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ABSTRACT

The Science Careers Program consists of 12 activities aimed at increasing the career relevance of science education for all students in grades 4 through 9, while at the same time particularly encouraging female and minority students to consider careers in science and engineering. This set of resource materials is available to help teachers in preparing to use these activities. The materials are presented in six sections: (1) program objectives; (2) various materials on sex, race, and handicap role stereotyping, including aids for detecting stereotyping; (3) a compilation of facts about women and minorities in the labor force; (4) a compendium of information about famous women and minority scientists, a list of these scientists keyed to science curriculum topics, and sample ideas for using posters about scientists; (5) career and employment information, a list of definitions of science/engineering careers, and a discussion of the participation of women and minorities in science (with consideration of their attitudes and performance as youngsters, educational and employment patterns); and (6) a description of ways students and teachers can learn more about science engineering careers (including guidelines for classroom visits by scientists). An extensive annotated bibliography of print and audiovisual materials is included. (JN)

EXPLORING CAREERS IN SCIENCE AND ENGINEERING

Resource Materials for Teachers

Second Edition

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Dr. Iris R. Weiss, Project Director

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1. OBJECTIVES

OBJECTIVES OF THE SCIENCE CAREERS PROGRAM

I. Women and Minorities in the Labor Force

One purpose of the Science Careers Program is to describe the current status of women and minorities in the labor force in general and in the science labor force in particular.

OBJECTIVES:

As a result of this program, students and teachers will:

1. Realize that most women work at some point in their lives, and that most of these women work because of pressing economic need.
2. Realize that women and minority workers tend to be concentrated in low paying dead-end jobs even though they have the same amount of education as other workers; be aware that salaries in traditionally male careers such as science are relatively high.
3. Be aware that while the numbers of women and minorities in science and technology are relatively low, the trend is for increased numbers to enter these fields.

II. Knowledge of Science Careers

A second purpose of the Science Careers Program is to illustrate that there are a diversity of science and technology careers available; that these require different levels of training and education, and different kinds of skills and interests; and that the ability to be a successful scientist is not restricted by sex, race, or many handicapping conditions.

OBJECTIVES:

As a result of this program, students and teachers will:

1. Be aware of the types of work done in each of a number of science and technology fields.
2. Recognize that the traditional stereotyped image of science and scientists does not reflect the diversity of modern science careers.
3. Realize that science careers are appropriate pursuits for women, minority, and handicapped persons and that these groups bring helpful perspectives to the solution of important problems.
4. Be aware that women, minority, and handicapped scientists have made important contributions to science.
5. Realize the importance of considering employment outlook in making career decisions; be aware of the current job outlook for a number of fields.

6. Be able to name a number of companies in their local area which employ scientists, and the types of scientists they employ.

7. Realize that one does not have to be a genius to succeed in a science career.

8. Realize the importance of adequate high school preparation in mathematics and science for future careers.

9. Be able to identify and use a number of resources, such as the Occupational Outlook Handbook, to learn more about science and technology careers.

III. Overcoming Barriers to the Participation of Women and Minorities in Science Careers

A third purpose of the Science Careers Program is to illustrate that many of the barriers to the participation of women and minorities in science and technology careers can be, and are being, overcome. Special attention will be given to illustrating the ways in which role stereotyping by parents, peers, teachers, and educational materials tend to limit female and minority students' career aspirations.

OBJECTIVES:

As a result of this program, students and teachers will:

1. Be able to detect sexist and racist language as well as role stereotyping by parents, peers, teachers and educational materials.

2. Be able to recognize that one should not restrict persons to roles based on race or sex.

3. Realize that a successful career and a full personal life are not incompatible; be aware of ways to combine career and family responsibilities.

4. Demonstrate interest in pursuing a science career or getting additional information about science careers.

2. SEX, RACE AND HANDICAP ROLE STEREOTYPING

   a. Women's Lib Comes to Class
   b. How to Tell if a Textbook is Biased
   c. Racism in the English Language
   d. 10 Quick Ways to Analyze Children's Books for Racism and Sexism
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WOMEN'S LIB COMES TO CLASS

By BETTY MILES

Bringing the Women's Liberation Movement into the elementary classroom doesn't mean pitting the girls against the boys, or teaching the girls to make militant speeches, or sending them home to put down their mothers.

It does mean adding some important goals to a teacher's expectations for all her children: freeing up stereotyped norms about how girls behave and boys behave; presenting a wider range of options to both girls and boys; and encouraging girls, as well as boys, to aim high—to go as far with their lives as they can go.

Isn't elementary school too soon for this? We are beginning to learn that it's already late. Sociologist Cynthia Epstein points out that role discrimination starts in the cradle, where boys and girls begin receiving messages about their future roles. It continues in the way toddlers are dressed, turns into the way nursery school children are "streamed" to block play or dishwashing, and is reinforced each time an elementary school teacher says, "Good morning, boys and girls."

A sexist remark? Of course not, but the message of difference is there. Consider how shocked we would feel if the same teacher were to say, "Good morning, white children and black children."

The fact is that a lot of matter-of-fact sex stereotyping is done by well-meaning teachers unaware of the thoughtless, incessant, and ultimately demeaning ways in which they limit the aspirations of girls and make inappropriate demands on boys.

"Teachers cannot avoid responding to their students' sex as part of their personality," comments Dr. Terry Borton of the Affective Education Development Program in Philadelphia. "The trouble is—and Women's Lib has made me increasingly aware of this—we tend to respond to little boys, and especially little girls, with a view of sex so narrow that it is a caricature."

A composite picture of a typical elementary school reveals this narrow view.

You may be genuinely surprised at the number of single-sex subgroups in all the classrooms. Children work at their desks, move around the room, go to the library, the nurse, the playground, and the cafeteria in the same unmixed groups. It's easy to say, "The children like it that way." But educators are suggesting that *teachers* who like it that way—or just haven't thought about any other way—foster the subtle norms of sex distinction which keep children fixed into rigid role behavior.

Examine a typical chart of boys' and girls' jobs in one of these classrooms. The boys are to set up the science corner, put away tools, care for the projector, while the girls wipe tables, fill paint jars, and scrub out sinks.

"I divided the jobs," the teacher says, "because we get through cleanup faster when the boys compete with the girls."

So the children learn to accept inter-sex rivalry and to define the most ordinary tasks according to sex: boys manage equipment, girls clean up. A bulletin-board displays pictures extending these distinctions to the adult world of work; there are photographs of the male as astronaut, mechanic, zoologist, and mayor, but the one picture of a female is Mother fixing dinner.

A second-grade teacher and her class have been coauthoring a story about "Men Who Help Us." They've included the fireman, the policeman, the store man, the mailman. *Women* who help us? They've overlooked the school doctor, the crossing guard, and —ironically—the teacher herself. It's not surprising that little girls in this typical room, asked to imagine the future, don't get beyond "When I grow up, I hope I will have four children—two boys and two girls" or "I want to be a plain housewife and take care of my family."

The books from which little girls and boys learn to read only reinforce such restrictive stereotypes. A recent survey * of 15 major American reading series found that these textbooks present a painfully negative image of girls and women to the children who pore over their words and pictures. Seventy-five per cent of the surveyed stories feature male heroes: the girls who appear are frequently pictured as silly and ineffective ("See funny Sally") and often physically smaller than the boys they watch admiringly.

No primer story shows girls enjoying chemistry sets or hammers, or women working as politicians, engineers, or explorers. Nearly 70 per cent of the women in these books were simply Mommy keeping house, while men worked at more than a hundred interesting occupations, from astronaut to zoo keeper. It is not surprising that in the reading series surveyed, there were 131 biographies of famous men and only 23 biographies of women—some of them famous only as wives. Children who learn to read from readers are learning that girls and women are less important than boys and men. It is not easy for a teacher to counteract such pervasive lessons.

Independent readers will find the same stereotypes in their library books. Boys grow up to have adventures; girls grow up to marry the boys. Few books in the school library would inspire a girl to dream of changing the world. It's a rare school librarian who considers these points when the new book catalogs come around, and so girls readily "learn their place" from the world of print supplied them.

In our composite school—every example of which is taken from life—only boys are chosen to be monitors, the most prized job. Girls are allowed to be school hostesses who make hot chocolate for the monitors on cold mornings. The boys learn responsibility, while the girls learn affability and second-class status.

Throughout the school day, these children hear what is *nice* for a girl or *right* for a boy.

"Girls, how will you ever cook for your husbands if you can't work with fractions?"

"Mr. Johnson says he'll teach any sixth-grade boy how to use the audio-visual equipment."

"Since we've elected all boys so far, couldn't someone nominate a girl for class secretary?"

Even music has sex distinctions. A girl who asked to learn the drums was routinely discouraged by the music teacher: "The flute is so much nicer for a girl, don't you think?"

What is it in the elementary classroom that has forced girls down?" asks Charlotte Winsor, Distinguished Teacher Education Specialist, Emeritus, of Bank Street College of Education. "It's been the teacher." But she notes, that teacher education—and teachers —are changing."

Students in today's graduate schools are being exposed to new ideas about sex roles, work, and the family. Conferences and workshops on Women's Liberation and education have been held across the country. Women in professional organizations, like the American Psychological Association, are pressing for research on sex stereotypes in education. Mothers and teachers

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* "Sex Stereotypes in School Readers." Women on Words and Images, 25 Cleveland Lane, P.O. #4, Princeton, NJ 08540.

are asking toy companies for educational toys to be used by both sexes. Parents are challenging school systems to offer equal opportunities to their daughters and their sons. School superintendents, like Dr. W. Scott Westerman, Jr., of Ann Arbor, call for attention to the needs of girls in school. A group called Feminists on Children's Media campaigns for unstereotyped books and textbooks for all school children. In Sweden, textbooks now picture mothers and fathers interchangeably working and caring for children. Two New York fathers are currently suing for "maternity" leave to care for young children while their teacher-wives continue their careers.

And in individual classrooms, aware teachers present new options.

"A man who chooses to spend his working day with young children is helping to alter their conceptions of sex roles, and offering new alternatives," says John Hill, a kindergarten teacher in Springfield, Ohio. "I have begun to make conscious efforts to counter stereotypes. When girls begin to participate in building with blocks, or boys decide to play house or make dinner for me, I try to encourage them. I strive not to pick children to help with jobs according to their sex."

"I make a point of teaching my girls softball," says Dorothy Seig, a third-grade teacher in Mill Valley, California. "Girls can feel so dumb all their lives, not knowing how to hit a ball—I know because I was once so bad myself!"

"I hadn't thought about the relation of Women's Lib to my own class," Mrs. Seig reports, "until someone made a crack about women during a news period. Then I realized how important everyday attitudes are. So when we had a unit on treatment of minorities—Indians, Chicanos, blacks—I raised the issue of women as well."

Karen Daley, a second-grade teacher in Ann Arbor, asked girls and boys to sit together to exchange help with math and reading. There was some resistance, but now the children like the arrangement. There is more informal discussion between girls and boys, and the-boys-against-the-girls competition has dropped off sharply.

A group of teachers, educational researchers, and graduate students met recently in Ann Arbor to invent easy ways to "liberate" any classroom. Here are some of their suggestions:

- Everyone likes to eat. Let's teach everyone to cook.
- Encourage girls to use manipulative materials like electric sockets and cords, screwdrivers and hammers. Make sewing machines available to boys as well as girls.
- Look for books with strong heroines and for superior biographies of women. Collect newspaper stories about women. Display pictures of working women.
- Teach boys and girls inter-sex sports, like volleyball, early.
- Invite mothers and women friends with special skills to visit your class.
- Teach girls as well as boys to help with audio-visual equipment. Choose boys and girls as library aides
- Write your own math problems. "Ann's mother needed six feet of lumber to make a bookshelf . . ." "Bill and John were cooking spaghetti for four friends. They bought . . ."
- Encourage children to make their own studies of sex stereotypes on television, in magazines, and in books.
- Learn about the history of women in America. If you are a woman, be aware that you are an important role model for your class. If you have a family, talk about it. If your husband shares the housework, mention it. If you experience discrimination, discuss it. If you are good at carpentry or baseball or car repair, demonstrate it! □

A Bibliography on Women's Status. *Confrontation*, Newsletter of the Lemberg Center for the Study of Violence (April, 1971). Brandeis University, Waltham, MA 02154. 75¢

A List of Articles on Sexism in Children's Books. Feminists on Children's Media, P.O. Box 4315, Grand Central Station, NY, NY 10017. Send a stamped, self-addressed envelope.

"Little Miss Muffet Fights Back." A pamphlet recommending non-sexist books about girls for young readers. Feminists on Children's Media (address above). Enclose 50¢ in coin and a self-addressed, stamped (16¢) legal-size envelope.

"Report on Sex Bias in the Public Schools" (1971). New York Chapter, National Organization for Women, c/o Anne West, 453 7th St., Brooklyn, NY 11215. $1.25.

Chapter Information—to find a chapter near you, or to learn how to start a chapter, write National Organization for Women, 1957 East 73rd St., Chicago, IL 60649.

A CHAUVINISTIC INDEX FOR EDUCATORS

PART I—Short Answers
Directions: Answer the following YES or NO according to the way you behave if you are a teacher, or according to the teacher behavior you condone if you are an administrator

	Yes	No
1. Do you generally ask boys to do heavy work and perform executive duties in the classroom, and girls to do light work and secretarial chores?	☐	☐
2 a Do you pity girls who are unable or unwilling to be fashionable, or call special attention to those who are fashionable?	☐	☐
b Do you pity boys who are unable or unwilling to be athletic or call special attention to those who are athletic?	☐	☐
3 Do you *react* negatively to boys who have long hair or to girls who wear slacks?	☐	☐
4. Do you plan different activities, or different adaptations of the same activity, for boys and for girls?	☐	☐
5. Do your lessons include more exciting role models for boys than for girls? (Do you stereotype women as housewives, mothers, or workers in menial or supportive positions?)	☐	☐
6. Do you use slang terms such as *sissy, fag, tomboy, chick*, etc.?	☐	☐
7. Do you say, "Boys shouldn't hit girls," "Ladies before gentlemen," "Ladies don't talk that way"?	☐	☐
8. Do you expect girls to be more verbal and artistic than boys, or boys to be more mathematical and scientific than girls?	☐	☐
9. Do you feel it is more important to help boys sort out career options than it is to help girls?	☐	☐
10. Do you tend to discipline girls verbally and leniently, but boys physically and strictly?	☐	☐

PART II—Essay Question
They may act exactly the same way, but they are called *absent-minded* if they are men, *scatterbrained* if they are women; *intellectually curious* if they are men, *nosy* if they are women; *planners* if they are men, *schemers* if they are women; *sensitive* if they are men, *emotional* if they are women, *logical* if they are men, *intuitive* if they are women.

Directions: 1. Respond logically to the above statement
2. Now respond intuitively.

SCORING: PART I—Give yourself 5 points for each NO. PART II—Give yourself 45 points for good logic in the essay, and zero for intuition. THIS IS NOT TO BE MARKED ON A CURVE! If you score below 80, meet with your colleagues to plan your own consciousness-raising group.

HOW TO TELL IF A TEXTBOOK IS BIASED

		YES	NO	NA
1.	Are most of the "people" illustrations of boys or men?	___	___	___
2.	Are most of the "people" illustrations of persons who are European or Euroamerican?	___	___	___
3.	Are men/boys in illustrations and exercises generally portrayed as <u>active</u>, that is, as doers, thinkers, leaders, problem-solvers, decision-makers, and women/girls as <u>passive</u>, that is, as watchers or standers-by?	___	___	___
4.	Are men generally portrayed in traditional male careers and women in traditional female careers or roles?	___	___	___
5.	In the portrayals of non-Euroamericans, are they generally in passive roles, i.e., watching rather than doing, non-contributive in the situation, having problems but not solving them, etc.?	___	___	___
6.	Are persons of ethnic or racial groups stereotyped in any way (i.e., American Indians as "primitive," feathered characters, Asian Americans as laundry or restaurant workers, Black Americans as athletes or slaves, Hispanics as rancheros or siesta-takers, etc.)?	___	___	___
7.	Does the book exclude characters who are physically disabled, obese, "homely," etc.? If portrayed, are they generally inactive, dependent, non-productive?	___	___	___
8.	Are the elderly generally ignored? If portrayed, are they inactive, incompetent, quaint, evil, or foolish?	___	___	___
9.	In the "history of..." section, are women's contributions generally ignored or mentioned only in token ways?	___	___	___

IF ONE OR MORE OF THE ABOVE QUESTIONS CAN BE ANSWERED WITH A "YES," THE BOOK IS PROBABLY BIASED IN THAT RESPECT AND SHOULD BE SUPPLEMENTED IN SOME WAY TO BALANCE THE CURRICULUM.

Developed by Ruth A. Gudinas, Department of Human Relations, Madison Metropolitan School District, Madison, Wisconsin. Reprinted with permission.

Racism in the English Language

Obvious Bigotry

Perhaps the most obvious aspect of racism in language would be terms like "nigger," "spook," "chink," "spic," etc. While these may be facing increasing social disdain, they certainly are not dead. Large numbers of white Americans continue to utilize these terms. "Chink," "gook," and "slant-eyes" were in common usage among U.S. troops in Vietnam. An NBC nightly news broadcast, in February 1972, reported that the basketball team in Pekin, Illinois, was called the "Pekin Chinks" and noted that even though this had been protested by Chinese Americans, the term continued to be used because it was easy, and meant no harm. Spiro Agnew's widely reported "fat Jap" remark and the "little Jap" comment of lawyer John Wilson, during the Watergate hearings, are surface indicators of a deep-rooted Archie Bunkerism.

Many white people continue to refer to Black people as "colored," as for instance in a July 30, 1975 *Boston Globe* article on a racist attack by whites on a group of Black people using a public beach in Boston. One white person was quoted as follows:

> We've always welcomed good colored people to South Boston but we will not tolerate radical blacks or Communists. . . . Good colored people are welcome in South Boston, black militants are not.

Many white people may still be unaware of the disdain many African Americans have for the term "colored," but it often appears that whether used intentionally or unintentionally, "colored" people are "good" and "know their place," while "Black" people are perceived as "uppity" and "threatening" to many whites. Similarly, the term "boy" to refer to African American men is now acknowledged to be a demeaning term, though still in common use. Other terms such as "the pot calling the kettle black" and "calling a spade a spade" have negative racial connotations but are still frequently used, as for example when President Ford was quoted in February 1976 saying that even though Daniel Moynihan had left the U.N., the U.S. would continue "calling a spade a spade."

Excerpted from Moore, Robert Racism in the English Language, 1976, Council on Interracial Books for Children. Reprinted by permission.

Color Symbolism

The symbolism of white as positive and black as negative is pervasive in our culture, with the black / white words used in the beginning of this essay only one of many aspects. "Good guys" wear white hats and ride white horses, "bad guys" wear black hats and ride black horses. Angels are white, and devils are black. The definition of *black* includes "without any moral light or goodness, evil, wicked, indicating disgrace, sinful," while that of *white* includes "morally pure, spotless, innocent, free from evil intent."

A children's TV cartoon program, *Captain Scarlet*, is about an organization called Spectrum, whose purpose is to save the world from an evil extra-terrestrial force called the Mysterons. Everyone in Spectrum has a color name—Captain Scarlet, Captain Blue, etc. The one Spectrum agent who has been mysteriously taken over by the Mysterons and works to advance their evil aims is Captain Black. The person who heads Spectrum, the good organization out to defend the world, is Colonel White.

Three of the dictionary definitions of white are "fairness of complexion, purity, innocence." These definitions affect the standards of beauty in our culture, in which whiteness represents the norm. "Blondes have more fun" and "Wouldn't you really rather be a blonde" are sexist in their attitudes toward women generally, but are racist white standards when applied to third world women. A 1971 *Mademoiselle* advertisement pictured a curly-headed, ivory-skinned woman over the caption, "When you go blonde go all the way," and asked: "Isn't this how, in the back of your mind, you always wanted to look? All wide-eyed and silky blonde down to there, and innocent?" Whatever the advertising people meant by this particular woman's innocence, one must remember that "innocent" is one of the definitions of the word white. This standard of beauty when preached to all women is racist. The statement "Isn't this how, in the back of your mind, you always wanted to look?" either ignores third world women or assumes they long to be white.

Time magazine in its coverage of the Wimbledon tennis competition between the black Australian Evonne Goolagong and the white American Chris Evert described Ms. Goolagong as "the dusky daughter of an Australian sheep-shearer," while Ms. Evert was "a fair young girl from the middle-class groves of Florida." *Dusky* is a synonym of "black" and is defined as "having dark skin; of a dark color; gloomy; dark; swarthy." Its antonyms are "fair" and "blonde." *Fair* is defined in part as "free from blemish, imperfection, or anything that impairs the appearance, quality, or character; pleasing in appearance, attractive; clean; pretty; comely." By defining Evonne Goolagong as "dusky," *Time* technically defined her as the opposite of "pleasing in appearance; attractive; clean; pretty; comely."

The studies of Kenneth B. Clark, Mary Ellen Goodman, Judith Porter and others indicate that this pervasive "rightness of whiteness" in U.S. culture affects children before the age of four, providing white youngsters with a false sense of superiority and encouraging self-hatred among third world youngsters.

