment for the AGS accelerator complex.

Castillo chose to pursue a career in science because it offered him the most interesting challenges. While studying part-time for a B.A. in physics, Castillo worked at engineering-oriented jobs and took practical courses in electronics. At BNL, he continued his studies, again on a part-time basis, and obtained an M.S. degree in physics. Presently, Castillo is working on his doctoral degree in physics at the State University of New York (SUNY) at Stony Brook.

Castillo believes that the ultimate responsibility for choosing a career is yours alone, despite input from others. Once that choice is made, however, he advises you to "work constructively towards that career goal. On a daily basis, act responsibly towards your duties and obligations. This is most important of all."

CAROL CREUTZ

Carol Creutz is a Senior Chemist in the Chemistry Department. Presently, she is studying how chemical reactions of metal complexes take place in the dark (thermal reactions), and in the light (photochemical reactions).

Creutz chose to pursue a career in chemistry because her freshman chemistry courses in college sparked her interest in the subject, and she found it very challenging. She went on to obtain a Ph.D. in chemistry.

When Creutz was looking for a job nearly twenty years ago, funding for basic science research was going through one of its low points, and her job hunting had its discouraging moments.

Creutz advises that you should work hard at developing your mathematical and verbal skills, since they are necessary for most careers today.

MICHELLE CUMMINGS

Michelle Cummings is a Senior Information Support Analyst in the Management Information Systems Division. Her duties include training BNL personnel to use the applications programs for such functions as inventory, purchasing and accounting. Cummings also trains personnel to use personal computer programs such as WordPerfect and LOTUS. She conducts seminars, forecasts training needs and develops training materials.

Cummings' association with BNL began with her participation in the High School Co-op program while in the 11th grade, working in the Affirmative Action Office. She later transferred to Management Information Systems, where she got her introduction to computers. Cummings first completed an A.A.S. degree in business administration, then went on for a B.S. in management information systems and an M.B.A. in business management. With her extensive experience in training and also in part-time adult education teaching in BOCES II, she plans to pursue further graduate study in education administration.

Cummings' advice regarding careers is to take a wide range of courses in the early years of college. She says, "Sometimes, you don't realize you like an area until you actually have some experience with it."

CRAIG S. DIAZ

Craig S. Diaz is a Reactor Shift Supervisor in the Reactor Division. He works at the High Flux Beam Reactor, where he has maintained and operated the reactor for the past 16 years.

Out of high school, Diaz entered college to study engineering but put it on hold to enter the Navy's nuclear power program, where he spent the next six years. He then came to BNL as a Reactor Operations trainee and completed his studies for a B.S. degree. Diaz plans to pursue a master's degree in nuclear engineering within the next few years.

Diaz suggests these two steps to help you in choosing a career in science or engineering: (1) "Take as much math, physics, and technical courses, to get an idea as to where your interests might really be," and (2) "Pursue hobbies or projects related to those interests in addition to those hobbies you may already have that are not related."

APRIL DONEGAIN

April Donegain is an Administrative Assistant in the Fiscal Division, which controls the Laboratory's finances. Fiscal is responsible for such matters as distributing the employee payroll, paying Laboratory bills, receiving monies payable to BNL, and ensuring that they are deposited into the proper accounts.

After graduation from high school, where she had learned shorthand and typing, Donegain chose to postpone continuing her education and went to work as a receptionist at BNL instead. Over the years, through hard work and good job performance, she advanced to her present position. She cautions those who want to be secretaries that advancement can be difficult, because there is usually an over-supply. In her words, "it's clear cut – you further your education, you advance." Donegain has accumulated credits for college courses and has decided to begin formal study toward a degree, for career advancement.

Her advice to high school students is to "continue your education directly after high school. Choose something that you enjoy doing; you may have to do it for a lifetime. It's all right to change career paths while going through college. Growing up causes changes. Be prepared for competition – it's heavy out there. You must sell yourself."

ROMNEY B. DUFFEY

Romney B. Duffey is the Chairman of the Department of Nuclear Energy, where he develops and manages programs and technology in all areas of applied nuclear science. These include waste management, nuclear safety, radiological sciences, physics and engineering.

Duffey liked physics in school, and, convinced that there was a future in studying science, he diligently studied it at university and obtained B.Sc. and Ph.D. degrees in physics and geophysics.

As an entry-level scientist in a field he found interesting, Duffey worked hard to improve his professional standing. He changed jobs and moved to the U.S. to gain experience and advance in his career. To sharpen his administrative skills, he also studied management techniques. Duffey continues to do research and publish papers. He presently studies carbon dioxide transport to and from the oceans, and the stability of natural circulation systems.

Duffey suggests that students preparing to make career choices should, "Develop a real interest in a subject. Read widely and gain experience. Learn how to study and keep studying for higher degrees. Look for career changes in the job market. Ask yourself what field will be growing in five years and how you would like to contribute to it."

YREANA-RENÉE FLACK

As a Senior Educational Programs Representative in the Office of Educational Programs, Yreana-Renée Flack is in the perfect position to do what she enjoys most — work with people, especially young people. She is responsible for the design, development and implementation of numerous laboratory educational programs. One of her main concerns is trying to encourage students to choose science as a career. Another is helping young people discover their full potential and realize their importance to society.

Flack realized that to enter any profession, one had to have the proper training and skills. She obtained her A.A.S., B.S. and M.B.A. degrees while working full-time, and plans to further her professional development by earning a Doctor of Education degree.

Flack also knows that there is more to getting a good job than having the proper training: "In addition to the required skills needed for a job, reliability, motivation and self-confidence are essential. Gaining experience, proficiency and respect for your abilities is usually more important than money. Tell yourself, **yes I can!**"

AROKIASAMY J. FRANCIS

Arokiasamy J. Francis is a Microbiologist in the Department of Applied Science, where he studies the microbiological treatment of wastes containing toxic metals and radionuclides. He also investigates the basic biochemical mechanisms involved in solubilization and stabilization of toxic metals and radionuclides, hoping to develop novel biochemical treatment processes for stabilization of wastes, as well as recovery and recycling of strategic metals.

From an early age, Francis showed an interest in gardening. In college, he majored in agricultural sciences and then decided to concentrate on soil microbiology, a field in which he obtained a Ph.D.

After graduating, Francis was interested in a position that combined both research and teaching. He did his post-doctoral research at Cornell University, which was followed by a microbiologist position at the Stanford Research Institute, from where he came to BNL.

Francis feels that students should receive a strong background in science and math, and expose themselves to a variety of fields. This will help them in making their career choices.

JUANITA HEYLIGER

Juanita Heyliger is an Advanced Business Systems Analyst in the Management Information Systems Division. Her job entails analyzing and programming a variety of computer systems such as personnel/payroll, travel, and budget and accounting.

Heyliger developed an interest for computers when she was an Executive Secretary in the Research Library. When she got a personal computer, Heyliger began automating manual procedures in the office and tried to learn to use every software package she could find. She applied for a job in another department as a Data Services Assistant, got the job, and was soon promoted to an Assistant Systems Specialist. On-the-job training, training courses and evening college courses helped her move up to her current position. Heyliger has a B.A. in business management and plans to earn an M.B.A. in the future.

From her experience, Heyliger counsels, "You never want anyone to say that you are not qualified for a job or rule you out because you don't have a degree. An education opens doors. If you find you are in a job that you don't like, don't feel that you are locked into it. If you want to change course, go ahead. Sometimes you have to try many different directions before you find one that is right for you. Remember, persistence pays off. You will experience failure at times, but try to learn from it and keep pushing towards a goal."

Where professionals in various fields are employed at BNL. As you can see, each discipline offers a variety of career opportunities.