Ethnocentrism or From a White Perspective

Some words and phrases that are commonly used represent particular perspectives and frames of reference, and these often distort the understanding of the reader or listener. David R. Burgest[3] has written about the effect of using the terms "slave" or "master." He argues that the psychological impact of the statement referring to "the master raped his slave" is different from the impact of the same statement substituting the words: "the white captor raped an African woman held in captivity."

> Implicit in the English usage of the "master-slave" concept is ownership of the "slave" by the "master," therefore, the "master" is merely abusing his property (slave). In reality, the captives (slave) were African individuals with human worth, right and dignity and the term "slave" denounces that human quality thereby making the mass rape of African women by white captors more acceptable in the minds of people and setting a mental frame of reference for legitimizing the atrocities perpetuated against African people.

The term slave connotes a less than human quality and turns the captive person into a thing. For example, two McGraw-Hill Far Eastern Publishers textbooks (1970) stated, "At first it was the slaves who worked the cane and they got only food for it. Now men work cane and get money." Next time you write about slavery or read about it, try transposing all "slaves" into "African people held in captivity," "Black people forced to work for no pay" or "African people stolen from their families and societies." While it is more cumbersome, such phrasing conveys a different meaning.

Passive Tense

Another means by which language shapes our perspective has been noted by Thomas Greenfield,[4] who writes that the achievements of Black people—and Black people themselves—have been hidden in

> the linguistic ghetto of the passive voice, the subordinate clause, and the 'understood' subject. The seemingly innocuous distinction (between active/passive voice) holds enormous implications for writers and speakers. When it is effectively applied, the rhetorical impact of the passive voice—the art of making the creator or instigator of action totally disappear from a reader's perception—can be devastating.

For instance, some history texts will discuss how European immigrants came to the United States seeking a better life and expanded opportunities, but will note that "slaves *were brought* to America." Not only does this omit the destruction of African societies and families, but it ignores the role of northern merchants and southern slaveholders in the profitable trade in human beings. Other books will state that "the continental railroad *was built*," conveniently omitting information about the Chinese laborers who built much of it or the oppression they suffered

Politics and Terminology

"Culturally deprived," "economically disadvantaged" and "underdeveloped" are other terms which mislead and distort our awareness of reality. The application of the term "culturally deprived" to third world children in this society reflects a value judgment. It assumes that the dominant whites are cultured and all others without culture. In fact, third world children generally are bicultural, and many are bilingual, having grown up in their own culture as well as absorbing the dominant culture. In many ways, they are equipped with skills and experiences which white youth have been deprived of, since most white youth develop in a monocultural, monolingual environment. Burgest[5] suggests that the term "culturally deprived" be replaced by "culturally dispossessed," and that the term "economically disadvantaged" be replaced by "economically exploited." Both these terms present a perspective and implication that provide an entirely different frame of reference as to the reality of the third world experience in U.S. society.

Terms such as "culturally deprived," "economically disadvantaged" and "underdeveloped" place the responsibility for their own conditions on those being so described. This is known as "Blaming the Victim."[6] It places responsibility for poverty on the victims of poverty. It removes the blame from those in power who benefit from, and continue to permit, poverty.

Still another example involves the use of "non-white," "minority" or "third world." While people of color are a minority in the U.S., they are part of the vast majority of the world's population, in which white people are a distinct minority. Thus, by utilizing the term minority to describe people of color in the U.S., we can lose sight of the global majority / minority reality—a fact of some importance in the increasing and interconnected struggles of people of color inside and outside the U.S.

To describe people of color as "non-white" is to use whiteness as the standard and norm against which to measure all others. Use of the term "third world" to describe all people of color overcomes the inherent bias of "minority" and "non-white." Moreover, it connects the struggles of third world people in the U.S. with the freedom struggles around the globe.

"Loaded" Words and Native Americans

Many words lead to a demeaning characterization of groups of people. For instance, Columbus, it is said, "discovered" America. The word *discover* is

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defined as "to gain sight or knowledge of something previously unseen or unknown; to discover may be to find some existent thing that was previously unknown." Thus, a continent inhabited by millions of human beings cannot be "discovered." For history books to continue this usage represents a Eurocentric (white European) perspective on world history and ignores the existence of, and the perspective of, Native Americans: "Discovery," as used in the Euro-American context, implies the right to take what one finds, ignoring the rights of those who already inhabit or own the "discovered" thing.

Eurocentrism is also apparent in the usage of "victory" and "massacre" to describe the battles between Native Americans and whites. *Victory* is defined in the dictionary as "a success or triumph over an enemy in battle or war; the decisive defeat of an opponent." *Conquest* denotes the "taking over of control by the victor, and the obedience of the conquered." *Massacre* is defined as "the unnecessary, indiscriminate killing of a number of human beings, as in barbarous warfare or persecution, or for revenge or plunder." *Defend* is described as "to ward off attack from; guard against assault or injury; to strive to keep safe by resisting attack."

Eurocentrism turns these definitions around to serve the purpose of distorting history and justifying Euro-American conquest of the Native American homelands. Euro-Americans are not described in history books as invading Native American lands, but rather as defending their homes against "Indian" attacks. Since European communities were constantly encroaching on land already occupied, then a more honest interpretation would state that it was the Native Americans who were "warding off," "guarding" and "defending" their homelands.

Native American victories are invariably defined as "massacres," while the indiscriminate killing, extermination and plunder of Native American nations by Euro-Americans is defined as "victory." Distortion of history by the choice of "loaded" words used to describe historical events is a common racist practice. Rather than portraying Native Americans as human beings in highly defined and complex societies, cultures and civilizations, history books use such adjectives as "savages," "beasts," "primitive," and "backward." Native people are referred to as "squaw," "brave," or "papoose" instead of "woman," "man," or "baby."

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"Loaded" Words and Africans

Conflicts among diverse peoples within African nations are often referred to as "tribal warfare," while conflicts among the diverse peoples within European countries are never described in such terms. If the rivalries between the Ibo and the Hausa and Yoruba in Nigeria are described as "tribal," why not the rivalries between Serbs and Slavs in Yugoslavia, or Scots and English in Great Britain, Protestants and Catholics in Ireland, or the Basques and the Southern Spaniards in Spain? Conflicts among African peoples in a particular nation have religious, cultural, economic and/or political roots. If we can analyze the roots of conflicts among European peoples in terms other than "tribal warfare," certainly we can do the same with African peoples, including correct reference to the ethnic groups or nations involved. For example, the terms "Kaffirs," "Hottentot" or "Bushmen" are names imposed by white Europeans. The correct names are always those by which a people refer to themselves, (In these instances Xhosa, Khoi-Khoin and San are correct.[9])

The generalized application of "tribal" in reference to Africans—as well as the failure to acknowledge the religious, cultural and social diversity of African peoples—is a decidedly racist dynamic. It is part of the process whereby Euro-Americans justify, or avoid confronting, their oppression of third world peoples. Africa has been particularly insulted by this dynamic, as witness the pervasive "darkest Africa" image. This image, widespread in Western culture, evokes an Africa covered by jungles and inhabited by "uncivilized," "cannibalistic," "pagan," "savage" peoples. This "darkest Africa" image avoids the geographical reality. Less than 20 per cent of the African continent is wooded savanna, for example. The image also ignores the history of African cultures and civilizations. Ample evidence suggests this distortion of reality was developed as a convenient rationale for the European and American slave trade. The Western powers, rather than exploiting, were civilizing and christianizing "uncivilized" and "pagan savages" (so the rationalization went). This dynamic also served to justify Western colonialism. From Tarzan movies to racist children's books like *Doctor Dolittle* and *Charlie and the Chocolate Factory*, the image of "savage" Africa and the myth of "the white man's burden" has been perpetuated in Western culture.

A 1972 *Time* magazine editorial lamenting the demise of *Life* magazine, stated that the "lavishness" of *Life's* enterprises included "organizing safaris into darkest Africa." The same year, the *New York Times'* C.L. Sulzberger wrote that Africa has "a history as dark as the skins of many of its people." Terms such as "darkest Africa," "primitive," "tribe" ("tribal") or "jungle," in reference to Africa, perpetuate myths and are especially inexcusable in such large circulation publications.

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Qualifying Adjectives

Words that would normally have positive connotations can have entirely different meanings when used in a racial context. For example, C. L. Sulzberger, the columnist of the *New York Times*, wrote in January 1975, about conversations he had with two people in Namibia. One was the white South African administrator of the country and the other a member of SWAPO, the Namibian liberation movement. The first is described as "Dirk Mudge, who as senior elected member of the administration is a kind of acting Prime Minister. . . ." But the second person is introduced as "Daniel Tjongarero, an intelligent Herero tribesman who is a member of SWAPO. . . ." What need was there for Sulzberger to state that Daniel Tjongarero is "intelligent"? Why not also state that Dirk Mudge was "intelligent"—or do we assume he wasn't?

A similar example from a 1968 *New York Times* article reporting on an address by Lyndon Johnson stated, "The President spoke to the well-dressed Negro officials and their wives." In what similar circumstances can one imagine a reporter finding it necessary to note that an audience of white government officials was "well-dressed"?

Still another word often used in a racist context is "qualified." In the 1960's white Americans often questioned whether Black people were "qualified" to hold public office, a question that was never raised (until too late) about white officials like Wallace, Maddox, Nixon, Agnew, Mitchell, et al. The question of qualifications has been raised even more frequently in recent years as white people question whether Black people are "qualified" to be hired for positions in industry and educational institutions. "We're looking for a qualified Black" has been heard again and again as institutions are confronted with affirmative action goals. Why stipulate that Blacks must be "qualified," when for others it is taken for granted that applicants must be "qualified."

Speaking English

Finally, the depiction in movies and children's books of third world people speaking English is often itself racist. Children's books about Puerto Ricans or Chicanos often connect poverty with a failure to speak English or to speak it well, thus blaming the victim and ignoring the racism which affects third world people regardless of their proficiency in English. Asian characters speak a stilted English ("Honorable so and so" or "Confucius say") or have a speech impediment ("rots or ruck," "velly solly," "flied lice"). Native American characters speak another variation of stilted English ("Boy not hide. Indian take boy.") repeat certain Hollywood-Indian phrases ("Heap big" and "Many moons") or simply grunt out "Ugh" or "How." The repeated use of these language characterizations functions to make third world people seem less intelligent and less capable than the English-speaking white characters.

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10 Quick Ways To Analyze Children's Books For Racism And Sexism

The Council on Interracial Books for Children
1841 Broadway, New York, New York 10023

Both in school and out, young children are exposed to racist and sexist attitudes. These attitudes—expressed over and over in books and in other media—gradually distort their perceptions until stereotypes and myths about minorities and women are accepted as reality. It is difficult for a librarian or teacher to convince children to question society's attitudes. But if a child can be shown how to detect racism and sexism in a book, the child can proceed to transfer the perception to wider areas. The following ten guidelines are offered as a starting point in evaluating children's books from this perspective.

1. CHECK THE ILLUSTRATIONS

Look for Stereotypes. A stereotype is an oversimplified generalization about a particular group, race or sex, which usually carries derogatory implications. Some infamous (overt) stereotypes of Blacks are the happy-go-lucky, watermelon-eating Sambo and the fat, eye-rolling "mammy"; of Chicanos, the sombrero-wearing peon or fiesta-loving, macho bandito; of Asian Americans, the inscrutable, slant-eyed "Oriental"; of Native Americans, the naked savage or "primitive brave" and his "squaw"; of Puerto Ricans, the switchblade-toting teenage gang member; of women, the completely domesticated mother, the demure, doll-loving little girl or the wicked stepmother. While you may not always find stereotypes in the blatant forms described, look for variations which in any way demean or ridicule characters because of their race or sex.

Look for Tokenism. If there are racial minority characters in the illustrations, do they look just like whites except for being tinted or colored in? Do all minority faces look stereotypically alike, or are they depicted as genuine individuals with distinctive features?

Who's Doing What? Do the illustrations depict minorities in subservient and passive roles or in leadership and action roles? Are males the active "doers" and females the inactive observers?

2. CHECK THE STORY LINE

Liberation movements have led publishers to weed out many insulting passages, particularly from stories with Black themes and from books depicting female

characters; however, racist and sexist attitudes still find expression in less obvious ways. The following checklist suggests some of the subtle (covert) forms of bias to watch for.

Standard for Success. Does it take "white" behavior standards for a minority person to "get ahead"? Is "making it" in the dominant white society projected as the only ideal? To gain acceptance and approval, do persons of color have to exhibit extraordinary qualities—excel in sports, get A's, etc? In friendships between white and non-white children, is it the child of color who does most of the understanding and forgiving?

Resolution of Problems. How are problems presented, conceived and resolved in the story? Are minority people considered to be "the problem"? Are the oppressions faced by minorities and women represented as related to social injustice? Are the reasons for poverty and oppression explained, or are they accepted as inevitable? Does the story line encourage passive acceptance or active resistance? Is a particular problem that is faced by a racial minority person or a female resolved through the benevolent intervention of a white person or a male?

Role of Women. Are the achievements of girls and women based on their own initiative and intelligence, or are they due to their good looks or to their relationship with boys? Are sex roles incidental or critical to characterization and plot? Could the same story be told if the sex roles were reversed?

3. LOOK AT THE LIFESTYLES

Are minority persons and their setting depicted in such a way that they contrast unfavorably with the unstated norm of white middle-class suburbia? If the minority group in question is depicted as "different," are negative value judgments implied? Are minorities depicted exclusively in ghettos, barrios or migrant camps? If the illustrations and text attempt to depict another culture, do they go beyond over-simplifications and offer genuine insights into another lifestyle? Look for inaccuracy and inappropriateness in the depiction of other cultures. Watch for instances of the "quaint-natives-in-costume" syndrome (most noticeable in areas like clothing and custom, but extending to behavior and personality traits as well)

4. WEIGH THE RELATIONSHIPS BETWEEN PEOPLE

*Do the whites in the story possess the power, take the leadership, and make the important decisions? Do racial minorities and females of all races function in essentially supporting roles?

*How are family relationships depicted? In Black families, is the mother always dominant? In Hispanic families, are there always lots of children? If the family is separated, are societal conditions—unemployment, poverty, for example—cited among the reasons for the separation?

5. NOTE THE HEROES

For many years, books showed only "safe" minority heroes—those who avoided serious conflict with the white establishment of their time. Minority groups today are insisting on the right to define their own heroes (of both sexes) based on their own concepts and struggles for justice.

When minority heroes do appear, are they admired for the same qualities that have made white heroes famous or because what they have done has benefited white people? Ask this question: "Whose interest is a particular hero really serving?"

6. CONSIDER THE EFFECTS ON A CHILD'S SELF-IMAGE

*Are norms established which limit any child's aspirations and self-concept? What effect can it have on Black children to be continuously bombarded with images of the color white as the ultimate in beauty, cleanliness, virtue, etc., and the color black as dirty, menacing, etc.? Does the book counteract or reinforce this positive association with the color white and negative association with black?

*What happens to a girl's self-image when she reads that boys perform all of the brave and important deeds? What about a girl's self-esteem if she is not "fair" of skin and slim of body?

*In a particular story, is there one or more persons with whom a minority child can readily identify to a positive and constructive end?

7. CONSIDER THE AUTHOR'S OR ILLUSTRATOR'S BACKGROUND

Analyze the biographical material on the jacket flap or the back of the book. If a story deals with a minority theme, what qualifies the author or illustrator to deal with the subject? If the author and illustrator are not members of the minority being written about, is there anything in their background that would specifically recommend them as the creators of this book?

8. CHECK OUT THE AUTHOR'S PERSPECTIVE

No author can be wholly objective. All authors write out of a cultural as well as a personal context. Children's books in the past have traditionally come from authors who were white and who were members of the middle class, with one result being that a single ethnocentric perspective has dominated children's literature in the United States. With any book in question, read carefully to determine whether the direction of the author's perspective substantially weakens or strengthens the value of his/her written work. Is the perspective patriarchal or feminist? Is it solely Eurocentric, or do minority cultural perspectives also receive respect?

9. WATCH FOR LOADED WORDS

A word is loaded when it has insulting overtones. Examples of loaded adjectives (usually racist) are "savage," "primitive," "conniving," "lazy," "superstitious," "treacherous," "wily," "crafty," "inscrutable," "docile," and "backward."

•Look for sexist language and adjectives that exclude or ridicule women. Look for use of the male pronoun to refer to both males and females. While the generic use of the word "man" was accepted in the past, its use today is outmoded. The following examples show how sexist language can be avoided: ancestors instead of forefathers; chairperson instead of chairman; community instead of brotherhood; fire-fighters instead of firemen; manufactured instead of manmade; the human family instead of the family of man.

10. LOOK AT THE COPYRIGHT DATE

Books on minority themes—usually hastily conceived—suddenly began appearing in the mid-1960's. There followed a growing number of "minority experience" books to meet the new market demand, but most of these were still written by white authors ted by white editors and published by white pub. rs. They therefore reflected a white point of view. Not until the early 1970's has the children's book world begun to even remotely reflect the realities of a multiracial society. The new direction resulted from the emergence of minority authors writing about their own experiences. Unfortunately, this trend has been reversing in the late 1970's, as publishers have cut back on such books. Non-sexist books, with rare exceptions, were not published before 1973.

The copyright dates, therefore, can be a clue as to how likely the book is to be overtly racist or sexist, although a recent copyright date, of course, is no guarantee of a book's relevance or sensitivity. The copyright date only means the year the book was published. It usually takes about two years from the time a manuscript is submitted to the publisher to the time it is actually printed and put on the market. This time lag meant very little in the past, but in a time of rapid change and changing consciousness, when children's book publishing is attempting to be "relevant," it is becoming increasingly significant. (For fully detailed criteria, a book titled *Guidelines for Selecting Bias-Free Textbooks and Storybooks*, $8.95, is available from CIBC at the address below.)

COMBATTING HANDICAP STEREOTYPING*

Handicapped people are often expected to enter only a restricted range of careers because . . . well, because it's thought to be suitable. People who are retarded are supposed to enjoy boring, tedious, repetitive work. Similarly, deaf people are often said to enjoy art and design work, and the blind to make good newsstand keepers. "Persons who are hearing impaired should work in noisy factories." "Disabled people prefer to work only in jobs helping other disabled people." The list of stereotypes can go on and on. Yet retarded people experience boredom and need relief from tedium. And, while some deaf people *do* enjoy art and design, others care little for them and have no talent in those areas. Almost any generalizations that one makes—even "positive" ones—will be at best distortions of reality.

SOME NOTES ON STEREOTYPES

All kinds of stereotypes exist. The important thing to recognize about *most* of them is that the specific content of the stereotype is not nearly as important as the fact that there is a stereotype present at all. Still, it is possible to identify some common kinds and discuss what career educators can do about them. Before doing so, however, a few other general points about stereotypes need to be considered. First, stereotypes are not universally held—some employers, for instance, have long since gotten over unjustified qualms about hiring or promoting handicapped people and see them as candidates for a wide range of jobs. Second, not all handicapped people have been equally affected by others' stereotypes—many handicapped children, for instance, have *not* been overly protected by their parents and suffer none of the problems that come from being watched over to excess. Finally, stereotypes are undesirable because they unfairly characterize whole groups of people, not because they are necessarily untrue of each individual—some deaf people *do* paint well, for example, and, less frivolously, some emotionally disturbed people are indeed hard to get along with. There is nothing wrong with recognizing a characteristic, desirable or otherwise, when an individual in fact possesses it; the error lies in presupposing that someone has this, that, or the other characteristic just because that person has a handicap.

STEREOTYPES AND THE ROLE OF CAREER EDUCATION

The creation of career education as a Congressional mandate in 1974 emphasized the importance of serving *all* students. The passage of the Career Education Incentive Act in 1977 re-emphasized this and drew special attention to the need to reduce the effects of stereotyping on the career choices

*Excerpted from American Institutes of Research, Programs to Combat Stereotyping in Career Choice, Palo Alto, California, 1980.

of handicapped people. P.L. 94-142 established a "free appropriate public education" in the "least restrictive environment" as the right of all handicapped children. The message of these various mandates is clear—*all* children must receive nonstereotyped career education and be integrated into society to the fullest extent possible consistent with their needs and desires.

But with what aspects of stereotyping should career education be concerned the most? Since the goals of career education are so broad, it might fairly be argued that practically any stereotype falls within its domain. Still, there are some common kinds with which career educators must be particularly concerned.

Some Common Stereotypes

We will consider three common classes of stereotypes, pointing out some ways in which they may manifest themselves in the school, in business and industry, or in the family.

STEREOTYPE 1: *There is only a very small range of careers that handicapped people can expect to pursue.* An unfortunately common habit of mind is to ruminate on the problems that a person with this or that disability might have in satisfying certain job requirements. Often, such ruminations identify genuine problems, but are still essentially obfuscatory for a couple of reasons. First, they direct attention to jobs that a person probably could not do, which is not very helpful—each of us is suited for some things and not others, with the former being much more worth thinking about than the latter. Second, most jobs are within reach of a great many handicapped people, including some jobs that seem unlikely on the face of it; by picking out some of the more extreme difficulties, one tends to subordinate this fact—again, an unhelpful approach. An effect of all this is that handicapped people may be presented with few opportunities in education to learn about and become interested in careers which they might well find rewarding.