Discipline	Department/Division (See list below)
Architectural Engineering	2, 12
Architecture	2, 12
Biology/Chemistry	2, 3, 8, 15
Chemical Engineering	2, 10
Chemistry/Geochemistry	2, 3, 4, 8, 10, 15
Civil Engineering	2, 10, 12
Computer Science	1–15
Conservation Engineering	2, 12
Economics	2
Electrical Engineering	1, 2, 5, 6, 9, 11, 12, 13, 14
Environmental Science	2, 3, 8, 15
Health Science	1, 4, 8, 9, 10, 13, 14, 15
Industrial Engineering	1, 2, 12, 13, 14
Industrial Hygiene	2, 8, 15
Library Science	1, 3, 4, 5, 9, 10, 11, 16
Mechanical Engineering	1, 2, 9, 10, 11, 12, 13
Metallurgy	2, 10, 11
Meteorology	2
Nuclear Engineering	2, 10, 13
Oceanography/Marine Science	2, 15
Physics	1, 2, 6, 9, 10, 11, 13, 14
1 Alternating Gradient Synchrotron	9 Nat'l Synchrotron Light Source
2 Applied Science	10 Nuclear Energy
3 Biology	11 Physics
4 Chemistry	12 Plant Engineering
5 Computing/Communications	13 Reactor
6 Instrumentation	14 Relativistic Heavy Ion Collider
7 Management Inf. Systems	15 Safety & Environ. Protection
8 Medical	16 Technical Information Division

Where technical specialists work at BNL. Some services, e.g. glass blowing in Chemistry, are available to the entire Laboratory.

Specialty	Department/Division (See list below)
Air-conditioning/heating (HVAC)	1-6, 8-14
Automotive Mechanics	12
Carpentry	12
Drafting	1, 2, 4, 6, 9-12, 14
Electrical	1-6, 8-12, 14
Electronics	1-7, 9-11, 14
Glass Blowing	4
Laboratory Technology	
Biology/Medical	2, 3, 8, 10, 15
Chemistry	2, 4, 8, 11, 15
Electrical/Electronics	2, 3, 8, 15
Mechanical	1, 2, 6, 9, 10, 11, 13, 14
Physics	1, 2, 9, 10, 11, 13, 14, 15
Machining	1, 6, 12
Nursing	8
Plumbing	1, 12, 14
Refrigeration	1, 9, 12, 14
Secretarial/Clerical	1-15
Security/Firefighting	15
Welding/Sheet Metal	1, 12
1 Alternating Gradient Synchrotron	9 Nat'l Synchrotron Light Source
2 Applied Science	10 Nuclear Energy
3 Biology	11 Physics
4 Chemistry	12 Plant Engineering
5 Computing/Communications	13 Reactor
6 Instrumentation	14 Relativistic Heavy Ion Collider
7 Management Inf. Systems	15 Safety & Environ. Protection
8 Medical	16 Technical Information Division

ANGELA JOHNSON

Angela Johnson is the Database Administrator for the High Flux Beam Reactor. Her duties include computer programming, system checks, writing procedures, data entry and tracking work requests. Johnson feels that her job is especially helpful to her because she is gaining more experience working with computers and programming, which is related to what she wants to do later on.

While in college, Johnson made sure that she would be prepared for any type of job that she might have to accept, while studying for a career in the biomedical field. She studied for a B.S. in mathematics and biology and an M.S. in applied mathematics and statistics. Johnson plans to continue her education by entering medical school in a year or two to study for a Ph.D./M.D. in epidemiology/pediatrics.

Take Johnson seriously when she says, "Anyone can be what he or she aspires to be in life. All it takes is a willingness, initiative and dedication to the chosen field of study. Each of us was made unique and has special gifts and talents."

MARSHA KIPPERMAN

Marsha Kipperman is the Employment Manager in the Personnel Division. In this position, she oversees the policies, practices and procedures related to recruiting, hiring and transferring of non-scientific personnel throughout the Laboratory. She also has oversight responsibilities for several student programs and other special projects.

While in high school, Kipperman wanted to be a physical education teacher. After her first year of college, she switched her major to sociology and obtained her B.A. in sociology. With advice from the Dean of Women and recognizing her interest in administrative work, she studied for an M.Ed. in personnel administration. While in graduate school, she supported herself with the help of a graduate assistantship in a dormitory.

About entering the job market after she received her master's degree, she says, "My first job was the worst! Point is, get that first job. The others will come." She considered no job beneath her and even stacked toys in a department store while she was "between jobs."

As advice to those students who are still unsure as to what type of career to choose, Kipperman says, "Survey your likes and dislikes. Recognize that your opinions and initial decisions can change in your early years, and don't panic if you don't have your whole life planned by your twentieth birthday. Find a guidance counselor or teacher who takes a sincere interest in you and use him or her to your advantage in planning your post high school future."

AHOVI KPONOU

Ahovi Kponou is a Senior Research Associate in the Alternating Gradient Synchrotron (AGS) Department, which operates the AGS particle accelerator for physics research. Kponou is involved in polarized ion source development (ion sources produce the ions that are injected into the AGS and then accelerated to very high energies for experiments). He also does computer simulation studies of the 200-million-electron-volt linear accelerator and of the ion beam transport lines to and from it.

Kponou had wanted to be a physicist since about the 10th grade. He had his early education in Africa, then studied in the United States to earn bachelor's and doctorate degrees in physics. As an undergraduate, he spent his summers working as a research assistant to get as much exposure to the world of experimental physics. After teaching at the college level for several years in Africa, he returned to the U.S., where he held a series of jobs leading to his present position.

To reenter the U.S. job market, Kponou says he relied heavily on his contacts with faculty advisors and peers from his graduate student days. "Networking is important at this level."

His advice about preparing for a career is to "aim for a college education by taking the appropriate courses in high school and working hard at them. Sample a variety of areas before settling on an area of specialization. It should be something you enjoy doing. Money and glamor should not be the deciding factors."

FRANCES V. LIGON

Frances V. Ligon's interest in public speaking and social welfare led her to her present position as Senior Equal Opportunity Representative in the Office of Equal Opportunity (OEO), which, by law, insures equality for all people in the workplace. Ligon's primary responsibility is to develop and monitor statistical data related to personnel movement, which aids in monitoring BNL's compliance with equality law. Her workload does not end here, however. An important part of her job is to interact with community leaders and organizations, and to coordinate student programs. She also organizes BNL's Career Awareness Day activities.

Having already earned her A.A.S. in secretarial science and her B.S. in general studies, Ligon has begun planning for her master's and Ph.D. degrees. She realizes that by furthering her education, the dream of advancing in her profession will be more readily attained.

Ligon's advice for you as you think about a career is: "What you do **now** will determine your successes **later** ... always do the best at whatever you do ... work for good grades; sometimes the only proof you have of how good you are, are your test scores or someone else's recommendation... Most of all, **aim high, keep yourself focused on what you want to do — go get it!**"

JANAKIRAM R. NAIDU

Janakiram R. Naidu is an Ecologist in the Safety and Environmental Protection Division with a Ph.D. in environmental pollution. Naidu is responsible for environmental monitoring at BNL and for publishing the site annual environmental report. He also does research on the movement and distribution of various pollutants in Long Island's groundwater and the Peconic River, with specific reference to BNL. This work is an integral part of the Laboratory's program to study the impact of its operations on the environment. Naidu also advises M.S. students at SUNY at Stony Brook on ecological issues pertaining to the Peconic River.

Naidu's interest in ecological studies began when he was working on his B.S. in zoology and chemistry, and it grew stronger when he was sent to the United States by the Atomic Energy Commission of India to study radiation effects on aquatic organisms.

An advanced degree, experience in the field of ecology, and being in the right place at the right time made it easy for Naidu to get his first position in the field of environmental studies.

To help students succeed in their career quests, Naidu's suggestions include:

- evaluate your scholastic aptitude and interests very early in school.
- talk to your high school career guidance counselors, and visit universities and colleges.
- read widely on things that interest you.
- discuss your interests and plans with your colleagues and parents.

Remember the movie, Karate Kid: "Balance and Focus."

FRED RODRIGUEZ

As an Assistant Buyer in the Division of Contracts and Procurement, Fred Rodriguez is responsible for purchasing computers, computer peripherals and software at the lowest price available to BNL.