This and related stereotypes often stand in the way of disabled people seeking employment. Employers may not see immediately how the disabled person can get the job done properly (or at all) and jump to the conclusion that the person cannot. Or, employers may believe that other workers will not be able to work well with handicapped colleagues, or will work adequately with them only in certain roles—the latter is particularly serious as it may serve to close off opportunities for advancement. Generally speaking, these fears will not come true; disabled individuals are as likely as those who are not disabled to work out well on the job.

STEREOTYPE 2: *Handicapped people are excluded from full participation in most activities by their disabilities.* This is really a more general statement of the first stereotype, representing the same unfortunate habit of mind more broadly applied. This stereotype tends to divert attention from the many ways in which various disability related problems can be over-

come—a greater appreciation is needed for the fact that many, perhaps most, tasks can be accomplished in ways other than those routinely used. An extreme, but not uncommon, manifestation of this stereotype in education and job training is that disabled people can *only* succeed in a "special" setting. Of course, special settings, from resource programs to residential schools, offer many valuable services. The trick is to arrive at the best "mix" for the individual that is as close to the regular environment as possible.

Staff in regular programs may manifest this stereotype in many ways, among them: disabled students will lower the standards in the classroom; they will not be able to get along with other students; they will not be able to communicate and teaching will be impossible; they will require a humanly impossible amount of work on the part of the teacher; they will require all instructional activities to be specifically designed for them; they will jeopardize their own or others' safety; they will waste precious time that might better be devoted to students who are more likely to succeed. There are, no doubt, cases in which each of these things has occurred resulting, very probably, from poorly conceived placements, inadequate support services, or a failure to prepare the teacher adequately to meet the student's special needs. If good planning and necessary support services are in evidence, however, disabled students can participate in most activities.

STEREOTYPE 3: *Disabled people have to be protected from the hurly-burly of the world.* It is, of course, true that everyone must learn to cope with life's vicissitudes, and that a person's capabilities and limitations are quite germane to determining how that individual copes. In some cases a disability does indeed serve to define situations to avoid. However, excessive solicitousness and overprotectiveness can arise all too easily. The individual exposed to too much protectiveness may become essentially an underachiever with a poor self-image. This may manifest itself as discouragement about the future, withdrawal from learning and working situations, lack of personal planning, or some other undesirable traits that interfere with realization of the person's full potential.

THE ROLE OF CAREER EDUCATION

Let us begin by looking at some of the reasons that stereotypes persist. Bogdan and Biklen (1977) state that a stereotype is often steadfastly maintained, although inaccurate. First, culture often supports the transmission of stereotypes, constantly reinforcing them. Second, handicapped people are often isolated, have relatively few opportunities for intimate relations to develop between themselves and so-called normal people, and consequently have little chance of disproving the stereotypes. Last, and perhaps most important, handicapped people are often treated in ways that correspond to various stereotypes and are rewarded for living up to others' image of them (Lemert, 1951). Career education can help to break these vicious cycles. Here are some of the ways.

SHOW HANDICAPPED PEOPLE IN A VARIETY OF ROLES. Career educators, when they develop materials, conduct "career days," invite guest speakers, take students to job sites, and so on, can include handicapped people in a variety of roles. They can be shown in pamphlets, serve as resource people, and otherwise be involved. *And, this should be done for all activities.* Disabled people should not just pop up in "handicapped activities" then go away, suggesting one-dimensionality. For example, a chemist who is cerebral palsied, might come to a career day assembly to discuss opportunities in science and related areas. That the person is disabled will be a good object lesson for all, and, quite possibly, a source of encouragement for handicapped students—but that need not be the theme of the presentation, or even mentioned. The person's profession is, after all, chemistry, not cerebral palsy.

EXPECT A LOT FROM HANDICAPPED STUDENTS. Handicapped people, notwithstanding the barriers they have faced, fill practically every role society offers. As barriers fall, it will become less and less unusual to find handicapped people in a wide variety of positions. Barriers are one thing, but challenges are another. The former are needless impediments, the latter are integral to life's endeavors and handicapped students should meet and master them along with the other students. Doing so is not only satisfying in and of itself, it also enhances a student's self-image, raises his or her standing with others, and provides important practice for career success.

GIVE OTHER CHILDREN A CHANCE TO MEET AND WORK WITH HANDICAPPED YOUNGSTERS. Students can work together on projects, reports, and in the multitude of day-to-day school activities. In this there is a balance to be struck between students taking on roles at which they are naturally adept, which is fine up to a point, and the routine assignment of a particular role. Everyone, handicapped children included, should get a chance to lead, to follow, to work cooperatively with others, and to make independent efforts.

GIVE OTHERS A CHANCE TO SEE THE STUDENTS ACHIEVE. This includes parents and the community. The vehicles are many, from projects to take home, to open-houses, to IEP review meetings, to work placements. Many possibilities are presented in the programs discussed below.

REMEMBER THAT A "HEAD-ON" APPROACH IS NOT ALWAYS NECESSARY. That stereotypes are attitudinal at base often suggests a "direct" approach to attitude change, one in which people are encouraged to identify their presuppositions and concerns and to deal with them. There is much value in this and some of the programs feature it. At the same time, a great deal of attitude change comes from doing and from seeing done. If disabled students are to realize their potential to become competent, independent members of society, they, no less than others, must have the chance to nurture their skills, to become involved with the world and explore the whole gamut of possibilities it offers, to learn to deal with life's realities, and to familiarize others with their capabilities. Providing opportunities to do these things may seem to be an "indirect" way of combatting stereotypes, but it is crucial.

These, of course, are things with which all educators should be involved. Career educators, however, are in an unusually advantageous position—if a concern with stereotype reduction permeates their endeavors, then, as career education is infused throughout the curriculum, this concern should become ubiquitous as well.

3. FACTS ABOUT WOMEN AND MINORITIES IN THE LABOR FORCE

FACTS ABOUT WOMEN AND MINORITIES IN THE LABOR FORCE

A. Women in the Labor Force

1. The stereotyped view of a young girl growing up, getting married, and being taken care of economically for the rest of her life is simply not consistent with reality. Consider the following statistics:

   a. Only about 3 out of 5 women aged 18 and over are married.

   b. Approximately 1 out of every 2 marriages ends in divorce.

   c. The number of one-parent families doubled between 1970 and 1983. By 1984, 1 out of 6 families was maintained by a woman.

   d. In 1 out of 2 married-couple families, both the husband and wife hold paying jobs.

   e. Nine out of 10 women work outside the home at some point in their lives.

2. The number of women in the labor force more than doubled between 1950 and 1980. More than half of all women aged 16 and over are in the labor force; they account for more than two-fifths of all workers. (See Table 1 and the accompanying graph in Figure 1.)

3. The fact is that most women work because of pressing economic need, not simply for "extras." Nearly two-thirds of all women in the labor force in 1984 were either single (26 percent), divorced (11 percent), widowed (5 percent), separated (4 percent), or had husbands whose 1983 incomes were less than $15,000 (19 percent).

4. Married women, including those with young children, have been entering the labor force in increasing proportions.

   a. In 1983, 52 percent of married women with husbands present were in the labor force compared to 24 percent in 1950 and 40 percent in 1972.

   b. In 1984, 61 percent of all mothers with children under 18 were in the labor force, compared to 30 percent in 1960, and 9 percent in 1940.

   c. In 1984, there were 8 million working mothers with pre-school children, up 3 million from 1973.

   d. In 1984, 52 percent of married women with children under 6 were in the labor force, compared to 30 percent in 1970 and 19 percent in 1960.

   e. In 1983, nearly three-fifths (56 percent) of all children under age 18 had mothers in the labor force; 48 percent of all children under age 6 had working mothers.

Table 1

WOMEN IN THE LABOR FORCE, 1950-1983

Year	Total Women (in thousands)	Percent of Total Labor Force	Percent of All Women Aged 16 Years and Over
1983	48,500	44.0	53.0
1980	44,733	42.4	51.7
1975	36,998	39.9	46.3
1970	31,520	38.1	43.3
1965	26,200	35.2	39.3
1960	23,240	33.4	37.7
1955	20,548	31.6	35.7
1950	18,389	29.6	33.8

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, "Handbook of Labor Statistics 1978" and "Employment and Unemployment: A Report on 1980, Special Labor Force Report 244".

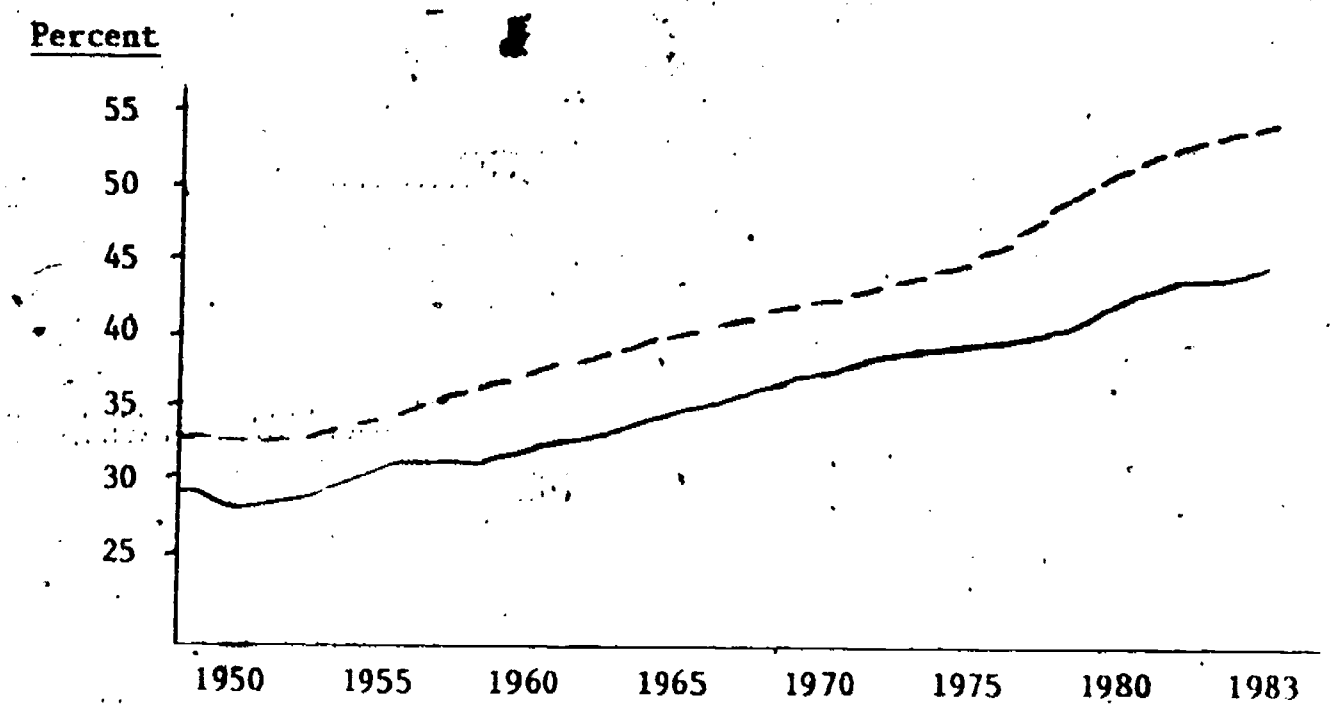

Figure 1. Increase of Women in the Labor Force.

5. Projections indicate that the trend of increased participation in the labor force will continue.

   a. By 1990, more than 70 percent of all females 16 to 54 will be in the job market.

   b. By 1990, two-thirds of all married women under age 55 will have jobs outside the home, including more than half of all mothers with children under 6.

   c. By 1990, only 1 out of every 4 women will fit the current stereotype of woman as full-time homemaker and mother.

6. Not only are more women working, but the average number of years they are working is increasing. The average worklife expectancy of women was approximately 6 years in 1900, and just over 12 years in 1940. In 1979-80, the average woman could expect to spend 29.3 years of her life in the work force.

7. Although women are working in every major industry group, one quarter of all employed women are found in only 22 of the 500 occupations recognized by the Department of Labor. They are especially concentrated in clerical, service, and selected professional occupations. In 1984, 99 percent of secretaries, 96 percent of registered nurses, 83 percent of elementary school teachers, and 70 percent of retail clerks were women (see Table 2).

8. The average woman worker is as well educated as the average man worker (median 12.2 years of school completed). However, in 1984 the average woman earned only 61 cents for every dollar earned by the average male when both are working year-round, full-time. As shown in Figure 2, there is a large gap between male and female earnings at each educational level. In 1983, women workers with 4 years of college education had a median income slightly above that of men who had only 1 to 3 years of high school.

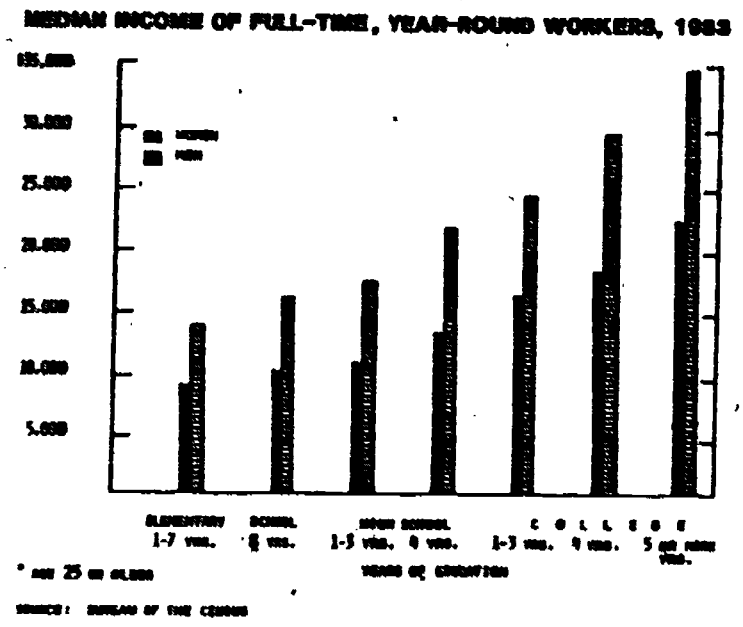

Figure 2. Median Income of Full-Time, Year-Round Workers, 1983.

Table 2

Employed Civilians by Detailed Occupation, Sex, Race, and Hispanic Origin[a/]

(Numbers in thousands)

Occupation	1983			
	Total employed	Percent of total		
		Women	Black	Hispanic origin
Total, 16 years and over	100,834	43.7	9.3	5.3
Managerial and professional specialty	23,592	40.9	5.6	2.6
Executive, administrative, and managerial	10,772	32.4	4.7	2.8
Officials and administrators, public administration	417	38.5	8.3	3.8
Administrators, protective services	54	14.0	2.8	1.0
Financial managers	357	38.6	3.5	3.1
Personnel and labor relations managers	108	43.9	4.9	2.6
Purchasing managers	82	23.6	5.1	1.4
Managers, marketing, advertising, and public relations	396	21.8	2.7	1.7
Administrators, education and related fields	415	41.4	11.3	2.4
Managers, medicine and health	91	57.0	5.0	2.0
Managers, properties and real estate	305	42.8	5.5	5.2
Management-related occupations	2,988	40.3	5.8	3.5
Accountants and auditors	1,105	38.7	5.5	3.3
Underwriters and other financial officers	541	41.5	5.0	4.1
Management analysts	134	29.5	5.3	1.7
Personnel, training, and labor relations specialists	325	52.3	11.9	2.9
Buyers, wholesale and retail trade, except farm products	191	47.2	2.5	5.8
Construction inspectors	53	7.0	2.9	4.2
Inspectors and compliance officers, except construction	150	23.1	11.4	4.1
Professional specialty	12,820	48.1	6.4	2.5
Architects	103	12.7	1.8	1.5
Engineers	1,572	5.8	2.7	2.2
Aerospace engineers	80	8.9	1.5	2.1
Chemical engineers	67	6.1	3.0	1.4
Civil engineers	211	4.0	1.8	3.2
Electrical and electronic engineers	450	6.1	3.4	3.1
Industrial engineers	210	11.0	3.3	2.4
Mechanical engineers	259	2.8	3.2	1.1
Mathematical and computer scientists	483	29.6	5.4	2.6
Computer systems analysts and scientists	276	27.8	6.2	2.7
Operations and systems researchers and analysts	142	31.3	4.9	2.2
Natural scientists	367	20.6	2.6	2.1
Chemists, except biochemists	98	23.3	4.3	1.2
Geologists and geodesists	65	18.0	1.1	2.6
Biological and life scientists	55	40.8	2.4	1.8
Health diagnosing occupations	735	13.3	2.7	3.3
Physicians	519	15.8	3.2	4.5
Dentists	128	6.7	2.4	1.0
Health assessment and treating occupations	1,800	85.8	7.1	2.2
Registered nurses	1,372	95.8	6.7	1.8
Pharmacists	158	28.7	3.8	2.6
Dietitians	71	90.6	21.0	3.7
Therapists	247	76.3	7.6	2.7
Inhalation therapists	69	69.4	6.5	3.7
Physical therapists	55	77.0	9.7	1.5
Speech therapists	51	90.5	1.5	(1)
Physicians assistants	51	39.3	7.7	4.4
Teachers, college and university	806	38.3	4.4	1.8
Teachers, except college and university	3,366	70.9	9.1	2.7
Prekindergarten and kindergarten	288	98.2	11.8	3.4
Elementary school	1,350	83.3	11.1	3.1
Secondary school	1,270	51.8	7.2	2.1
Special education	81	82.7	10.2	2.1
Teachers, n.e.c.	425	64.5	5.7	2.0
Counselors, educational and vocational	184	53.1	13.9	3.2
Librarians, archivists, and curators	213	84.4	7.8	1.6
Librarians	163	87.3	7.9	1.8
Social scientists and urban planners	261	46.8	7.1	2.1
Economists	98	37.9	6.3	2.7
Psychologists	135	57.1	8.8	1.1
Social, recreation, and religious workers	631	43.1	12.1	3.8
Social workers	407	64.3	18.2	6.3
Recreation workers	85	71.9	15.7	2.0
Clergy	293	5.8	4.9	1.4
Religious workers, n.e.c.	66	50.9	2.5	.4
Lawyers and judges	651	15.8	2.7	1.0
Lawyers	612	15.3	2.8	.9
Writers, artists, entertainers, and athletes	1,544	42.7	4.8	2.9
Authors	62	48.7	2.1	.9
Designers	383	52.7	3.1	2.7
Musicians and composers	155	28.0	7.9	4.4
Painters, sculptors, craft-artists, and artist printmakers	186	47.4	2.1	2.3
Photographers	113	20.7	4.0	3.4
Editors and reporters	204	48.4	2.9	2.1
Public relations specialists	157	50.1	6.2	1.9
Athletes	58	17.6	9.4	1.7

See footnotes at end of table

a/ Employment and Earnings, March 1984.

(continued)

Employed civilians by detailed occupation, sex, race, and Hispanic origin—Continued

(Numbers in thousands)

Occupation	1983			
	Total employed	Percent of total		
		Women	Black	Hispanic origin
Technical, sales, and administrative support	[illegible]	64 6	7 6	4 1
Technicians and related support	[illegible]	48 2	8 2	3 1
Health technologists and technicians	1,111	84 3	12 7	3 1
Clinical laboratory technologists and technicians	255	78.2	10 5	2 9
Dental hygienists	66	98 6	1 6	(1)
Radiologic technicians	101	71 7	8 6	4 5
Licensed practical nurses	443	97 0	17 7	3 1
Engineering and related technologists and technicians	822	18 4	6 1	3.5
Electrical and electronic technicians	280	12.5	8.2	4.6
Drafting occupations	273	17 5	5 5	2 3
Science technicians	202	29 1	8 6	2 8
Biological technicians	52	37 7	2 9	2 0
Chemical technicians	82	26 9	9 5	3 5
Technicians, except health, engineering, and science	917	35 3	5 0	2 7
Airplane pilots and navigators	69	2 1	(1)	1 6
Computer programmers	443	32 5	4 4	2 1
Legal assistants	126	74.0	4.3	3.6
Sales occupations	11,818	47 5	4 7	3 7
Supervisors and proprietors	2,958	28 4	3 8	3 4
Sales representatives, finance and business services	1,853	37 2	2 7	2 2
Insurance sales	551	25 1	3 8	2 5
Real estate sales	570	48.4	1 3	1 5
Securities and financial services sales	212	23 6	3 1	1 1
Advertising and related sales	124	47 9	4 5	3 3
Sales occupations, other business services	[illegible]	41 0	2 4	2 9
Sales representatives, commodities, except retail	1,442	15 1	2 1	2 2
Sales workers, retail and personal services	5,511	69 7	6 7	4 8
Sales workers, motor vehicles and boats	[illegible]	6 4	1 2	3 0
Sales workers, apparel	[illegible]	[illegible]	8 1	6 0
Sales workers, shoes	117	65 4	5 0	7 3
Sales workers, furniture and home furnishings	140	49 8	2 7	4 8
Sales workers, radio, television, hi-fi, and appliances	124	30 4	5 0	6 2
Sales workers, hardware and building supplies	189	22 7	2 5	3 6
Sales workers, parts	149	10 9	1 8	6 2
Sales workers, other commodities	1,441	74 1	4 5	4 0
Sales counter clerks	140	70 1	7 8	4 3
Cashiers	2,009	84 4	10 1	5 4
Street and door-to-door sales workers	378	81 0	4 4	3 4
News vendors	143	27 4	5 8	2 9
Sales-related occupations	54	58 7	2 8	1 3
Administrative support, including clerical	18,395	79 9	9 6	5 0
Supervisors	676	53 4	9 3	5 0
General office	382	85.7	10 5	4 9
Financial records processing	93	62 2	5 8	5 1
Supervisors, distribution, scheduling, and adjusting clerks	156	22.7	6 9	5 3
Computer equipment operators	605	63 9	12 5	6 0
Computer operators	597	63 7	12 1	6 0
Secretaries, stenographers, and typists	4,861	98.2	7 3	4 5
Secretaries	3,891	99 0	5 8	4 0
Stenographers	85	88 7	6 4	2 0
Typists	906	95 6	13 8	6 4
Information clerks	1,174	89 9	8 5	5 5
Interviewers	184	88 0	9 7	4 6
Hotel clerks	64	68 6	6 7	3 2
Transportation ticket and reservation agents	88	64 7	10 1	5 7
Receptionists	[illegible]	[illegible]	7 5	8 8
Records processing occupations, except financial	[illegible]	[illegible]	11 8	4 8
Order clerks	188	78 1	10 6	4 4
Personnel clerks, except payroll and timekeeping	64	91 1	14 9	4 6
Library clerks	147	81 9	15 4	2 5
File clerks	287	83 5	16 7	6 1
Records clerks	157	82 9	11 6	5 6
Financial records processing	2,457	89 4	4 6	3 7
Bookkeepers, accounting, and auditing clerks	1,970	91 0	4 3	3 3
Payroll and timekeeping clerks	192	82.2	5 9	5 0
Billing clerks	146	88 4	6 2	3 9
Cost and rate clerks	98	75 6	5 9	5 3
Billing, posting, and calculating machine operators	53	85 5	5 4	8 9
Duplicating, mail and other office machine operators	68	62 6	16 0	6 1
Communications equipment operators	256	89 1	17 0	4 4
Telephone operators	244	90 4	17 0	4 3
Mail and message distributing occupations	799	31 6	18 1	4 5
Postal clerks, except mail carriers	248	38 7	28.2	5 2
Mail carriers, postal service	259	17 1	12 5	2 7
Mail clerks, except postal service	170	50 0	15 8	5 9
Messengers	122	26 2	16 7	5 2
Material recording, scheduling, and distributing clerks	1,562	37 5	10 9	6 6
Dispatchers	157	[illegible]	11 4	4 3
Production coordinators	182	40 6	6 1	2 2
Traffic, shipping, and receiving clerks	421	22 6	9 1	11 1
Stock and inventory clerks	532	28 7	13 3	5 5
Weighers, measurers, and checkers	78	47 2	16 9	5 8
Expediters	112	57 5	8 4	4 3

See footnotes at end of table

(continued)

Table 2 (continued)

Employed civilians by detailed occupation, sex, race, and Hispanic origin—Continued

(Numbers in thousands)

Occupation	1983			
	Total employed	Percent of total		
		Women	Black	Hispanic origin
Adjusters and investigators	675	69 9	11 1	5 1
Insurance adjusters, examiners, and investigators	199	65 0	11 5	3.3
Investigators and adjusters, except insurance	301	70 1	11 3	4.8
Eligibility clerks, social welfare	69	88 7	12 9	9 4
Bill and account collectors	106	66 4	8 5	6 5
Miscellaneous administrative support	2,397	85 2	12 5	5 9
General office clerks	848	80 6	12 7	5.2
Bank tellers	480	91 0	7 5	4.3
Data entry keyers	311	93.6	18.8	5.8
Statistical clerks	96	75 7	7 5	3 4
Teachers' aides	346	93 7	17 8	12.8
Service occupations	13,857	60 1	18.6	6.8
Private household	980	96.1	27 8	8.5
Child care workers	408	96.9	7 9	3.6
Cleaners and servants	512	95.8	42.4	11.8
Protective service	1,672	12.6	13.6	4.6
Supervisors, protective service	127	4 7	7.7	3.1
Supervisors, police and detectives	58	5.2	9.3	1.2
Firefighting and fire prevention	189	1.0	6.7	4.1
Firefighting occupations	170	1 0	7 3	3 8
Police and detectives	845	9 4	13 1	4 0
Police and detectives, public service	412	5.7	9.5	4 4
Sheriffs, bailiffs, and other law enforcement officers	87	13.2	11 5	4 0
Correctional institution officers	148	17.8	24 0	2.8
Guards	711	20.8	17.9	5.6
Guards and police, except public service	602	13 0	18.9	8 2
Service occupations, except private household and protective service	11,206	64 0	16 0	6 9
Food preparation and service occupations	4,880	63 3	10 5	6.6
Supervisors	229	63.5	10.6	5.0
Bartenders	338	48.4	2.7	4 4
Waiters and waitresses	1,367	87.8	4.1	3.6
Cooks, except short order	1,259	50.8	16.0	6.8
Short-order cooks	93	38.5	12.9	2.4
Food counter, fountain, and related occupations	329	78.0	9.1	6.7
Kitchen workers, food preparation	136	77.0	13.7	8.1
Waiters' and waitresses' assistants	364	38 8	12.6	14.2
Miscellaneous food preparation	646	54.0	15.1	11.6
Health service occupations	1,739	89.2	23.5	4.8
Dental assistants	184	96.1	6.1	5.7
Health aides, except nursing	316	86.8	16.5	4.8
Nursing aides, orderlies, and attendants	1,269	88.7	27.3	4.7
Cleaning and building service occupations	2,736	36.8	24.4	9.2
Supervisors	124	38.4	28.3	6.8
Maids and housemen	531	81.2	32.3	10.1
Janitors and cleaners	2,031	28.6	22.6	8.9
Personal service occupations	1,870	79.2	11.1	6.0
Barbers	92	12.9	8.4	12.1
Hairdressers and cosmetologists	622	88.7	7.0	5.7
Attendants, amusement and recreation facilities	134	40.2	7.1	4.3
Public transportation attendants	83	74.3	11.3	5.9
Welfare service aides	77	82.5	24.2	10.5
Child care workers	833	98.8	12.8	5.2
Precision production, craft, and repair	12,328	8 1	8 8	8.2
Mechanics and repairers	4,158	3 0	6 8	5 1
Supervisors	252	7 0	3 7	3 3
Mechanics and repairers, except supervisors	3,906	2 8	7 0	5 5
Vehicle and mobile equipment mechanics and repairers	1,883	8	6.9	6.0
Automobile mechanics	800	5	7 8	6.0
Bus, truck, and stationary engine mechanics	299	8	6.5	5.7
Aircraft engine mechanics	95	2 5	4 0	7 6
Small engine repairers	83	1	5.4	3 4
Automobile body and related repairers	199	.7	6 5	6 8
Heavy equipment mechanics	162	7	5.4	4 9
Industrial machinery repairers	529	2 2	6 0	4 9
Electrical and electronic equipment repairers	874	7 4	7 3	4 5
Electronic repairers, communications, and industrial equipment	158	5 3	8 0	6 1
Data processing equipment repairers	98	9 3	6 1	4 5
Telephone line installers and repairers	59	5 6	5 8	4 6
Telephone installers and repairers	247	9 9	7 8	3 7
Heating, air conditioning, and refrigeration mechanics	200	5	6 0	5 3
Miscellaneous mechanics and repairers	782	4 0	7 5	5 4
Office machine repairers	88	3 3	8 3	3 9
Millwrights	94	1 0	6 4	2 4

See footnotes at end of table

(continued)

Table 2 (continued)

Employed civilians by detailed occupation, sex, race, and Hispanic origin—Continued

(Numbers in thousands)

Occupation	1983			
	Total employed	Percent of total		
		Women	Black	Hispanic origin
Construction trades	4,289	1.6	6.6	8.0
Supervisors	404	1.3	3.2	4.6
Construction trades, except supervisors	3,784	1.9	7.1	8.1
Bricklayers and stonemasons	156	.3	12.2	9.2
Carpet installers	88	2.0	3.4	6.6
Carpenters	1,160	1.4	5.0	5.0
Drywall installers	95	1.4	3.8	8.6
Electricians	602	1.5	6.2	3.3
Electrical power installers and repairers	108	.2	12.0	1.7
Painters, construction and maintenance	473	4.9	8.7	8.8
Plumbers, pipefitters, and steamfitters	443	1.1	7.9	4.7
Concrete and terrazzo finishers	64	(1)	23.0	22.3
Insulation workers	56	4.8	5.8	11.3
Roofers	133	.1	7.4	7.8
Structural metal workers	63	1.2	3.9	3.2
Extractive occupations	196	2.3	3.3	6.0
Supervisors	56	1.7	.6	2.2
Drillers, oil wells	60	1.9	2.5	7.3
Precision production occupations	3,685	21.5	7.3	7.4
Supervisors	1,210	14.1	6.6	5.7
Precision metalworking	892	5.5	6.2	6.3
Tool and die makers	148	1.2	2.1	2.9
Machinists	471	4.1	7.3	7.7
Sheet-metal workers	127	4.5	5.1	4.6
Precision woodworking	66	16.7	3.3	9.7
Precision textile, apparel, and furnishings machine workers	280	58.9	7.9	12.7
Dressmakers	111	96.1	8.9	7.9
Upholsterers	67	26.2	6.9	17.7
Precision workers, assorted materials	452	58.9	7.5	10.4
Optical goods workers	56	41.5	2.9	3.5
Dental laboratory and medical appliance technicians	50	41.1	5.5	7.3
Electrical and electronic equipment assemblers	246	74.2	10.8	13.2
Precision food production occupations	408	25.5	11.1	9.6
Butchers and meat cutters	278	15.6	13.5	9.2
Bakers	105	44.4	6.7	8.9
Precision inspectors, testers, and related workers	130	25.6	6.8	6.3
Inspectors, testers, and graders	121	24.6	6.7	6.2
Plant and system operators	247	3.4	7.8	4.5
Power plant operators	52	4.7	6.3	5.6
Stationary engineers	119	2.1	7.8	4.1
Operators, fabricators, and laborers	18,091	26.6	14.0	8.3
Machine operators, assemblers, and inspectors	7,744	42.1	14.0	9.4
Machine operators and tenders, except precision	5,235	43.1	15.0	9.8
Metalworking and plastic working machine operators	489	16.6	11.4	6.7
Lathe and turning machine operators	78	9.2	10.0	6.1
Punching and stamping press machine operators	114	33.0	14.3	4.3
Grinding, abrading, buffing, and polishing machine operators	151	14.0	12.9	11.2
Metal and plastic processing machine operators	172	23.0	13.1	12.2
Molding and casting machine operators	102	30.9	12.5	13.0
Woodworking machine operators	145	11.9	11.2	7.9
Sewing machine operators	95	7.7	12.1	7.4
Printing machine operators	459	25.6	7.0	4.7
Printing machine operators	306	13.8	8.7	5.5
Typesetters and compositors	76	64.1	1.9	2.1
Textile, apparel, and furnishings machine operators	1,414	82.1	18.7	12.5
Winding and twisting machine operators	97	75.2	36.2	2.5
Textile sewing machine operators	806	94.0	15.5	14.5
Shoe machine operators	77	77.5	17.4	7.7
Pressing machine operators	141	86.4	27.1	14.2
Laundering and dry cleaning machine operators	184	64.7	21.0	12.9
Machine operators, assorted materials	2,517	32.6	15.3	9.9
Packaging and filling machine operators	396	63.1	17.6	14.7
Mixing and blending machine operators	113	7.6	19.0	8.0
Separating, filtering, and clarifying machine operators	62	5.4	12.0	2.7
Painting and paint spraying machine operators	185	13.6	12.4	11.0
Furnace, kiln, and oven operators, except food	108	3.5	14.5	4.9
Slicing and cutting machine operators	195	23.3	15.9	14.9
Photographic process machine operators	93	52.4	8.4	6.4
Fabricators, assemblers, and hand working occupations	1,715	33.7	11.3	8.7
Welders and cutters	543	5.0	8.3	8.6
Assemblers	953	46.4	13.5	8.9
Production inspectors, testers, samplers, and weighers	794	53.8	13.0	7.7
Production inspectors, checkers, and examiners	624	54.9	13.4	8.6
Production testers	58	37.4	8.0	3.8
Graders and sorters, except agricultural	103	58.6	13.5	16.5

See footnotes at end of table

(continued)

Employed civilians by detailed occupation, sex, race, and Hispanic origin—Continued

(Numbers in thousands)

Occupation	1983			
	Total employed	Percent of total		
		Women	Black	Hispanic origin
Transportation and material moving occupations	4,201	7.8	13.0	5.9
Motor vehicle operators	2,978	9.2	13.5	6.0
Truck drivers, heavy	1,771	2.1	12.8	5.1
Truck drivers, light	424	7.8	10.4	8.3
Drivers-sales workers	200	7.6	5.2	3.6
Bus drivers	365	45.5	22.2	7.0
Taxi-cab drivers and chauffeurs	148	10.4	19.6	8.6
Transportation occupations, except motor vehicles	212	2.4	8.7	3.0
Rail transportation occupations	154	2.0	7.8	3.1
Locomotive operating occupations	64	2.3	8.5	1.7
Railroad brake, signal, and switch operators	50	1.5	8.7	6.0
Water transportation occupations	58	3.5	5.7	2.9
Material moving equipment operators	1,011	4.8	12.9	6.3
Operating engineers	145	.4	6.8	3.8
Crane and tower operators	93	1.3	15.6	2.6
Excavating and loading machine operators	98	1.2	5.9	6.2
Grader, dozer, and scraper operators	112	.2	7.7	4.9
Industrial truck and tractor equipment operators	369	5.8	19.6	8.2
Handlers, equipment cleaners, helpers, and laborers	4,147	16.8	15.1	8.6
Helpers, construction and extractive occupations	167	13.0	11.4	10.9
Helpers, construction trades	153	2.9	11.5	11.5
Construction laborers	595	2.1	16.1	11.3
Production helpers	75	24.4	13.7	9.1
Freight, stock, and material handlers	1,488	15.4	15.3	7.1
Garbage collectors	83	1.0	28.0	8.2
Stock handlers and baggers	815	20.7	9.4	6.9
Machine feeders and offbearers	88	32.1	22.7	5.0
Garage and service station related occupations	293	4.8	8.6	7.3
Vehicle washers and equipment cleaners	175	14.7	22.3	12.4
Hand packers and packagers	298	67.0	13.6	7.7
Laborers, except construction	1,024	19.4	18.0	8.6
Farming, forestry, and fishing	3,700	18.0	7.5	8.2
Farm operators and managers	1,450	12.1	1.3	.7
Farmers	1,369	12.1	1.2	.7
Farm managers	81	10.5	3.0	1.7
Other agricultural and related occupations	2,072	19.9	11.7	14.0
Farm occupations, except managerial	1,216	24.4	11.3	16.0
Farm workers	1,149	24.8	11.6	15.9
Related agricultural occupations	855	13.6	12.3	11.2
Supervisors	99	5.0	5.8	10.4
Groundskeepers and gardeners, except farm	645	6.8	14.7	11.6
Animal caretakers, except farm	97	80.0	3.2	5.9
Forestry and logging occupations	126	1.4	12.8	2.1
Timber cutting and logging	98	(1)	14.4	2.3
Fishers, hunters, and trappers	53	4.5	1.8	2.5

[1] Less than 0.05 percent.

NOTE: N.e.c. is an abbreviation for "not elsewhere classified" and designates broad categories of occupations which cannot be more specifically identified.

9. The more education a woman has, the more likely she will seek paid employment. In 1984 about 3 out of 4 women college graduates were in the labor force, compared to fewer than 1 out of 3 women who had not gone beyond the eighth grade.

10. "Women's work" is not as narrowly defined in some other countries. For example, in several countries in Western Europe 18 to 25 percent of the doctors are women; in West Germany 33 percent of the lawyers are women; in the Soviet Union women are 28 percent of the engineers, 38 percent of the scientists, 36 percent of the lawyers, and 75 percent of the doctors. The percentage of women physicists in China has been variously estimated at between 10 and 25 percent.

11. The situation in the United States is changing, with more and more females in the United States entering traditionally male careers.

    a. While the majority of employed women are still in traditional clerical and service occupations, a substantial number have made inroads into professional-technical jobs with higher status and earnings. In 1970, 60 percent of all female professional technical workers were in the more traditional areas of nursing and pre-college teaching; by 1982 this proportion had dropped to about 50 percent.

    b. As shown in Table 3, the number of women in many traditionally male fields increased dramatically between 1972 and 1982. For example, 24 percent of pharmacists were women in 1982, compared to only 15 percent ten years earlier.

    c. While only 11 percent of practicing physicians in 1979 were women, women received 25 percent of the M.D. degrees awarded in 1982.

    d. The number of women receiving degrees in dentistry increased from 1 percent in 1971 to 15 percent in 1982.

    e. In 1971 only 7 percent of law degrees went to women; by 1982 this had increased to 33 percent.

    f. There were only 328 women in the fall 1969 engineering class, less than one percent of entering students. By 1983 there were 18,689 women in the engineering freshman class, representing 17 percent of entering students.

    g. In 1983 women received 13 percent of the total number of bachelor degrees in engineering, compared to 2 percent in 1975 and three-tenths of a percent in 1955.

Table 3

Comparison of Selected Occupations for Women:
1972 and 1982

Occupation	Percent of Total Employed	
	1972	1982
Accountants	38	44
Computer specialists	39	45
Engineers	17	29
Lawyers/judges	4	15
Life and physical scientists	10	21
Pharmacists	13	24
Engineering and science technicians	9	18
Social scientists	21	38
Bank officers and financial managers	19	37
Insurance agents, brokers, and underwriters	12	26
Sales representatives, manufacturing industries	7	21

B. Minority Workers

1. While more than half of all white men are in professional, managerial or skilled craft occupations--those paying relatively high wages--only about 30 percent of minority men, 25 percent of white women, and less than 20 percent of minority women are so employed.

2. Minorities are underrepresented in many of the more prestigious, well-paying occupations but overrepresented in many lower-paying positions. For example, blacks are about 9 percent of the total labor force and Hispanics about 5 percent by only:

   3 percent of dentists
   3 percent of engineers
   4 percent of lawyers
   4 percent of painters and sculptors
   6 percent of college teachers.

   On the other hand, blacks represent:

   17 percent of file clerks
   24 percent of correctional institutional officers
   38 percent of garbage collectors
   28 percent of private household cleaners and servants.

3. The median salary for black women who worked full-time throughout 1983 was $13,000, compared with $14,677 for white women, $16,410 for black men and $23,114 for white men.

4. In 1983, 44 percent of the white households had a monthly income of $2,000 or more, compared to 31 percent for Hispanic households, and 24 percent for black households.

5. Adult employment rates show that white males are the most advantaged and minority males and females are the most disadvantaged. In 1984, unemployment rates ranged from about 6 percent for white men and women to over 10 percent for Hispanic men and women, and more than 16 percent for black men and black women.

6. According to the Census Bureau definition of poverty, poor families in 1980 included:

   8 percent of all the white families
   23 percent of all the Spanish origin families
   29 percent of all the black families.

7. Given the poverty figures, it is not surprising that minorities have poorer health and living conditions than whites.

   a. Thirty-three percent of all black children suffer from malnutritional deficiencies compared to 15 percent of all white children.

b. Minority children have a 30 percent higher chance than do white children of dying before thay are 14 years old.

c. Ten percent of the total U.S. population lives in housing with one or more physical deficiencies. For Chicanos the figure is 19 percent and for Puerto Ricans it is 27 percent.

d. The worst health care in the U.S. is found on Indian reservations. Life expectancy for men on the Navajo reservation is 44 years, compared with 67 nationally.

8. Socioeconomic status is related to educational opportunities. For example, 64 percent of medical students come from families where the father is a physician, another professional, an owner, or a manager.

9. Seventy-five percent of whites graduate from high school compared to 56 percent of blacks and 54 percent of Latinos.

10. Blacks, Hispanics, and Native Americans account for almost 20 percent of the U.S. population but in 1981 constituted less than 10 percent of all Bachelor's degree recipients.

11. The trend is for increased numbers of minority workers to enter professional and technical fields:

    a. Between 1960 and 1982 the percent of minority women who were professional and technical workers increased from 7 to 14 percent.

    b. The number of blacks earning degrees in engineering has increased significantly since the early 1970's--more than tripling (from almost 600 to over 2,142) between 1972 and 1983.

    c. Minorities increased their share of medical degrees from less than 1 percent in 1970 to 10 percent in 1983.