Rodriguez feels that career preparation only starts with high school, and a college education is vital and should be obtained at any cost. Rodriguez studied for a bachelor's degree through the military, where he served for four years as an administrative specialist in the Air Force, and spent another four years as a purchasing agent for the New York Air National Guard. Rodriguez says of the military, "It offers a wide range of career opportunities and helps a person to apply that career in the civilian world."

JOSE A. RODRIGUEZ

Jose A. Rodriguez is an Assistant Chemist in the Chemistry Department. As a member of the department's program on structure and reactivity in catalysis, his research is directed towards looking for relationships between the structure and electronic properties of certain types of metallic surfaces and the behavior of these surfaces as catalysts in chemical reactions.

Rodriguez developed an interest in chemistry in his senior year in high school and majored in it in college, then went on to obtain his Ph.D. in physical chemistry. He set out on this quest, knowing full well the time and effort it takes to prepare for a scientific career.

According to Rodriguez, the job market for chemists is the worst it has been in nearly two decades, but he thinks it will improve in the near future. The chemical industry is very important to society, and so there will always be good jobs for well-trained chemists.

Here is advice from someone who developed a liking for chemistry in high school and then went on to prepare for a career in it: "Choose a career that will make you a better individual. Never sacrifice your humanity for your career. See what you want to do and what society needs. Sometimes it is possible to find a compromise that would make your life easier."

ABASS WESSEN

Abass Wessen is an Electrical Engineer in the Plant Engineering Division. He performs engineering and design work and project coordination on Laboratory projects, including preparation of specifications, installation drawings and estimation of contract costs. Two of his recent projects were serving as Electrical Engineer on the new Science Education Center and as a Project Engineer for the renovation of apartments in the on-site housing area.

When Wessen entered college, his goal was to become a mathematician. He soon realized, however, that by the time he received his B.A. in mathematics there would be very few job openings in this field, and so he switched to electrical engineering in his junior year and graduated with a B.E.E.E. degree.

Wessen believes that by researching prospective employers, one is almost assured success in a job interview. "Try to sell yourself as the best candidate for the position by asking pertinent questions about the organization. Choose a career you will enjoy, but always have an alternate career just in case your main goal is not fulfilled," he advises.

OTTO WHITE

Otto White is the Deputy Head of the Safety and Environmental Protection Division, which oversees BNL's environmental, safety and health programs. He assists in managing the division and directly supervises occupational health and safety services.

While White was majoring in chemistry in college, he worked part-time in the air pollution and industrial hygiene lab. This experience steered him to his present career in occupational and environmental health and safety. He obtained a master's degree in this area, then worked for the U.S. Atomic Energy Commission and the Occupational Safety and Health Administration before coming to BNL. His experiences in all three jobs have been "positive and rewarding."

White's words of advice are: "Find and settle on a career you truly enjoy. Do the best that you can in every instance and in every endeavor. Do not settle for second best. Be prepared for barriers and find solutions to problems."

MITCHELL D. WILLIAMS

An interest in blueprints and the challenge of working with machinery led Mitchell D. Williams to his present position of Technical Specialist in the Accelerator Development Department. He is currently working with the Relativistic Heavy Ion Collider (RHIC) project and with the Superconducting Super Collider (SSC) magnet fabrication group. He is a member of the team building a machine that will accurately move a magnetic field measuring coil through the long dipole magnets that these accelerators will use.

Realizing that he liked working with machinery, Williams took mechanical drawing and a lot of shop classes in high school. After high school, he honed his technical skills by taking more courses in electronics and machine shop. "As a member of a minority group, you have to really stay on top of it. Education and dedication are most important," he says.

REBECCA WILLIAMS

Rebecca Williams works in the Budget Office as a Budget Administrator. Her major responsibilities are the administration and control of an assigned area of the Laboratory budget. Williams is also responsible for the fiscal coordination of high energy physics, nuclear physics and basic energy sciences programs. She reviews, monitors and validates departmental budgets, and prepares related financial reports and analyses for upper management of BNL, the U.S. Department of Energy and other federal agencies.

Williams entered Michigan State University as a business administration major, but subsequently changed her major to art. Her college education was interrupted when she began a family, but she was still able to secure a position as an account clerk because of the accounting classes she had taken. This job helped her realize that her lack of a college degree limited her chances of advancement and promotion. Williams reentered school at the University of Michigan as a business administration major. After retirement, Williams hopes to resume instruction and classes in drawing and painting to start a second career.

Williams advises high school students, "Have confidence in yourself. Without it, one can lose sight of attainable goals. Also, be realistic in setting those goals. Be prepared to listen to counselors, teachers and family. In most cases they are there to support and help you succeed in reaching your goals. However, don't let someone tell you that certain endeavors are not possible. With perseverance and hard work, everything is possible."

BNL EDUCATIONAL PROGRAMS FOR HIGH SCHOOL STUDENTS

Brookhaven National Laboratory has a wide variety of educational programs, several of which are for high school students. These programs are meant to get young people excited about science, to the point that you will think seriously about careers in science and technology. We list some of them below, plus one that is open to students in college. You can find out more about them through your high school or by contacting the Office of Educational Programs at (516)282-3054/4503. (For 6 and 7, contact the Personnel Office at (516)282-2754, and for 8, contact the Office of Equal Opportunity at (516)282-3709.)

Please note that applications for these programs must be submitted through your high school.

1. Northeast Consortium Program.

This program encourages minority junior high school students to go through the Laboratory's sequence of science enrichment programs and then enroll at one of the partner colleges and universities. It is for students in the Northeast. Other partners in the program are Clarkson University, LaGuardia Community College and Bronx Community College, North Shore Community College (Boston, MA) and Monroe Community College (Rochester, NY).

2. Minority High School Summer Apprenticeship Program.

Three four-week sessions for fifteen students each. One week each of physics, chemistry, life science and applied science. The schedule includes classroom work, visits to labs on site and field trips. Students are recommended by their high school science faculty.

3. NIH Biomedical Student Internships.

Eight-week summer research appointments in health sciences at BNL for about ten minority high school students. It is sponsored by the National Institutes of Health (NIH). Participants are selected from those who have previously attended the Minority High School Summer Apprenticeship Program.

4. High School Mini-Semester Program.

Fifteen minority students from Long Island and New York City spend spring break at BNL, where they learn about the Laboratory's programs in environmental science and technology.

5. Community Summer Science Program.

For eleventh and twelfth graders. There are morning lectures on frontier research in science. Some twelfth-grade participants serve as

interns to BNL staffers in the afternoons. The program runs for six weeks.

6. High School Co-op Program

Participants in this program are recommended by designated staff members from local high schools. The program provides meaningful work opportunities for eligible students. Eligibility is based in part on economic need. The program runs from October until May, with students working from 1 to 5 p.m. each school day. Transportation to the Laboratory is provided by the school district.

7. Youth on Campus Program

The Youth on Campus Program is the same as the High School Co-op Program, but runs in July and August. Usually, eligible students in the High School Co-op Program continue in the Youth on Campus Program, and additional students are recruited through the Office of Equal Opportunity. Students provide their own transportation.

8. Science and Engineering Opportunities Program for Minorities and Women

Participants, who are enrolled in college as a first-year student, sophomore or junior, are employed at BNL for 12 weeks during the summer, during which time they gain research experience and on-the-job training under the guidance of the research staff. They work in such fields as chemistry, physics, engineering, biology, nuclear medicine, applied mathematics, accelerator physics and science writing. Area students get first consideration, since the Laboratory does not provide transportation or housing.

STUDENT PROFILES

The following are profiles of a few participants in some of the educational and training programs that BNL sponsors during the summer and year-round. To find out more about these programs, contact the Office of Educational Programs at (516)282-3054/4503, or the Office of Equal Opportunity, (516)282-3709. You can also write to either office at Brookhaven National Laboratory, Upton, New York 11973.