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4. ROLE MODELS

   a. Compendium of Women and Minority Scientists and Engineers
   b. Sample Ideas for Using Posters of Scientists
   c. Women and Minority Scientists Keyed to Science Curriculum Topics

COMPENDIUM OF WOMEN AND MINORITY SCIENTISTS AND ENGINEERS

I. BLACK SCIENTISTS AND ENGINEERS

A. Life Sciences

1. George Washington Carver, 1864-1943 (1,3,4,5,6)*

   AGRICULTURE SCIENTIST; developed hundreds of products from the peanut, the soybean, the pecan nut, the sweet potato, and other plants.

2. Charles Drew, 1904-1950 (1,4,5,6)

   BLOOD PLASMA RESEARCHER; developed techniques for storing human blood until it is needed; created "blood banks."

3. William Hinton, 1883-1959 (I,3,5)

   MEDICAL SCIENTIST; developed a test to detect syphilis; world expert on diagnosis and treatment of venereal disease.

4. Ernest Just, 1883-1941 (1,4,5,6)

   CELL BIOLOGIST; studied the structure and function of cells, especially egg cells and embryos.

5. Theodore Lawless, 1892-1971 (1,3,5)

   DERMATOLOGIST; established a skin clinic in Chicago's Black community; internationally known skin specialist; became a millionaire.

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6. Vance H. Marchbanks, 1905- (1,3)

SURGEON; project head physician on Mercury space program; also helped design space suits and monitoring systems for the Apollo moon shot.

7. Leon Roddy, 1921- (3,4)

ZOOLOGIST; expert on the life cycle and behavior of spiders, identified more than 6,000 kinds of spiders.

8. Charles Henry Turner, 1861-1923 (1,3,4,6)

ZOOLOGIST; expert on the social behavior of ants and bees; discovered that bees are attracted to flowers by color and odor as well as by the pattern of the flowers.

9. Daniel Hale Williams, 1858-1931 (1,3,4,5,6)

SURGEON; credited with performing the first "open-heart" surgery in 1893 when he saved the life of a knifing victim by sewing up his heart.

B. Physical and Earth Sciences

1. Benjamin Banneker, 1731-1806 (1,3,4,5,6)

ASTRONOMER, mathematician and inventor; used his mathematical skills and studies of the stars to develop an almanac; developed the first clock totally built in America.

2. Lloyd Hall, 1894-1971 (3,5)

CHEMIST; applied his knowledge of chemistry to problems in the food industry; responsible for the development of seasonings, meat curing products, and other food preservatives.

3. Percy Julian, 1898-1975 (1,3,4,5)

CHEMIST; sometimes called the "soybean chemist;" synthesized a number of important compounds from soybeans, including chemicals used in the treatment of glaucoma and arthritis; became a millionaire.

4. J. Ernest Wilkins, 1923- (1,2,3)

PHYSICIST, mathematician, and engineer; expert in the development of nuclear power; attracted nationwide attention when he received a college degree at 17 and a Ph.D at 19.

C. Engineers and Inventors

1. Archie Alexander, 1888-1958 (2,3,5)

CIVIL ENGINEER; established an engineering firm and constructed bridges, freeways, airfields, and power plants.

2. Andrew J. Beard, 1849?-1921 (1,5)

INVENTOR; patented a device for the automatic coupling of railroad cars, eliminating dangerous job of manual coupling.

3. Otis Boykin, 1920- (1,2)

ENGINEER; developed a control unit for artificial heart stimulators, a resistor used in radios, televisions and computers; a chemical air filter, and many other devices.

4. David N. Crosthwait, 1891-1976 (2,3,5)

MECHANICAL ENGINEER; specialist in designing heating and refrigeration systems, including the one used in Rockefeller Center in New York City; received more than 30 U.S. patents and many foreign patents.

5. Sarah E. Goode

INVENTOR; folding cabinet bed patented in 1885; first recorded Black woman to receive a patent.

6. Meredith Gourdine, 1929- (1,2,3)

ENGINEER; developed a method for producing high-voltage electricity from natural gas; this method has potential for supplying power for heat and light in homes, desalting sea water, and burning coal more efficiently; Gourdine also won a silver medal in track at the 1952 Olympics.

7. Frederick McKinley Jones, 1893-1961 (1,2,5)

ENGINEER; developed the first automatic refrigerator for long-haul trucks, a portable X-ray machine, box-office equipment for handing out tickets and making change, and many other inventions; held more than 60 patents.

8. Lewis Howard Latimer, 1848-1928 (1,2,5)

ELECTRICAL ENGINEER; member of Thomas Edison's research team; patented a process for making carbon filaments for light bulbs and invented the bulb's threaded socket.

9. Jan Matzeliger, 1852-1889 (1,5)

INVENTOR; developed a machine to make shoes automatically; this machine could make thousands of pairs of shoes per day.

10. Elijah McCoy, 1843-1929 (1,2,3,4,5)

INVENTOR; developed a device for the automatic lubrication of machines, which revolutionized the machine industry (persons inspecting a new machine often asked if it contained the "real McCoy," a term which is still used to mean genuine quality); earned more than 50 patents for various inventions.

11. Garrett Morgan, 1877-1963 (1,2,4,5)

INVENTOR; developed a safety helmet and gas mask for firemen which he himself used to rescue men trapped in a tunnel by a gas explosion; also invented the automatic stop sign, the forerunner of modern traffic lights.

12. Norbert Rillieux, 1806-1894 (1,2,5)

ENGINEER; patented a sugar-refining process which greatly reduced the cost and danger of producing sugar.

13. Rufus Stokes, 1922- (1,2)

INVENTOR; developed an air-purification device to reduce the levels of gases and ash from furnace and power plant smoke.

14. Virgil Trice, 1926- (2,3)

CHEMICAL ENGINEER; expert on managing radioactive wastes from nuclear power plants; works for the U.S. Department of Energy.

15. Madame C. J. Walker, 1869-1919 (1,3)

INVENTOR; invented a hair softener and a comb for straightening hair; one of the first women to become a millionaire through her own efforts.

16. Granville Woods, 1856-1910 (1,2,3,4,5)

ELECTRICAL ENGINEER; earned patents for more than 35 electrical inventions including a third rail system for an electric locomotive, an improved airbrake system, and a telegraph system for communicating between moving trains; sold many of his inventions to the General Electric, Westinghouse, and Bell Telephone companies.

II. WOMEN SCIENTISTS AND ENGINEERS

A. Life Sciences

1. Rachel Carson, 1907-1964 (5,6)*

   BIOLOGIST; studied the effects of DDT and other pesticides; wrote the controversial book The Silent Spring warning about the dangers of DDT.

2. Gerti Cori, 1896-1957 (1,3,4)

   BIOCHEMIST; studied the processing of carbohydrates in humans; shared the 1947 Nobel prize in physiology with her husband Carl for their discovery of how glycogen is catalytically converted.

3. Gladys Anderson Emerson, 1903- (3,6,7)

   BIOCHEMIST; studied the effects of vitamin deficiencies on the body.

4. Jane Goodall, 1934- (1,5)

   BIOLOGIST; studies behavior of chimpanzees in Africa.

5. Frances Oldham Kelsey, 1914-

   PHYSICIAN; employed by Federal Drug Administration; refused to approve use of thalidomide after determining it had dangerous side effects.

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6. Dixie Lee Ray, 1914- (6)

MARINE BIOLOGIST; first woman to chair the U.S. Atomic Energy Commission; one of the first women governors.

7. Shull Russell, 1913- (3)

GENETICIST; helped explain the physiological processes of genes.

8. Florence Siebert, 1897- (2)

BIOCHEMIST; discovered the tuberculin which leads to tuberculosis and developed the Tine test for tuberculosis.

9. Helen Brooke Taussig, 1898-

PHYSICIAN; devised an operation to correct oxygen deficiences in children born with heart defects ("blue babies"); first woman president of the American Heart Association.

10. Rosalyn S. Yalow, 1921- (7)

PHYSIOLOGIST; won 1977 Nobel prize in physiology and medicine for her technique to detect and measure minute levels of chemicals in the body.

B. Physical and Earth Sciences

1. Florence Bascom, 1862-1945

GEOLOGIST; first woman to receive a Ph.D. degree from Johns Hopkins University.

2. Katherine Burr Blodgett, 1898- (2)

PHYSICIST; discovered how to make nonreflecting glass; led to the improvement of camera and telescope lenses.

3. Annie Jump Cannon, 1863-1941 (2,6)

ASTRONOMER; identified and classified 340,000 stars (more than anyone else in the world).

4. Marie Sklodowska Curie, 1867-1934 (1,4,5)

PHYSICIST, CHEMIST; discovered radium and polonium; explained radioactivity. Won Nobel prizes in both physics (1903, shared with her husband Pierre), and chemistry (1911).

5. Rosalind Franklin, 1921-1978

PHYSICAL CHEMIST; used X-ray diffraction techniques to study the structure of DNA; her results were the starting point for Watson and Crick in their work which led to "breaking" the genetic code.

6. Maria Goeppert-Mayer, 1906-1972 (1,4,7)

PHYSICIST; shared the 1963 Nobel prize in physics for the shell model theory of atomic nuclei.

7. Caroline Herschel, 1750-1848 (1)

ASTRONOMER; discovered 7 comets and many nebulae.

8. Dorothy Crowfoot Hodgkin, 1910- (4,5,7)

CHEMIST; won the 1964 Nobel prize in chemistry for discovery of the molecular structure of vitamin B-12, a compound essential in combatting pernicious anemia.

9. Irene Joliet-Curie, 1897-1956 (1,4,5)

CHEMIST; continued the work of her parents on radioactivity; shared the 1935 Nobel prize in chemistry with her husband Frederic for their synthesis of new radioactive elements.

10. Lise Meitner, 1878-1968 (1,3,5,7)

PHYSICIST; research on radioactive materials; first to suggest that the uranium nucleus splits in two (nuclear fission) when bombarded with neutrons.

11. Maria Mitchell, 1818-1889 (1,5,6)

ASTRONOMER; received a gold medal from the King of Denmark for her discovery of a new comet; first professor of astronomy at Vassar College.

12. Ellen Swallow Richards, 1842-1911 (1,2)

CHEMIST; first woman to graduate from Massachusetts Institute of Technology; conducted water purity surveys for the state of Massachusetts and served as an adviser in sanitary engineering to more than 200 companies and schools.

13. Florence van Straten, 1913- (3,6)

METEOROLOGIST; improved techniques for using weather balloons to collect information; contributed to the development of naval weather stations.

14. Chien Shiung Wu, 1912- (1,3,6)

NUCLEAR PHYSICIST; explained concept of the physical structure of the universe; her work overthrew a previous idea (the principal of parity) which said that an object and its image behave in the same way; currently professor at Columbia University.

C. Mathematical Scientists

2. Hypatia, 370-415 (1,4)

Greek MATHEMATICIAN, Inventor; wrote several textbooks on mathematics and philosophy; also invented 2 instruments to study the stars (an astrolobe and a planesphere).

2. Grace Hopper, 1906-

COMPUTER SCIENTIST; helped pioneer the current method of computer programming by designing a compiler system which serves as a translator between people and machine; instrumental in developing COBOL, a computer language which is widely used in business.

3. Ada Byron Lovelace, 1815-1852

English MATHEMATICIAN; first person to program a computing machine.

D. Engineers and Inventors

1. Lillian Moller Gilbreth, 1878-1972 (2,6)

INDUSTRIAL ENGINEER; specialist in time and motion studies.

2. Sarah E. Goode

INVENTOR; folding cabinet bed patented in 1885; first recorded Black woman to receive a patent.

3. Mary Kies (1)

INVENTOR; devised a process of straw-weaving with silk or thread; the first woman to receive a U.S. patent (1809).

4. Margaret Knight

INVENTOR; developed a machine for making paper bags (patented in 1871) and used it in a manufacturing business.

5. Sibella Masters, ?-1720 (1)

INVENTOR; developed a new method of cleaning and airing corn; she was the first American inventor to receive a British patent but it was recorded in her husband's name.

6. Sarah Mather

INVENTOR; developed a submarine telescope and lamp which was patented in 1855.

7. Madame C. J. Walker, 1869-1919

INVENTOR; invented a hair softener and a comb for straigtening hair; one of the first women to become a millionaire through her own efforts.

SAMPLE IDEAS FOR USING POSTERS OF SCIENTISTS

1. Discuss the "Scientist of the Week," setting aside a time each week for presenting a profile of a scientist and discussing various aspects of that person's job and life.

2. Discuss the scientist(s) appropriate to the science topics being covered, perhaps planning a demonstration or experiment related to the work done by the scientist.

3. Discuss the diversity of science and engineering careers available, perhaps assigning groups of students to find out more about each career and report back to the class.

4. Discuss the preparation needed for science and engineering careers, especially the importance of getting a good background in mathematics, but pointing out that you need not be a genius to succeed in a science career.

5. Discuss combining careers and full personal lives, including family life and leisure activities.

6. Discuss the diversity of people in science careers—including women, minorities, and the handicapped; married and single people with a variety of life styles, etc.

7. Discuss possible barriers to participating in science careers.

WOMEN AND MINORITY SCIENTISTS KEYED TO SCIENCE CURRICULUM TOPICS

	Famous Minority Scientists	Famous Women Scientists
A. Biological Sciences		
1. Biology of the Cell	Ernest Just	--
2. Genetics	--	Rosalind Franklin Shull Russell
3. Animal Behavior	Leon Roddy Charles Henry Turner	Jane Goodall
4. Botany	George Washington Carver	--
5. Human Biology	Charles Drew William Hinton Theodore Lawless Daniel Hale Williams	Frances Oldham Kelsey Florence Siebert Helen Brooke Taussig
6. Ecology/Pollution	Rufus Stokes	Rachel Carson Ellen Swallow Richards
7. Biochemistry	--	Gerti Cori Gladys Anderson Emerson Dorothy Crowfoot Hodgkin Rosalyn Yalow

WOMEN AND MINORITY SCIENTISTS KEYED TO SCIENCE CURRICULUM TOPICS (continued)

	Famous Minority Scientists	Famous Women Scientists
B. Chemistry		
1. Atomic Structure	--	Maria Goeppert-Mayer
2. Nuclear Chemistry	--	Marie Curie Irene Joliet-Curie Lise Meitner
3. Organic Chemistry	Percy Julian	--
4. Chemistry in Industry	Lloyd Hall Norbert Rillieux	--
C. Physics		
1. Time and Movement	--	Lillian Gilbreth
2. Machines (industrial)	David N. Crosthwait Frederick McKinley Jones Jan Matzeliger Elijah McCoy	Margaret Knight
3. Light	--	Katherine Burr Blodgett Sarah Mather
4. Electricity	Meredith Gourdine Lewis Latimer Granville Woods	--
5. Nuclear Physics and Radioactivity	J. Ernest Wilkins Virgil Trice	Dixie Lee Ray Chien Shiung Wu

WOMEN AND MINORITY SCIENTISTS KEYED TO SCIENCE CURRICULUM TOPICS (continued)

	Famous Minority Scientists	Famous Women Scientists
D. Earth Sciences		
1. Astronomers	Benjamin Banneker	Annie Jump Cannon Caroline Herschel Maria Mitchell
2. Space Exploration	Vance H. Marshbanks	--
3. Meteorology	--	Florence van Straten
4. The Water Cycle	--	--
5. Geology	--	Florence Bascom

5. SCIENCE AND ENGINEERING CAREERS

   a. Information About Science and Engineering Careers
   b. Participation of Women and Minorities in Science
   c. The Math in High School You'll Need for College
   d. Definitions of Selected Science and Engineering Fields

SCIENCE AND ENGINEERING CAREERS

A. Information About Science and Engineering Careers

Roughly 2 million persons are employed as scientists and engineers, with more than half of them being employed in engineering. There is a very uneven distribution among fields. As shown in Table 1, relatively few are employed as nuclear engineers, mining engineers, or meteorologists, while large numbers are employed in chemistry, computer sciences, and the electrical, mechanical, industrial, and civil branches of engineering.

Scientists and engineers are employed by private industry, colleges and universities, government agencies, and non-profit organizations. The breakdown of scientists and engineers by type of employer is shown in Figure 1. Note that in 1978 almost half of all employed scientists and more than three-fourths of all employed engineers worked in industry. The situation varies

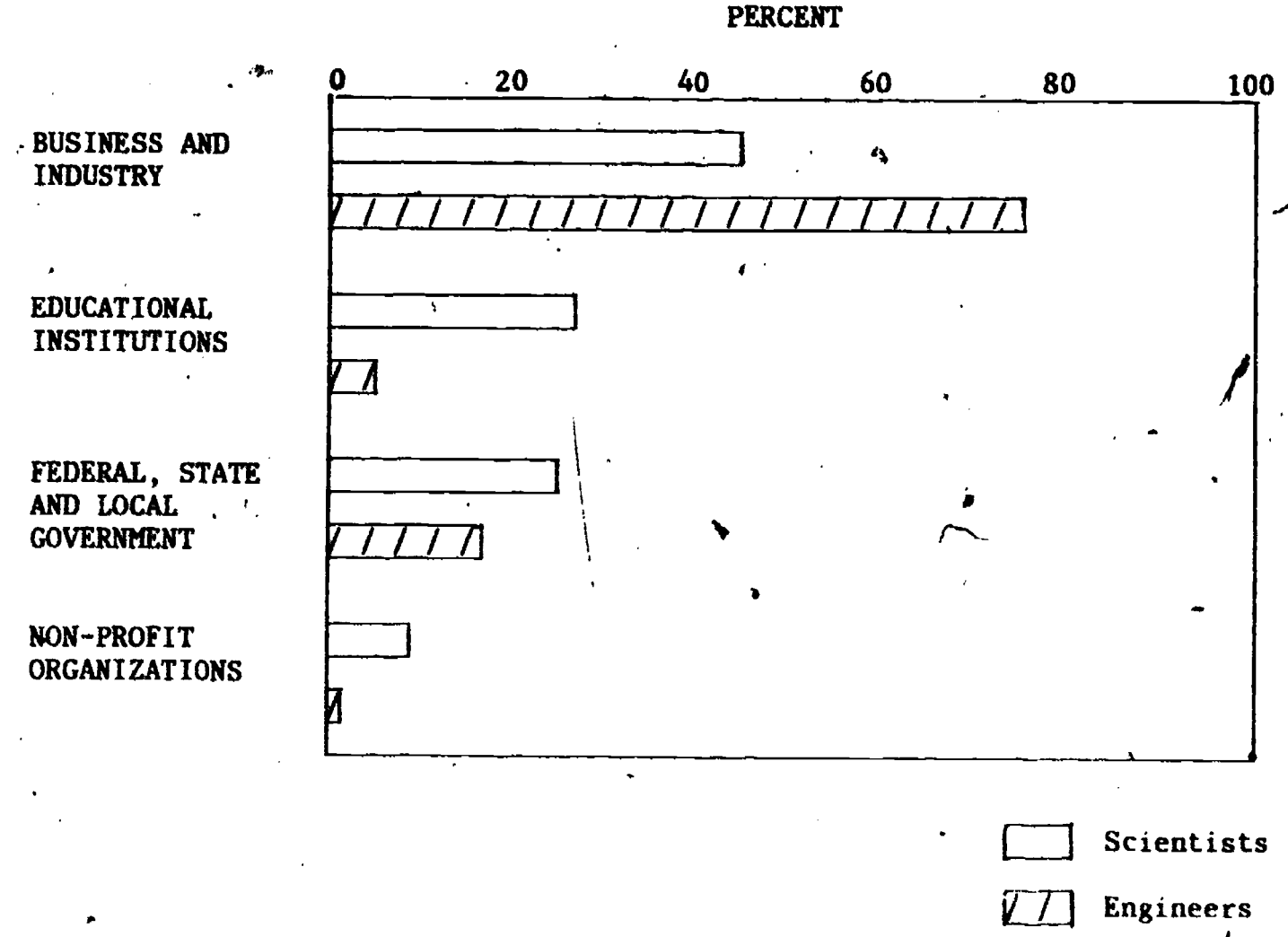

Figure 1. Employers of Scientists and Engineers, 1978.

Table 1

NUMBERS OF SCIENTISTS EMPLOYED IN VARIOUS CAREERS

ENGINEERING:	
Selected Branches	
Electrical and Electronic	320,000
Mechanical	209,000
Industrial	160,000
Civil	155,000
Chemical	56,000
Aerospace	44,000
Petroleum	26,000
Metallurgical	14,000
Nuclear	6,300
Mining	5,700
LIFE SCIENCE:	
Selected Branches	
Biological Scientists	52,000
Foresters and Conservationists	31,000
Agricultural Scientists	22,000
PHYSICAL SCIENCE:	
Selected Branches	
Chemists	89,000
Geologists and Geophysicists	49,000
Physicists	19,000
Meteorologists	3,700
MATHEMATICS AND SYSTEMS ANALYSTS:	
Selected Branches	
Computer Systems Analysts	254,000
Statistics	20,000
Mathematicians	11,000
Actuaries	8,200

SOURCE: Occupational Outlook Handbook, U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 2205, April 1984.

considerably by type of science, with scientists such as statisticians, chemists, computer programmers, systems analysts, and geologists being primarily employed in industry while astronomers, mathematicians, and life scientists are primarily employed in colleges and universities.

The majority of scientists and engineers do not have Ph.D degrees. (In 1982 roughly 52 percent of all scientists and engineers had only bachelor's degrees, about 26 percent had master's as their highest degrees, and about 11 percent had Ph.D degrees.) In some fields it is becomingly increasingly necessary to have an advanced degree for employment beyond the technician level. Engineers and computer specialists, on the other hand, can find many career employment opportunities with only a bachelor's degree.

The employment outlook for various professional careers, both science and non-science, is shown in Table 2. In general the employment outlook for college graduates is best for those studying professional and technical fields.

Between 1982 and 1995, the Bureau of Labor Statistics projects a 23 to 28 percent increase in total employment; however, professional, technical, and related professions are anticipating a more rapid growth of 30 to 35 percent. This includes a projected 77 increase in the hiring of computer programmers, a 65 percent increase in the hiring of electrical engineers, and a 37 percent increase in the hiring of physicists.

Starting salaries are also an indicator of the job market. The more rare a needed commodity, the higher the price that is paid for it. Thus, as shown in Table 3, graduates in petroleum engineering get salary offers that average more than $12,000 per year above those offered to graduates in the social sciences.

Table 2

Projected Employment Outlook for Various Careers
Between 1982 and 1995

Much Faster than Average Growth (increase 50 percent or more)

Electrical Engineer
Mechanical Engineer
Nuclear Engineer
Computer Systems Analysts/Programmers
Civil Engineering Technicians

Faster than Average Growth (30 to 44 percent increase)

Aerospace Engineer
Chemical Engineer
Civil Engineer
Industrial Engineer
Metalurgical Engineer
Biological Scientists
Physicists (with Ph.D.)

Average Growth (20 to 29 percent increase)

Mining Engineer
Petroleum Engineer
Mathematical Specialist
Chemists
Geologists

Slower than Average Growth (6 to 19 percent increase)

Meteorologists
Agricultural Scientists
Foresters
College and University Faculty
Secondary School Teacher

SOURCES: Occuptional Outlook Handbook, 1984-85 Edition; Occupational Outlook Quarterly, Spring 1984.

Table 3

Average Starting Salary Offers
to Bachelor's Degree Candidates, 1984

	Annual	Monthly	Hourly
Engineering			
Petroleum	$29,568	$2,464	$14.67
Chemical	27,420	2,285	13.60
Electrical	26,556	2,213	13.17
Mechanical	26,280	2,190	13.04
Computer Science	24,552	2,046	12.18
Mathematics	23,400	1,950	11.61
Physical and Earth Science	22,800	1,900	11.31
Chemistry	21,072	1,756	10.45
Health Professional	18,912	1,576	9.38
Humanities	17,724	1,477	8.79
Other Social Sciences	17,424	1,452	8.64
Biological Science	16,824	1,402	8.35

SOURCE: College Placement Council, Salary Survey: Final Report, 1984.

NOTE: Annual and hourly salaries were computed from the monthly salaries by multiplying by 12 months/year and dividing by 168 working hours/month (21 days x 8 hours/day), respectively.

B. Participation of Women and Minorities in Science

By any of a number of measures, women and minorities do not participate in the sciences to the same extent as white males. They perform at a lower level on tests of science and mathematics achievement, take fewer science and mathematics courses, and generally have poorer attitudes toward science and mathematics. When it is time to select college majors and fields of graduate study, women and minorities are less likely to choose the sciences and therefore less likely to wind up employed as scientists and engineers. However, there is evidence that the trend is for increased participation of these underrepresented groups in the sciences. Information about both the current status of women and minorities in the sciences and apparent trends is presented in the following sections. In general there is more available information about women than about minorities, especially minorities other than blacks.

1. Science Performance and Attitudes

The National Assessment of Educational Progress (NAEP) regularly surveys the educational attainments of 9-year-olds, 13-year-olds, 17-year-olds, and young adults. During the most recent assessment of science learning (1981-82) NAEP also investigated students' attitudes toward science and science education. Some of the performance and attitude results are presented below, with special attention to comparisons between males and females and between whites and minority groups.

At age 9, white males perform at a higher level in science than all other groups (white females, black males and females) by amounts ranging from less than 1 percentage point in the case of white females to more than 14 percentage points in the case of the other groups. By age 13 the gap between white males and each of the other groups has widened to more than 4 percentage points above white females and is 12 to 16 percentage points above the other groups. In assessments of mathematics performance, NAEP found that a very similar situation exists in mathematics.

NAEP also found that blacks and females are less likely than white males to have had science-related experiences. For example, there were large differences between blacks and whites in visiting fairly common places such as forests. Blacks were also less likely to report having seen such science-related

objects as a sprouting seed, the North Star, an animal skeleton, or a fossil. Sex differences were largest for those activities having to do with electricity: males were much more likely than females to have wired together an electric circuit and to have made a magnet using electricity and wire.

The NAEP results showed no important differences in attitudes toward science classes between males and females or blacks and whites at age 9. Most 9-year-olds in each group considered science classes interesting and useful and wished they had more science in school. However, by age 13, attitudes toward science classes were not as favorable in general, and sex and race differences began to appear. Females at both ages 13 and 17 were less positive than their male counterparts in their attitudes toward science classes. Interestingly, while their performance levels were low, blacks at ages 13 and 17 had more positive feelings toward science classes than did whites.

2. Enrollments in High School Science and Mathematics Courses

Studies conducted during the early 1970's found that many fewer females than males were taking higher level mathematics courses in high school. For example, a study of freshmen admitted at Berkeley in fall 1972 found that only 8 percent of the female students had taken 4 years of mathematics, compared to 57 percent of the males.[1]

There are indications that the differences in the numbers of males and females taking mathematics courses are becoming smaller, but there is conflicting evidence about the extent of the improvement. One study found that "among SAT takers, the percentage of girls who have had four or more years of math in high school rose from 37 percent 5 years ago to 43 percent in 1979. That is still, however, far behind boys, 63 percent of whom take math for four years."[2] Data collected by the National Assessment of Educational Progress in 1976-77, on the other hand, found only small differences between the number of males and females taking four years of mathematics in high school--41 and 37 percent, respectively. The NAEP survey included all 17-year-old high school students, not just SAT takers, and that may help explain the very different results.

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[1] Ernest, John. Mathematics and Sex, University of California, Santa Barbara, 1976, p.9.

[2] Westoff, Leslie Aldridge (ed). Focus: Women in Search of Equality, Educational Testing Service, 1979, p. 16.

There is no conflict in the data about black enrollments in high school science and mathematics courses: all findings indicate that black enrollments lag far behind those of whites. For example, NAEP reports that only 24 percent of black 17-year-olds had taken Algebra II compared to 39 percent of white students. Similarly, a study of science enrollments in Florida found that blacks represented 25 percent of the total school enrollments but less than 10 percent of the chemistry and physics enrollments.[3]

3. Career Aspirations

Not too long ago many girls grew up with the goal of becoming full-time wives and mothers. However, female aspirations may be shifting, with more and more young women planning to seek employment when they finish their education. In 1974 NAEP found that only 3 percent of 17-year-old females listed housewife as their first choice and only 9 percent included housewife among their first five choices. Nevertheless, there is still a great deal of sex stereotyping in career aspirations. Forty-one percent of these young women listed teacher, nurse, or clerical worker as first choice.

The same lack of interest on the part of females in traditionally male careers was seen in the results of the 1981-82 NAEP assessment of attitudes toward science. In that survey females at both ages 13 and 17 were less likely than their male counterparts to express interest in science as a career. Similarly, the 1975 Purdue Opinion Panel survey found that only 41 percent of the females compared to 57 percent of the males had ever considered a career in science.[4] A 1979 study of college-bound seniors conducted by the Admissions Testing Program of the College Board found that the extent of the sex differences in intent to study science depended on the particular science field. For example, males and females were about equally likely to express intent to study the biological sciences but only 2 percent of females compared to 19 percent of males indicated an intent to study engineering.

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[3] Ignatz, Milton G. "Low Black Enrollment in Chemistry and Physics Courses," Science Education, 59(4) 471-573, 1975.

[4] "Factors Influencing the Science Career Plans of High School Students," Report of Poll No. 101 of the Purdue Opinion Panel, Purdue University, West Lafayette, IN, 1975.

4. Undergraduate and Graduate School Science Enrollments

The trend is for increasing numbers of women to study science. In 1950, women earned only 12 percent of the bachelor's degrees in science (including social science) and engineering. This proportion had risen to 26 percent by 1970 and to 37 percent by 1982. There is, of course, variation by science field. Nevertheless, as shown in Figure 2, the female share of bachelor's degrees is now at an all-time high for most scientific disciplines. Similarly, there has been an increase in the number of women enrolled in master's and doctoral programs in the sciences. For example, the number of Ph.D's in science and engineering awarded to women almost tripled from 1970 to 1983, with the proportion of these degrees earned by women increasing from 9 percent to 26 percent.

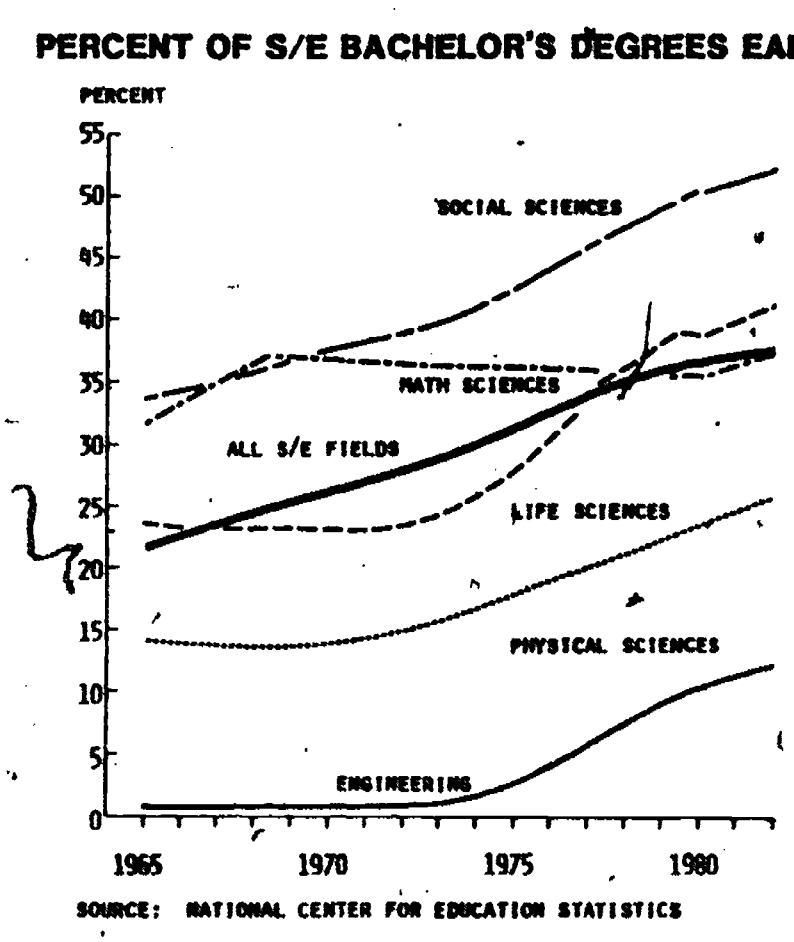

Figure 2. Proportion of Bachelor's Degrees Awarded to Women, 1950-1982.

As is the case with women, the trend is for increasing numbers of minority group members to study science but, with the exception of Asian Americans, they are still generally underrepresented in the sciences. In 1978 minority students represented approximately 18 percent of undergraduate enrollment; their science enrollments ranged from 10 percent in the physical sciences to 17 percent in the biological sciences. Similarly, as can be seen in Figure 3, there has been a rapid rise in minority engineering enrollments in recent years; however, minorities are still greatly underrepresented in the engineering profession.

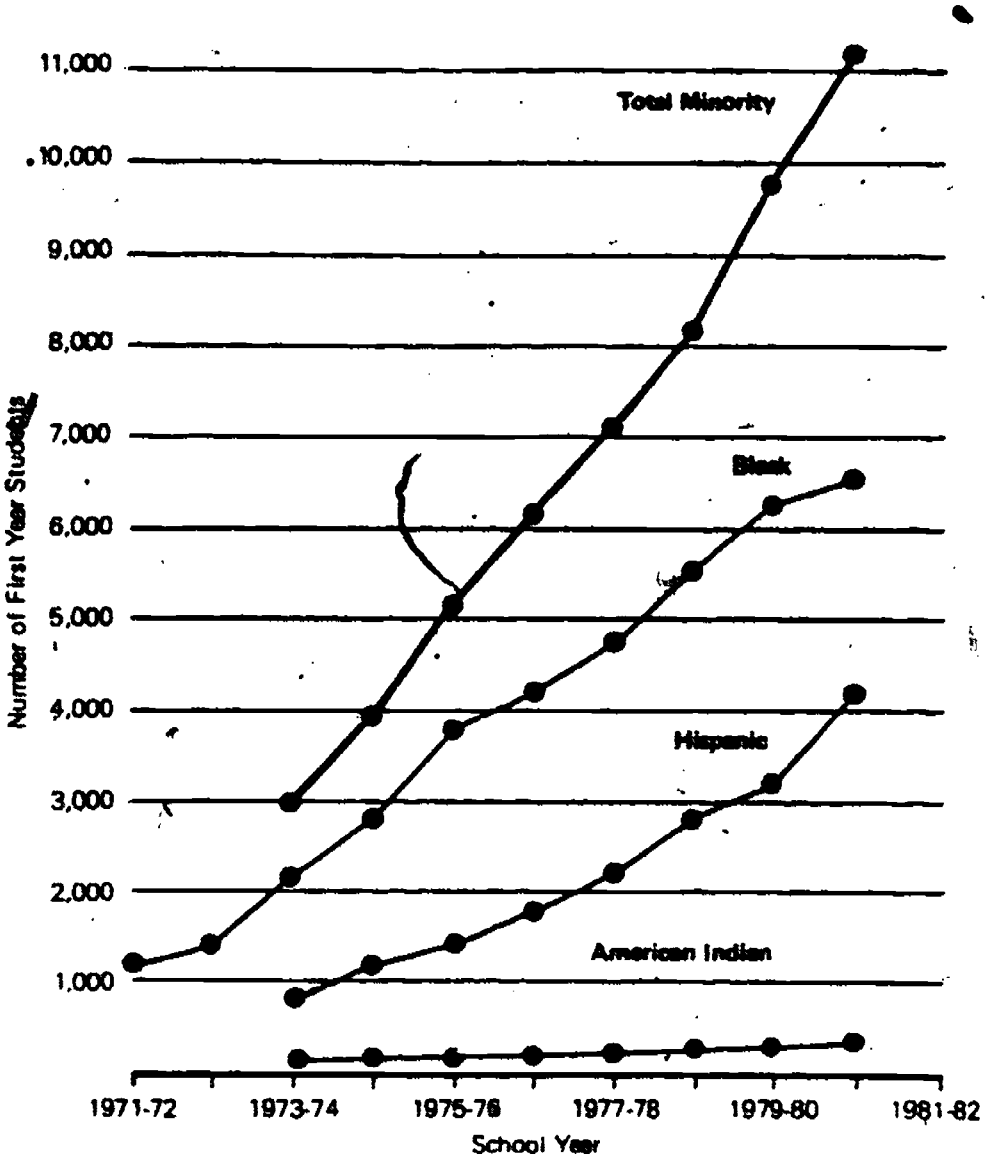

Figure 3. Minority Students Entering Engineering School.

5. Employment in Science Careers

The science graduates in any one year represent only a very small fraction of the people employed in science. In addition, many people who earn degrees in science do not pursue science careers. Therefore, the representation of women and minorities in science careers differs somewhat from that of science enrollments. Nevertheless, the general pattern is the same: the trend is for increased participation of women and minorities in science and engineering fields, but they are still far from being proportionately represented in these fields.

Table 4 shows the percent of females and blacks employed in each of a number of science and engineering fields. Note that once again there is considerable variation in representation depending on field. For example, women represented 44 percent of the 1983 employed labor force and 41 percent of the biological and life scientists but only 6 percent of the engineers. Blacks and Hispanics were proportionately underrepresented in the life and physical sciences and in engineering careers.

Table 4

1983 EMPLOYED SCIENTISTS BY SEX AND BY RACE[a/]

Occupation	Percent of Total		
	Female	Black	Hispanic
Total, All Occupations	44	9	5
Engineers	6	3	2
Aerospace	7	2	2
Chemical	6	3	1
Civil	4	2	3
Electrical and Electronic	6	3	3
Industrial	11	3	2
Mechanical	3	3	1
Computer Systems Analysts and Scientists	28	6	3
Operations and Systems Researchers and Analysts	31	5	2
Natural Scientists	21	3	2
Biological and Life Scientists	41	2	2
Chemists	23	4	1
Geologists	18	1	3

a/ U.S. Department of Labor. Employment and Earnings, March 1984.

6. Minority Women in Science--The Double Bind

a. Background Statistics

Minority women represent a very small part of the total scientific manpower pool. While minority women comprised approximately 12 percent of the United States population in 1979, they were only 1 percent of the doctoral scientists and engineers. By contrast, white males were 40 percent of the population and 77 percent of the doctoral scientists and engineers.

The statistics on minority women in science are meager. Minority women usually are aggregated in the statistics with "women," or with "minorities" and sometimes with both, providing a double count. The data that do exist on minority women are incomplete at best, and often misleading.

Nonetheless, a few facts seem evident:[5]

First, minority women, like majority women, are substantially underrepresented in science and engineering in proportion to their representation in the population, except for Asian Americans.

Second, the unemployment rate for Asian American women scientists and engineers at the doctoral level is appallingly high, and appears to belie the common complaint that "qualified women are not available" for science and engineering positions. This is true, as well, for majority women.

Third, more complete, more accurate and more timely data are needed as a base for developing programs to encourage minority girls to consider careers in science and engineering; to provide support as needed during their training and education, and to produce, ultimately, a critical mass of minority women scientists and engineers that is sufficiently large to provide individual role models for younger women and to demonstrate to the employers of scientists and engineers their valuable contribution to the technological enterprise.

Minority men have advanced faster in the sciences and engineering than have all women in reaching toward salary parity, equal job opportunities and equal advancement. There are too few data to show whether minority women are generally worse off in these areas than majority women, but there is nothing to indicate that they are better off; or as well off as minority men.

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5 Excerpted from an article by Vetter, Betty M. "Minority Women in Science and Engineering" presented at the AAAS Conference of Minority Women Scientists, December 1975.

b. The Double Bind

To study the problems of underrepresentation of minority women in science, the Office of Opportunities in Science of the American Association for the Advancement of Science held a conference of minority women scientists in December 1975. Some of the findings of the conference are presented below.[6]

Minority women represent a disturbingly small part of the total scientific manpower pool, but are a significant component whose needs seem not to have been addressed by existing programs for minorities or women. They have traditionally been excluded because of biases related to both their race or ethnicity and gender, constituting a double bind. Programs for minorities and women have generally been assumed to include minority women, but in fact minority women fall in the cracks between the two. The programs designed to increase the number of women in science have been largely devoted to assisting majority women. The programs developed for minorities in science have mostly been dominated by male scientists. Similarly, the women's science organizations are overwhelmingly white, and the minority science organizations, overwhelmingly male.

The traditional male domination of the science fields has made the attainment of and participation in science careers for women difficult at best. The price of a professional science career is therefore significantly higher for a woman. The demands on women to assume family-related responsibilities are not thought to be compatible with study for or work in these traditionally male professions. The mode of academic preparation and work-style have been developed around traditional majority male lifestyles which differ substantially from the varied life patterns of women. Role stereotyping and sex discrimination add to the personal costs of women who seek to fulfill career goals as scientists, engineers or biomedical professionals.

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6 Excerpted from Malcom, Shirley M., Paul Quick Hall, and Janet Welsh Brown, The Double Bind: The Price of Being a Minority Woman in Science, AAAS Office of Opportunities in Science, 1976. The conference participants included Blacks, Mexican-American, Puerto Rican, and Native American scientists. Asian American scientists, both male and female, are not underrepresented in the sciences and were therefore not included in the conference.

The toll of foregone social and personal activity, highly valued in traditionally defined cultural roles, was for many severe. The scarcity of companions of their own racial or ethnic group and gender, progressively greater as the degree of specialization in science increased, was a source of isolation and loneliness. Majority males and, to a lesser degree, females are not required to bear this burden. The feeling of differentness, which for most of the conferees began to develop as early as their interest in science, was reinforced continually by the recurrent experience of being the only member of their own, or any, minority group, and/or the only woman in so many situations.

The conferees have managed to overcome or avoid the prejudice which pervades a system that refuses even to acknowledge that many nontraditional career options are available to women and minorities. The aborted careers of many of their less fortunate peers testify to the destructiveness of the race and gender-based bias, so deeply rooted in our counseling systems. For instance, one engineer who attended a predominately white high school recalled being advised to apply only to minority colleges that had no engineering programs, without regard to her particular career interest and with no consideration of other alternatives.