GILES CHARLESTON

Giles Charleston participated in the Science and Engineering Program for Minorities and Women, working in the AGS Department. His main project, in computer programming, was to update the PC version of a well-known computer code used in the design and simulation of proton linear accelerators. Because Charleston is fluent in French from attending high school in Haiti, he was also asked to translate parts of a physics Ph.D. thesis in French into English. Charleston says he found working at BNL very rewarding because he was able to use knowledge that he acquired in the classroom to solve problems he encountered in his work.

Charleston is working on a double major in electrical engineering and computer science at SUNY at Stony Brook.

EVELYN GALLEGO

Evelyn Gallego is studying engineering at Suffolk Community College. She will transfer to Polytechnic University in the spring of 1993, to major in chemical engineering. She participated in the Science & Engineering Opportunities Program for Minorities and Women, working in a group in the Physics Department that is producing thin films to be used in experiments to study percolation theory.

Gallego says that her love for science developed at a very young age.

FRASER FORDE

Fraser Forde graduated in sociology and educational studies from SUNY at Binghamton. He participated in the Science & Engineering Opportunities Program for Minorities and Women and was assigned to the Science Education Center, where he helped with the administration of the summer programs. He hopes to receive his teacher's certification soon and then teach in an elementary school. Forde majored in sociology because he likes to study how people interact in different settings.

TODD FARROW

Todd Farrow is a participant in the National Consortium for Graduate Degrees for Minorities in Engineering (GEM) program, for minority engineering juniors and seniors. He is assigned to the Department of Applied Science, working in the Free-Air Carbon Dioxide Enrichment (FACE) project, which is studying the effects of high levels of carbon dioxide on plants. Farrow has obtained his B.S. degree, majoring in physics, and will enter graduate school to work towards a Ph.D. in physics.

Farrow always had a thirst for knowledge and a curiosity for things scientific, and so his decision to study science was no surprise. He likes physics because it presents challenges and opportunities to understand the world around us and to make it better. Farrow says, "Selecting and preparing for a career should be pursued with self-awareness and enthusiasm...You should choose a path that will bring you happiness and self-fulfillment. Working for anything less is just that — work."

JOSEPH M. TORRES

Joseph M. Torres was in the Science & Engineering Program for Minorities and Women, and served as a summer intern in the Physics Department. In his assignment, he gained valuable hands-on experience related to his field of study in college, electrical engineering. Torres is entering his senior year at City College of the City University of New York. His ambition to become an electrical engineer goes back to his elementary school days. Throughout high school, he worked very hard to develop a solid foundation in mathematics and science, in preparation for his engineering studies. Torres plans to study for master's and Ph.D. degrees in electrical engineering.

As you think about careers, Torres urges you to "speak to career guidance counselors and get as much information as you can about your career choices...consider those options which interest you the most...visit colleges and talk to students and faculty members about your options."

ALEXANDER LAWRENCE

Alexander Lawrence is a participant in the GEM program, and he worked in the Department of Nuclear Energy at BNL. He was involved with the design, maintenance and performance evaluation of gas and diesel generators. Lawrence also did studies of nuclear power plant alarm systems.

After graduating from Drexel University, Lawrence will attend Georgia Tech to pursue a master's degree in electrical engineering. His main course of study will be power engineering as it relates to the electrical power industry.

Lawrence believes that "dedication and perseverance are important traits to a successful career. The math and science you study now provide the foundation for future courses."

CAREERS - A HIGH SCHOOL SENIOR'S PERSPECTIVE

By Becky M. Patterson*
Riverhead High School, '92.

As toddlers, we all had our preconceptions of what we wanted to be "when we grow up." We were never told about the work and commitment that it takes to make our dreams a reality.

If I had known about all the preparation needed for high school and college, to ensure that I would have a job to support my family in the future, I probably would have run off with Peter Pan — never wanting to grow up. So students, listen up, because this one's for you.

Young people should start thinking about the future at an early age. I'm not trying to say that we should give up our childhood, but I believe that we could all benefit from considering our career choices sooner. The future is not just a day, a week, or a few months — it's your whole life.

Choosing a career is like buying a pair of sneakers. If you buy a pair because they're 'cool,' they might not really fit. But if you buy a pair that is comfortable and in a color and style that *you* prefer, they could satisfy you for a while.