There was pressure from school, family and community sources, eventually internalized to some degree, to conform to expected roles, behavior and interests in science and the special demands of science courses often set these women apart from their peers, male and female, of all racial or ethnic groups. The lack of role models, of minority women scientists, within the communities, in books or electronic media, contributed to the communication gap between the science world and the minority communities. Some of the values of the minority cultures were perceived as being in conflict with the priorities of preparing for a science career.

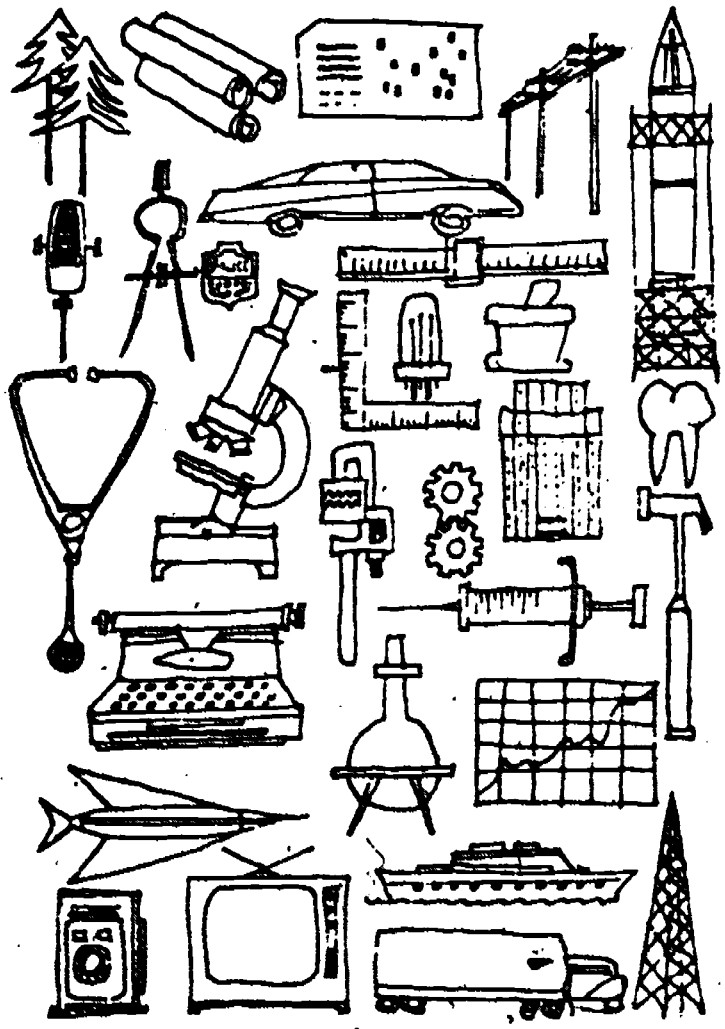
The minority woman scientist is caught in the middle of a difficult situation. She is often being pulled from both sides by women's groups and minority organizations. Minority males and majority females must come to realize that a demand for the minority woman to make a choice places her in an untenable position since she can deny neither the fact of her race or ethnic identity nor her gender. Nor can she avoid the problems associated with both.

c.

The

MATH in HIGH SCHOOL

...you'll need for college



Information for high school
students on preparation in
mathematics for college

The Mathematical Association of America

The

MATH in HIGH SCHOOL

...you'll need for college

Recommendations prepared by the Mathematical Association of America with the cooperation of the National Council of Teachers of Mathematics.

YOUR FUTURE

Have you thought much about it?
Are you interested in a particular field?
Do you realize that you will need math?

When you are planning what courses to take in high school, be sure to think about these questions. Think about your math courses.

You certainly know that to become an engineer or a scientist you will have to take all the high school math you can. Did you know that mathematics is important in other fields, too, including many fields that have been considered "non-mathematical" up to now? Colleges have increased their entrance requirements in mathematics for programs that lead into these fields. Keep this in mind.

Here are some fields that need

MORE THAN TWO YEARS

of high school mathematics:

Agriculture	Food Science
Architecture	Geography
Biology	Nursing
Business	Physical Education
Dental hygiene	Pre-medicine
Economics	Pre-pharmacy
Elementary Education	Psychology

The whole list is even longer.

What if you don't know right now what your career will be? Be sure you take enough high school math to keep your options open.

It is particularly important if you are a woman to keep your options open by taking enough math courses. Women are now entering many careers which were formerly closed to them. Years from now you may be glad you took those extra math courses.

WHY?

What happens when you don't take enough high school math? Your whole college program may be delayed while you take remedial courses (and pay tuition for them besides!) Your graduation may be postponed for a whole year or even longer.

HOW MUCH?

Here are some careers that require more than one year of high school math. Universities differ in specific requirements, of course. However, if you take the amount of math listed here for the career of your choice you will probably be adequately prepared in mathematics to begin a college program in that field.

Mark those programs which interest you.

For a program in	take this many years of high school math
__ Agriculture:	
__ Agricultural economics	3
__ Entomology	3
__ Environmental sciences	4
__ Food sciences	3
__ Forestry	3
__ Genetics	3
__ Landscape architecture	3
__ Plant pathology	3
__ Rural sociology	3
__ Wildlife ecology	3
__ Other areas of agriculture	2
__ Architecture	3
__ Art	2
__ Business:	
__ Accounting	3
__ Economics	4
__ Management	4
__ Communications	2
__ Education:	
__ Elementary	3
__ Child Development and Preschool	3
__ Engineering	4
__ History	2
__ Language and Literature	2
__ Law	3

For a program in	take this many years of high school math
__ Life sciences:	
__ Bacteriology	4
__ Biochemistry	4
__ Biology	4
__ Linguistics	3
__ Mathematical sciences:	
__ Mathematics	4
__ Statistics	4
__ Actuarial sciences	4
__ Computer science	4
__ Medicine:	
__ Allied medicine	3
__ Dental hygiene	3
__ Dentistry	4
__ Medical technology	4
__ Nursing	3
__ Optometry	4
__ Physical therapy	3
__ Pre-medicine	4
__ Public health	3
__ Music	2
__ Pharmacy	4
__ Philosophy	2
__ Physical sciences:	
__ Astronomy	4
__ Chemistry	4
__ Geology	4
__ Physics	4
__ Social sciences:	
__ Anthropology	2
__ Asian studies	2
__ Black studies	3
__ Geography	3
__ Political science	3
__ Psychology	4
__ Social welfare	2
__ Sociology	3
__ Theater	2

WHAT?

On the preceding pages we have suggested a certain number of years of high school mathematics for each career. Naturally, most important is what mathematics you study. Here is what we mean by 2, 3, and 4 years of high school math.

2 YEARS of high school mathematics means:

1 year of **ALGEBRA** to include, in addition to the basic topics:

linear equations	integer exponents
systems of equations	special products and factoring

1 year of **GEOMETRY** to include:

basic properties of geometric figures in two and three dimensions, applications of formulas for perimeters, areas, volumes, and surface areas

3 YEARS of high school mathematics means:

a 1st year of **ALGEBRA** as above
1 year of **GEOMETRY** as above

plus

a 2nd year of **ALGEBRA** to include, in addition to the basic topics

quadratic equations (including the method of completing the squares)	logarithms
	exponential and logarithmic equations
	arithmetic and geometric sequences
polynomial functions	the binomial theorem
rational expressions	infinite geometric series
graphs of functions	linear and quadratic inequalities
fractional exponents	
radicals	

4 YEARS of high school mathematics means:

a 1st year of **ALGEBRA** as above
1 year of **GEOMETRY** as above
a 2nd year of **ALGEBRA** as above

plus

1 year of **PRECALCULUS MATHEMATICS** including the study of elementary functions and the equivalent of one semester of trigonometry. Topics in trigonometry should include:

trigonometric functions and their graphs	trigonometric identities and equations
degree and radian measures	inverse trigonometric functions and their graphs

If you can take additional math courses,

the following offer valuable preparation for many college programs:

PROBABILITY and STATISTICS
COMPUTER PROGRAMMING

A FINAL WORD

Here's a suggestion: Plan to take math in your senior year. Then it will be fresh in your mind when you are getting started in college.

The information in this pamphlet is to help you plan. Today more fields are using more math than ever before. Your career will extend over many years.
THE TIME TO PREPARE FOR IT IS NOW!

I'm not out to convince anyone that calculus, or even algebra and geometry, are necessities in the hotel business. But I will argue long and loud that they are not useless ornaments pinned onto an average man's education. For me, at any rate, the ability to formulate quickly, to resolve any problem into its simplest, clearest form, has been exceedingly useful. It is true that you do not use algebraic formulae but in those three small brick buildings at Socorro I found higher mathematics the best possible exercise for developing the mental muscles necessary to this process.

In later years, I was to be faced with large financial problems, enormous business deals with as many ramifications as an octopus has arms, where bankers, lawyers, consultants, all threw in their particular bit of information. It is always necessary to listen carefully to the powwow, but in the end someone has to put them all together, see the actual problem for what it is, and make a decision—come up with an answer.

A thorough training in the mental disciplines of mathematics precludes any tendency to be fuzzy, to be misled by red herrings, and I can only believe that my two years at the School of Mines helped me to see quickly what the actual problem was – and where the problem is, the answer is. Any time you have two times two and *know* it, you are bound to have four.

From the book, BE MY GUEST
by Conrad Hilton.

Published by Prentice-Hall, Inc.,
Englewood Cliffs, New Jersey

Additional copies in limited quantity may be requested from the Mathematical Association of America, 1529 18th Street, N.W., Washington, D.C. 20036

February, 1978

D. Definitions of Selected Science and Engineering Fields*

1. Life Sciences

AGRONOMY

This branch of the life sciences is concerned with the mass development of plants. Agronomists seek to improve the quality and yield of crops by developing new growth methods and by controlling disease, pests, and weeds. They also analyze soils to determine ways to increase acreage yields and decrease soil erosion.

ANATOMY

Anatomists study the structure of organisms, from cell structure to the formation of tissues and organs. Many specialize in human anatomy. Research methods may entail dissections with the aid of an electron microscope.

BIOCHEMISTRY

Biochemists study the chemical composition and behavior of living things. Their work is vital to the understanding of the basic functions of living things, often leading to the discovery of the effects of substances such as food, hormones, and drugs on various organisms.

BOTANY

Life scientists dealing with plants are called botanists. Some study all aspects of plant life, while others work in specific areas such as identifying and classifying plants or studying the structure of plants and plant cells. Some botanists concentrate on the causes and cures of plant diseases.

ECOLOGY

Ecologists study the relationships among organisms and their environments. They are interested in the effects on organisms of environmental influences such as rainfall, temperature, and pollution.

EMBRYOLOGY

Embryologists study the development of organisms from a fertilized egg through the hatching process or gestation period. They investigate the causes of healthy and abnormal development in organisms.

* Adapted from the Occupational Outlook Handbook, 1982-83.

1. Life Sciences (continued)

HORTICULTURE

Horticulturists work with orchards and garden plants such as fruit and nut trees, vegetables, and flowers. They seek to improve plant culture methods for the beautification of communities, homes, parks, and other areas as well as for increasing crop quality and yield.

MICROBIOLOGY

Microbiologists investigate the growth and characteristics of microscopic organisms such as bacteria, viruses, and molds. Medical microbiologists are concerned with problems such as the relationship between bacteria and disease or the effect of antibiotics on bacteria.

PATHOLOGY

Pathologists specialize in the effects of diseases, parasites, and insects on human cells, tissues, and organs. Others may investigage genetic variations caused by drugs.

PHARMACOLOGY

Pharmacologists conduct tests on animals such as rats, guinea pigs, and monkeys to determine the effects of drugs and other substances.

ZOOLOGY

Zoologists concentrate on animal life--its origin, behavior, and life processes. Some conduct experimental studies with live animals and others examine dissected animals in laboratories. Zoologists are usually identified by the animal group studied, such as ornithologists (birds), entomologists (insects), and mammalogists (mammals). Animal husbandry specialists research the breeding, feeding, and diseases of domestic farm animals.

2. Physical and Earth Sciences

ASTRONOMY

Astronomers seek answers to questions about the fundamental nature of the universe such as its origin and history and the evolution of our solar system. They use the principles of physics and mathematics to study the behavior of matter and energy in distant galaxies.

CHEMISTRY

Analytical chemists determine the structure, composition, and nature of substances, and develop new techniques. One example of this type of work was the analysis of moon rocks by an international team of chemists.

2. Physical and Earth Sciences (continued)

Inorganic chemists study compounds other than those which contain carbon. They may, for example, develop materials to use in solid state electronic components.

Organic chemists at one time studied the chemistry of living things, but this area has been broadened to include all carbon compounds. When combined with other elements, carbon forms an enormous number of different substances. Many modern commercial products such as plastics and other synthetics have resulted from the work of organic chemists.

GEOLOGY

Geologists study the structure, composition, and history of the earth's crust. They identify rocks and minerals; search for oil, natural gas, and solid fuels; give warnings of natural disasters such as earthquakes; and advise companies about the suitability of building sites.

METEOROLOGY

Meteorology is the study of the atmosphere. Meteorologists who specialize in forecasting weather study current weather information, such as air pressure, temperature, humidity, and wind velocity, in order to make short- and long-range predictions.

OCEANOGRAPHY

Oceanographers apply principles and techniques of natural science, mathematics, and engineering to study oceans. Their research not only extends basic scientific knowledge, but also helps develop practical methods for forecasting weather, developing fisheries, mining ocean resources, and improving national defense.

PHYSICS

Physicists develop theories that describe the fundamental forces and laws of nature, including such phenomena as gravity, electromagnetism and nuclear interaction. In recent years physicists have contributed to scientific progress in such areas as nuclear energy, electronics, communications, aerospace, and medical instrumentation.

3. Mathematics and Related Sciences

COMPUTER SCIENCE

Computer scientists design systems for processing information. They also write instructions and translate them into machine-readable language. Systems analysts plan efficient methods of processing data and handling the results. Computer programmers take the problem descriptions prepared by the systems analysts and write detailed instructions for processing the data using one of the languages developed especially for computers.

3. Mathematics and Related Sciences (continued)

MATHEMATICS

Mathematicians develop new principles and new relationships between existing principles of mathematics. Applied mathematicians use mathematics to develop theories, techniques and approaches to solve practical problems, e.g., launching earth satellites.

STATISTICS

Statisticians devise, carry out, and interpret the numerical results of surveys and experiments. Often statisticians are able to obtain accurate information about a large group of people or things by surveying a small sample of the group. They also use statistical techniques to predict population growth or economic conditions, develop quality control tests for manufactured products, and provide information for managers to use in making decisions.

4. Engineering

AEROSPACE ENGINEERING

Aerospace engineers design, develop, test, and help produce commercial and military aircraft, missiles, and spacecraft. They play an important role in advancing the state of technology in commercial aviation, defense systems, and space exploration.

AGRICULTURAL ENGINEERING

Agricultural engineers design machinery and equipment, and develop methods to improve efficiency in the production, processing, and distribution of food and other agricultural products. They also are concerned with conservation and management of energy, soil, and water resources.

BIOMEDICAL ENGINEERING

Biomedical engineers use engineering principles to solve medical and health-related problems. Many do research, along with life scientists, chemists, and members of the medical profession, on the engineering aspects of the biological systems of man and animals. Some design and develop medical instruments and devices including artificial hearts and kidneys, lasers for surgery, and pacemakers that regulate the heartbeat. Other biomedical engineers adapt computers to medical science and design and build systems to modernize laboratory, hospital, and clinical procedures.

4. Engineering (continued)

CERAMIC ENGINEERING

Ceramic engineers develop new ceramic materials and methods for making ceramic materials into useful products. Although to some the word ceramics means pottery, ceramics actually include all non-metallic, inorganic materials which require the use of high temperature in their processing. Thus, ceramic engineers may work on diverse products such as glassware, heat-resistant materials for furnaces, electronic components, and nuclear reactors.

CHEMICAL ENGINEERING

Chemical engineers are involved in many phases of the production of chemicals and chemical products. They design equipment and chemical plants as well as determine methods of manufacturing the product. Often, they design and operate pilot plants to test their work and develop chemical processes such as those to remove chemical contaminants from waste materials.

CIVIL ENGINEERING

Civil engineers, who work in the oldest branch of the engineering profession, design and supervise the construction of roads, harbors, airports, tunnels, bridges, water supply and sewage systems, and buildings. Major specialities within civil engineering are structural, hydraulic, environmental (sanitary), transportation (including highways and railways), urban planning, and soil mechnics.

ELECTRICAL ENGINEERING

Electrical engineers design, develop, test, and supervise the manufacture of electrical and electronic equipment. Electrical engineers also design and operate facilities for generating and distributing electric power. Electrical engineers generally specialize in a major area--such as integrated circuits, computers, or communications--or in a subdivision of these areas--microwave communication, for example. Electrical engineers design new products, specify their uses, and write performance requirements and maintenance schedules. They also test equipment, solve operating problems, and estimate the time and cost of engineering projects.

4. Engineering (continued)

INDUSTRIAL ENGINEERING

Industrial engineers determine the most effective ways for an organization to use the basic factors of production--people, machines, and materials. They are more concerned with people and methods of business organization than are engineers in other specialties. To solve organizational, production, and related problems most efficiently, industrial engineers design data processing systems and apply mathematical concepts. They also develop management control systems to aid in financial planning and cost analysis, design production planning and control systems to coordinate activities and control product quality, and design or improve systems for the physical distribution of goods and services. Industrial engineers also conduct plant location surveys, develop wage and salary administration systems, and construct job evaluation programs.

MECHANICAL ENGINEERING

Mechanical engineers are concerned with the production, transmission, and use of power. They design and develop machines such as internal combustion engines, steam and gas turbines, and jet and rocket engines. They also design and develop many machines that use power such as refrigeration and air-conditioning equipment, elevators, machine tools, printing presses, and steel-rolling mills.

METALLURGICAL ENGINEERING

Metallurgical engineers develop methods to process and convert metals into useful products. For example, metallurgical engineers are working on procedures to recycle metals from scrap automobiles.

MINING ENGINEERING

Mining engineers find, extract, and prepare minerals for commercial use. They design the layouts of open pit and underground mines, supervise the construction of mine shafts and tunnels in underground operations, and devise methods for transporting minerals to processing plants. Many mining engineers work on finding ways to restore the earth's surface when the mining is completed.

PETROLEUM ENGINEERING

Petroleum engineers are mainly involved in exploring and drilling for and producing oil and gas. They work to achieve the maximum profitable recovery of oil and gas from a petroleum reservoir by determining and developing the best and most efficient production methods.

6. LEARNING MORE ABOUT SCIENCE AND ENGINEERING CAREERS

   a. Arranging Visits with Scientists and Engineers

   b. Selected Resources for Learning More About Science and Engineering Careers

   c. Science Careers Program Annotated Bibliography

ARRANGING VISITS WITH SCIENTISTS AND ENGINEERS

A. Arranging to Have Scientists Visit the Class

1. It would be extremely valuable to have at least 1 and preferably several scientists visit your class. It is important for students to have an opportunity to meet and interact with scientists, including women and minority scientists, so they will recognize the inaccuracy of the traditional stereotyped image of scientists. Among the ways you can get names of scientists who might be interested in serving as role models are to contact local industries, ask students or parents for suggestions, or consult the Women Scientists Roster.[1] You might also consider contacting the engineering or science departments of a local college or university to get names of current students or former students now employed locally who might be interested in visiting your class.

2. Contact potential visitors either by telephone or note, explaining that your class is learning about science career opportunities and that you would like them to be able to meet some practicing scientists. Explain that you would like the scientists to describe their current job activities and responsibilities, hopefully demonstrating some job-related activity. They might also talk about how and when they decided on a science career, their education, other jobs they have had, how they combine their careers with other pursuits, and their future career plans--as well as allowing the students to ask questions.

3. Once the scientist agrees to visit the class, send a note confirming the arrangements and describing your class. Include a copy of the "Guidelines for Scientists" and the "Sample Interview Questions" to help the scientist prepare for the visit. A sample note (Sample Letter A) and a copy of the guidelines are attached.

   The "Guidelines for Scientists" provide important information for them to use in preparing their presentations. In addition, as you talk to the scientists keep in mind the following considerations:

   a. Demonstrations

      The simplest demonstrations are often the most effective. Demonstrations should be of interest to students, visible to all students in the rooom, and at a level they can understand. Be sure the scientists resist the temptation to use the occasion to teach the students science or mathematics in an obvious fashion; attempts to do this in earlier programs had disastrous results.

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[1] The national Women Scientists Roster contains name, address, science field, type of employment and race/ethnic background information for approximately 1300 women scientists who have expressed interest in serving as role models. It is available for $5.00 from the National Science Teachers Association, 1742 Connecticut Avenue, NW, Washington, D.C. 20009.

b. Discussion of Life-Style

It is important that students realize that science careers are compatible with many different life styles. You might tell the scientist that it would be preferable if she/he did not advocate any one life style (e.g., women not working while their children are very young, have a full-time housekeeper, or having both the husband and wife employed part-time). Indicate that in previous programs some scientists kept balance by presenting examples of how a number of colleagues handled similar situations differently.