Similarly, your career choice must be made for the right reasons. What you choose to do in life must satisfy you and you only. Don't choose a job because your friend will be there, to please Daddy and Mommy, or even for the money and power, unless, of course, that makes you genuinely happy. Your career should involve something that you enjoy doing.

There are many steps to selecting a career. First, one should start by working hard in school. In high school, do well and stay active. Colleges not only love brains, they love well-rounded students who can maintain good grades while also staying involved. Of course, if you're a student who can only handle one or the other, **your education should come first – Always!** A prospective employer would rather read a resume that lists four years of math courses, instead of four years on a varsity football team.

The next course of action is selecting a college, one known for its academic standards, not for its outrageous keg parties. So many of our generation are led to believe that they are missing out on life by going to college. They think, "Well, I've already wasted 12 years of my life in school; it's time I started livin' it up." In these times, you cannot "live it up" with only a high school diploma.

The bottom line is, get a solid educational background. And when selecting your career, remember, it's better to have a comfortable

pair of sneakers and walk tall, than to suffer from blisters wearing a 'cool' pair. Most important, start preparing for your career early in life. Find out which educational tools you need for your particular career choice. If you are undecided, then remain open and flexible with the courses that you choose to take.

For example, I would like to become a writer, but I've always loved math. I will continue balancing my writing courses with my math courses. In case one doesn't work out, I'll have something to fall back on.

And speaking of math, here's a simple equation that anyone can handle:

$$\begin{array}{l} \text{a well-rounded student} \\ + \text{ a solid education} \\ + \text{ planning} \\ \hline = \text{ a career with security, self-fulfillment, happiness and } \$ \$ \$ \$ \text{ !!!!} \end{array}$$

*Becky Patterson spent two summers at Brookhaven in the Youth On Campus Program, helping produce of the first two issues of the Career Awareness Brochure. We asked her to put down her thoughts on careers before she headed for Spellman College in Atlanta, Georgia, to begin her college education.

RESOURCE MATERIALS ON CAREERS

Brownstone, Douglass L. and Sene R. Hawes. The Outdoor Careers Guide. New York: Facts on File Publications, 1986.

Dorgon, Charity Anne and Kathleen M. Savage, eds. Professional Careers Source Book. Detroit: Sale Research, Inc.

Feigen, Roberta and Carolyn Males. Life After High School. New York: Julian Messner, 1986.

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Lobb, Charlotte. Explosive Apprenticeship Careers. New York: Richards Rosen Press, Inc., 1978.

Mitchell, Joyce Slayton. The Work Book - A Guide to Skilled Jobs. New York: Sterling Publishing Co., Inc., 1978.

Nadler, Burton Jay. Liberal Arts Jobs. Princeton: Peterson Guides, 1986.

Winkler, Connie. Careers in High Technology. New York: Prentice Hall, 1987.

U.S. Department of Labor and Bureau of Labor Statistics. Occupational Outlook Handbook. Published quarterly.
[For each job classification, this reference gives information on the nature of work, working conditions, employment statistics, training, qualifications, and advancement, job outlook, earnings, related occupations and sources of additional information.]

For more information on BNL's educational programs, please refer to: Educational Programs at Brookhaven National Laboratory, BNL 52216.

Credits

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Once again, Becky Patterson, now a freshman at Spellman College, Atlanta, provided valuable editorial and secretarial assistance while serving as a Summer Intern at the Laboratory. Thanks also to Celesta Blanch for providing clerical support while participating in the High School Co-op program.

The information in the tables under CHOOSING A CAREER was reproduced from *Life After High School* (see RESOURCE MATERIALS ON CAREERS in this brochure), with the permission of the publishers, Simon & Schuster, New York.

We relied heavily on the *Occupational Outlook Handbook* (see RESOURCE MATERIALS ON CAREERS in this brochure) for the material in the section on CAREER OPTIONS.

Sincere thanks to those who agreed to be profiled and offered words of advice and encouragement to the youth of today.

Notes

An aerial view of Brookhaven National Laboratory.

END

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