It is especially important that women scientists not foster the image of "superwomen." Students will find it hard to identify with a woman who is an award-winning scientist who at the same time sews all of the clothes her family wears and cooks candlelit dinners for 20 people on a weekly basis. They might easily become discouraged from pursuing a science career because such feats are clearly beyond them.

Be sure to tell the scientist how much time there is for his/her presentation and how you prefer to have that time structured, e.g., first a demonstration, then an oral presentation, then questions and answers.

4. Call the scientist at least 2 days prior to the visit to answer any questions he/she might have, to discuss plans for the presentation, and to make sure that you agree about arrangements, including who will be responsible for providing particular materials and equipment (e.g., a slide projector).

5. Prepare the students for the visit by telling them who will be visiting them and discussing the types of questions they might ask this person. You may wish to use the "Sample Interview Questions" and/or ask the students to generate questions they would like to have answered.

6. Send a thank-you letter to the scientist as soon as possible after the visit. Mention the parts of the presentation which were most beneficial and include student comments as appropriate.

B. Arranging a Visit to a Local Industry

1. Locating Industries to be Visited

Find out the names of companies in your area which employ scientists, perhaps by contacting community organizations such as the Chamber of Commerce, or examining the classified advertisement sections of the local newspapers, or asking students or parents for suggestions.

2. Initial Contacts With the Industry

If you do not know anyone who works for that company begin by contacting the Information Office about the possibility of arranging a visit. If you write a note it may be routed around to several different offices but it should eventually reach the appropriate person. If you call (either initially or if you get no response to your note), be prepared to be referred to a number of different people before you find a person who can let you know if a visit is feasible and work with you in arranging the visit. If the switchboard indicates there is no Information Office you might ask for the Office of Personnel, or Public Affairs, or Education, or Equal Employment Opportunity. If none of these work you might ask to speak to the secretary of the president for referrals.

Keep records of the contacts you have made and their results so that you and other teachers will be able to more easily arrange visits in the future.

3. Arranging the Visit

Be sure that you and your industry contact person discuss the plans for the visit and are in complete agreement about the details:

a. Date and time of visit
b. Purposes of the visit
c. Subject and grade level of the group
d. Size of group
e. Length of tour
f. Activities to be conducted

You may wish to visit the industry prior to the class visit to see the site, meet the contact person, and confirm details of the visit. Such a visit can help ensure that the students' visit runs smoothly. Whether or not you visit the company ahead of time, send a letter to the contact person to confirm details of the visit. (See attached Sample Letter B.)

4. Preparations for the Visit

Arrange necessary transportation and obtain parental and school permission for the trip. Prepare the students for the visit by discussing what the company does and what the students will see and having them read any brochures provided by the company. Have the students prepare questions they would like to ask the scientists and engineers. (These may need to be approved by the company; it would be a good idea to send the questions to the contact person ahead of time and find out if students may ask questions during the tour or, alternatively, during a question and answer period immediately after the tour.)

5. Follow-up to the Visit

Send a thank-you letter to the contact person with a copy to the company president. Mention the parts of the visit which were most beneficial and include your own and students' suggestions for improving future visits. You might also file a copy of the letter with the science department chairperson and/or the career counselor to assist teachers in arranging future visits.

SAMPLE LETTER A

Confirmation Letter

to Prospective Visiting Scientist

Kipling Elementary School
76 Bedford Drive
Denver, CO 97370

Ms. Sandra Gray
Chemicals Unlimited
60 Garden Street
Madison, WI 53706

Dear Ms. Gray:

Thank you for agreeing to visit our class on Tuesday, October 9 from 2:00 p.m to 2:50 p.m. I will plan to meet you in the principal's office at 1:50 p.m.

As I mentioned, this is a fifth grade class with 26 students. We have already studied about careers in the biological sciences and are now beginning our study of careers in the physical sciences; we will then move on to mathematics and computer sciences and engineering. You will be our second visitor in the series; the previous visitor, a biologist for a drug company, demonstrated the way she studies the effect of drugs on rats. The students were also very interested in hearing about the barriers she had encountered as a black woman entering a field which had traditionally been dominated by white males.

I am enclosing a copy of the "Guidelines for Scientists" which should help you in preparing for your visit. I will call you a few days before your visit so we can discuss plans for your presentations. Feel free to call me either at school (555-1234) or at home (555-9876) if you would like to discuss your visit with me prior to that time.

I appreciate your willingness to serve as a role model for my students and am looking forward to your visit.

Sincerely,

Thomas Anderson

SAMPLE LETTER B

Confirmation Letter to

Industry Contact Person

Belvoir Middle School
335 North Chelsea Street
Cleveland, Ohio 44117

Ms. Jane Powell
ABC Corporation
1214 Braxton Boulevard
Cleveland, OH 44118

Dear Ms. Powell:

It was a pleasure to talk with you yesterday to make arrangements for our visit to the ABC Corporation on Wednesday, November 10, 1980. As I mentioned, there will be 12 sixth grade students (and 2 adults) on the visit; we hope the visit will show them that the science and mathematics they are learning in school are relevant to careers they may wish to pursue.

I would appreciate it if you would send me brochures or other material about the ABC Corporation that students can read in preparation for our visit.

I can be reached at school (555-1234) or at home (555-9876) if you need to contact me for any reason.

Thank you very much for your help. We are looking forward to our visit.

Sincerely,

Cathy Young

Sample Interview Questions

1. ~~When you~~ were young, what careers did you think you might choose?

2. How did you get where you are now?

   Did anyone encourage you to pursue this career?
   Discourage you?
   What educational background prepared you for this job?
   Have you experienced any obstacles in pursuing your career?

3. What do you do in your job?

   How much of your work is done alone? with other people? with technical equipment?
   Does your job involve communications skills? math skills?
   Do you supervise others?
   Can you describe a typical day?

4. What is the most satisfying part of your job? the most frustrating?

5. How does your job fit with your other interests?

   What are your hobbies and leisure time activities?
   Are you married?
   Do you have children?

6. What career plans do you have for the future?

7. What kind of person would enjoy doing your job?

8. What kind of person would not like to do your work?

9. What advice would you give to others interested in pursuing a science or engineering career?

GUIDELINES FOR SCIENTISTS AND ENGINEERS PREPARING TO VISIT CLASSES[1]

A major purpose of having students meet scientists is to show them that scientists are real people, the vast majority of whom do not fit the stereotyped image of the bespectacled, white coated "mad scientist." By showing students a diversity of scientists, including women, minority and handicapped scientists, we hope to illustrate that science careers are appropriate pursuits for all groups of people. The individual's interests and abilities, not sex or race, should determine his or her career choice. In addition to having scientists visit their class, students are learning about the diversity of scientists and science careers through the use of a filmstrip presentation and posters of "typical" scientists.

In preparing your presentation, consider the following suggestions.

1. Be prepared to talk to the students about various aspects of your career and your life. If possible include a demonstration or materials to illustrate some job-related activity.

   Previous programs have found that scientists who use such "show and tell" devices generally have an easier time motivating the students. Among the demonstrations which have been used effectively: An engineer assembled a miniature water treatment system and showed how it removed minerals from hard water. Another used a portable air monitoring device to determine levels of various chemicals in the school. A chemist brought photographic plates and developed them. A mathematician showed how the "Golden Rectangle" has been used in great works of art over the centuries. An environmental scientist brought a set of line drawings which illustrated how diseases are spread and discussed how her work in sanitation control helped prevent this spread. A computer scientist brought along both a slide rule and a mini-computer; although she could not hook up the computer, it served as an effective prop for her discussion about emerging careers.

   A number of visiting scientists have used slides to demonstrate aspects of their jobs, while others have shown slides of people with whom they work. This latter approach was particularly effective since it gave the scientists an opportunity to show examples of a number of different jobs which require different skills and varying levels of education. They were also able to show scientists (colleagues) with differing personal situations, and women scientists working with (and sometimes supervising) men as well as other women.

[1] These guidelines are adapted from those used in the Visiting Women Scientists Program which was conducted by the Research Triangle Institute under contract to the National Science Foundation. In that program, 90 women scientists used the guidelines in preparing for visits to 250 schools across the United States.

2. In addition to describing your current job activities and responsibilities, you should plan to discuss other aspects of your career and your life. These might include:

   1. Your career development--when you decided upon a science career, who influenced you, who tried to dissuade you, your education, jobs you've held, problems you've encountered and how you've solved them.

   2. How you've combined your career with other pursuits (e.g., family, social, community, leisure). If you're married, how does your spouse feel about your career? How do you and your spouse divide up housekeeping responsibilities? Have you had to decide what to do if one of you is offered a position in another area of the country? If you have children, how are family responsibilities handled?

   3. A typical day. In preparation for their visits some scientists kept a brief diary of their activities both on and off the job for an entire day and then discussed it with the students. This proved to be a very effective device for showing the students that scientists are "real people."

3. Your remarks should be presented conversationally, should generally include some anecdotal information, and should include some humor with which the students can relate.

4. Be sure you know how much time is available to you and how you might best break up the time between demonstration, presentation, questions and answers, etc.

SELECTED RESOURCES FOR LEARNING MORE ABOUT SCIENCE AND ENGINEERING CAREERS

A. Exploring Careers

Exploring Careers, published by the U.S. Department of Labor, is a recent career education resource aimed at young people. It attempts to build career awareness by means of descriptions of occupations, questions, student activities, and career games.

The introductory section, entitled "The World of Work and You," includes a discussion of the different reasons people work; an activity to help individual students define and express the relative importance to them of various possible job satisfactions (e.g., working with others, doing creative work, helping others, earning large amounts of money); and a description of the training needed for various types of jobs.

The introduction is followed by a series of 14 chapters, each treating careers within an occupational cluster. Each chapter has descriptions of a number of careers within that cluster including pictures illustrating various aspects of these careers. Detailed profiles of particular individuals provide a more in-depth picture of what it is like on the job in selected careers. Suggested activities are provided for further exploration, as well as a number of games which can be used to help students learn about various careers.

B. The Occupational Outlook Handbook

This "encyclopedia of careers," also published by the U.S. Department of Labor, is available in most school and public libraries. While more advanced than Exploring Careers, it can be used successfully by junior high school students.

The handbook includes information about 850 jobs and more than 30 major industries. In the table of contents, most science, mathematics, and engineering occupations are listed under "Science and Technical Occupations"; computer-related occupations are included with office occupations. The following examples are a small sample of the information that can be obtained in the Occupational Outlook Handbook. The definitions of science and engineering fields included in Section 5 of this book were also drawn from the handbook.

Nature of the Work

- Civil engineers design and supervise the construction of roads, bridges, airports, and buildings.
- Computer systems analysts plan efficient methods of processing data.

Places of Employment

- Most astronomers, mathematicians, and life scientists work in colleges and universities while most statisticians and economists work in private industry or research organizations.

- Nearly one-fifth of all oceanographers work in the Washington, DC metropolitan area.

Training, Qualifications and Advancements

- A bachelor's degree in engineering is the usual requirement for a beginning engineering job.

- A doctoral degree is almost always required for a job as an astronomer or a psychologist.

Job Prospects Through the Mid-1980's

- Engineers will be particularly needed in energy-related activities such as designing energy-saving systems for automobiles and homes.

- The outlook for graduates of computer-related curriculums should be excellent.

- The number of persons who will graduate with advanced degrees in sociology is likely to exceed available job openings.

Salary and Working Conditions

- Biologists with a bachelor's degree and no experience had an average starting salary of $15,200 in private industry in 1981, while the average starting salary for engineering graduates in private industry was $22,400 a year.

- Many engineers work indoors in offices and research laboratories, but others spend a lot of time in factories, mines, construction sites, or other outdoor locations.

Sources of Additional Information

- Lists of schools offering education in forestry are available from the Society of American Forestors, 5400 Grosvenor Lane, Washington, D.C. 20014.

- Information on career opportunities and earnings for chemists is available from the American Chemical Society, 1155 16th Street, NW, Washington, D.C. 20036.

C. Professional Societies

The Occupational Outlook Handbook lists sources of additional information as part of its description of each science and engineering field. Typically these are professional societies such as the National Society of Professional Engineers or industry associations such as the Manufacturing Chemists Associations. There are also professional groups which focus on women or minorities in particular fields; these may be subgroups within a professional society or separate organizations such as the Society of Women Engineers. The Annotated Bibliography included in this program provides ordering information for a number of pamphlets prepared by professional societies. Teachers (and students as well) can write and ask for these particular pamphlets or they can make a more general request for information about science and engineering careers and career opportunities.

D. Industry

Many companies prepare brochures for use in recruiting scientists and engineers; some also prepare pamphlets, posters, and films aimed specifically at pre-college students. Both types of materials often include profiles of scientists and engineers employed by that company and can be very useful sources of information about science careers. Some of the industry materials aimed at young people are described in the Annotated Bibliography. Again, teachers or students can also make more general requests for information about science and engineering careers and career opportunities.

E. Media

Newspapers, magazines, and television programs often contain information about scientists and science careers. Some news magazines such as Time and Newsweek have a separate section devoted to science. Students can be encouraged to be on the lookout for articles and programs about science and engineering careers, and may be asked to bring relevant newspaper and magazine clippings for posting on the bulletin board or inclusion in a class scrapbook on science careers.

F. School Personnel

Some junior high, middle schools, and elementary schools have guidance counselors, career counselors, or both available to assist students in thinking about future careers and how to prepare for them. The school librarian may also have helpful suggestions for sources of information about science careers available in the school or public library. One or more of these people can be invited to talk to a class about the availability of resources for learning about science careers; alternatively teachers can describe the types of assistance available from particular school staff members and encourage individual students, particularly female and minority students, to consult them.

Excerpted from

Exploring Careers

The World of Work and You

The world of work may seem far away right now

School and Work

So far, you've heard a lot about the importance of career exploration. You know that finding out about yourself is the first step. You've discovered that different kinds of jobs suit different people. The right kind of career depends on the person you really are—or want to be.

You've completed the work values exercise. You may have a clearer picture now of your reasons for working—and a better idea of the things about a job that matter to you

The table on personal and job characteristics may have helped you narrow down the occupations to those that appeal to you the most.

Now let's look at another way of exploring careers, one that involves your school subjects. First, decide what your favorite subject is. Then list the subjects that come easily for you. *If you like a subject and do well in it, it's worth investigating occupations that involve that subject.*

We'll use mathematics as an example. (You may have chosen English or science or industrial arts.) Some of the jobs in which you'd use mathematics are written up in this book: Bricklayer, carpenter, plumber, machinist, air traffic controller, medical technologist, biochemist, electrical engineer, architect, computer programmer/systems analyst, computer service technician, bank officer, securities sales worker, and forester. There are stories and activities in *Exploring Careers* for each of these occupations. And these are just a few of the occupations that require either practical or theoretical ability in mathematics. Your teacher or counselor can direct you to more.

Suppose you are uncomfortable and confused in math class and don't like the subject at all. Does that mean you have to rule out a career in construction, or health, or forestry? Not necessarily. But it does require some more digging on your part. You need to be honest with yourself. Is it the subject matter you dislike, or is something else influencing your feelings about math? Is it a particular teacher, for example, or a particular textbook? Or is it your own attitude?

It's up to you, with the aid of your teacher or counselor, to determine just how much ability in mathematics you have. It's important, too, to find out exactly how math is used in the kinds of jobs that interest you. Machinists, for example, need to be good at arithmetic to calculate quickly and make precise measurements. Systems analysts use calculus and must be able to apply mathematical theory to practical problems. Talking to people about their work and asking how they use math on the job should help you determine whether you should seriously consider work that involves the use of math. Or, whether, instead, you should rule it out

You can also *test some of your career ideas by exploring high school subject areas in greater depth.* Say you're good at science and like to build things and work with your hands. You're aware that engineering and drafting are possible career choices. Now is the time to test your

You can test your career ideas by exploring school subjects.

interest in those and related fields. Use class assignments, projects, and science fairs to learn about the kind of work engineers and drafters actually do. If one branch of engineering in particular appeals to you, try to figure out why. Find out what engineering and scientific technicians do, and how their work fits in with that of engineers and scientists. In the Suggested Activities sections in chapter 9, you'll find ideas for things you can do—in school and on your own—to learn more about scientific and technical occupations. While you're at it, investigate the activities in other chapters of the book. With an interest in science, you'd probably find it worthwhile to learn more about the work of a computer programmer/systems analyst (chapter 3), an architect (chapter 14), or a forester (chapter 15).

Perhaps you're deeply interested in consumer issues but don't know quite where that might lead you. Try taking a home economics course and use the opportunity to find out about careers in consumer economics, food and nutrition, or clothing and textiles. Other courses that give you a good chance to explore career interests are art, music, business education, and distributive education.

Table 3 lists subjects taught in many high schools. Opposite each subject, we've listed one or more chapters of *Exploring Careers*. Use this list as a starting point.

Table 3. School Subjects and *Exploring Careers* Chapters

Subject	*Chapter*
Agriculture	Agriculture, Forestry, and Fishery Occupations
Art	Education Occupations Performing Arts, Design, and Communications Occupations
Business education	Agriculture, Forestry, and Fishery Occupations Education Occupations Office Occupations Service Occupations
Distributive education	Sales Occupations
Driver education	Transportation Occupations
Health	Health Occupations Scientific and Technical Occupations
Home economics	Agriculture, Forestry, and Fishery Occupations Education Occupations Service Occupations Social Service Occupations
Industrial arts	Agriculture, Forestry, and Fishery Occupations Construction Occupations Industrial Production Occupations Mechanics and Repairers Performing Arts, Design, and Communications Occupations Scientific and Technical Occupations Service Occupations Transportation Occupations
Language arts	Education Occupations Office Occupations Performing Arts, Design, and Communications Occupations Sales Occupations Service Occupations Social Scientists Social Service Occupations
Mathematics	Agriculture, Forestry, and Fishery Occupations Construction Occupations Health Occupations Industrial Production Occupations Office Occupations Performing Arts, Design, and Communications Occupations Sales Occupations Scientific and Technical Occupations Social Scientists
Music	Education Occupations Performing Arts, Design, and Communications Occupations
Physical education	Construction Occupations Education Occupations Health Occupations Service Occupations
Science	Agriculture, Forestry, and Fishery Occupations Education Occupations Health Occupations Industrial Production Occupations Office Occupations Scientific and Technical Occupations Social Scientists Transportation Occupations
Social studies	Education Occupations Office Occupations Performing Arts, Design, and Communications Occupations Service Occupations Social Scientists Social Service Occupations

Excerpt 2:

Scientific and Technical Occupations

Engineers Put Science to Work

Did you ever stop to think how many plastic items you use every day? At school you use plastic pens and rulers. You may sit at a desk with a plastic top. In the cafeteria you eat from plastic plates and trays. Perhaps the plates and cups in your kitchen at home are plastic, too. You talk on plastic telephones, listen to plastic records, and use plastic sports equipment. Look around, and see if you can count the number of plastic items in the room you're in right now.

Plastics are just one result of the work of engineers. Others include radio and television, automobiles and airplanes, bridges and skyscrapers, ships and submarines, anything electrical . . the list goes on and on. Engineers produced all these things by applying scientific knowledge to everyday problems. In fact, most of the discoveries of modern science would have remained laboratory curiosities if not for engineers.

To do their jobs well, engineers must be creative

What Do Engineers Do?

Engineers begin with a "how to" problem--how to build a bridge, how to increase the output of a factory, or how to turn sunlight into electricity. Like scientists, they do research to find a solution. In designing a supersonic airplane, for example, aeronautical engineers test different airplane shapes in a wind tunnel to see how they behave at high speeds. Such tests help them decide on the best design before actually building the plane. Similarly, civil engineers make models of various bridges to test each design for strength.

Through research, engineers find scientific answers to the "how to" problem. But finding a solution that works is only the beginning. Engineers also must figure out the cost and difficulty of using that solution. Imagine you are a civil engineer designing a subway tunnel for a large

Engineering careers are for people who like to solve problems.

city. You have designed a tunnel that you think would work very well. But you would not have solved the city's problem if your tunnel would cost twice what the city could afford, or if large buildings had to be moved to build it. You have to make sure that your solution to the problem is *economical* and *practical* as well as technically correct.

How do engineers solve problems? They use tools of various kinds, the most important being analytical tools. Analytical tools permit engineers to reshape their problems into manageable forms, and this helps in the search for a solution. Mathematical models are one such analytical tool. The model that an engineer builds is nothing more than a set of equations that describes the problem mathematically. By building a model, an engineer can examine the effects of changes in different parts of the final product.

Engineers also employ equipment of all shapes and sizes for measuring, calculating, and testing. Some devices, such as wind tunnels, serve a very specialized purpose. Others, such as calculators and oscilloscopes, you would find in the laboratories of many kinds of engineers. Some tools remain in the lab; others are used outside, "in the field."

The computer is very important. It can perform calculations that are too long or involved to do by hand. It can handle hundreds of equations at once, so that the engineer can build larger, more complex mathematical models. It can also be used to actually help design whatever the engineer is trying to create.

Engineers rely on one other important tool: Creativity. Unlike math, creativity can't be taught. But good engineers have it and use it to apply science in new, slightly different ways. Although engineers rely heavily on the work of others (such as scientists), they constantly face problems requiring original solutions. They discover, explore, invent, and devise. To do their job well, they must be creative.

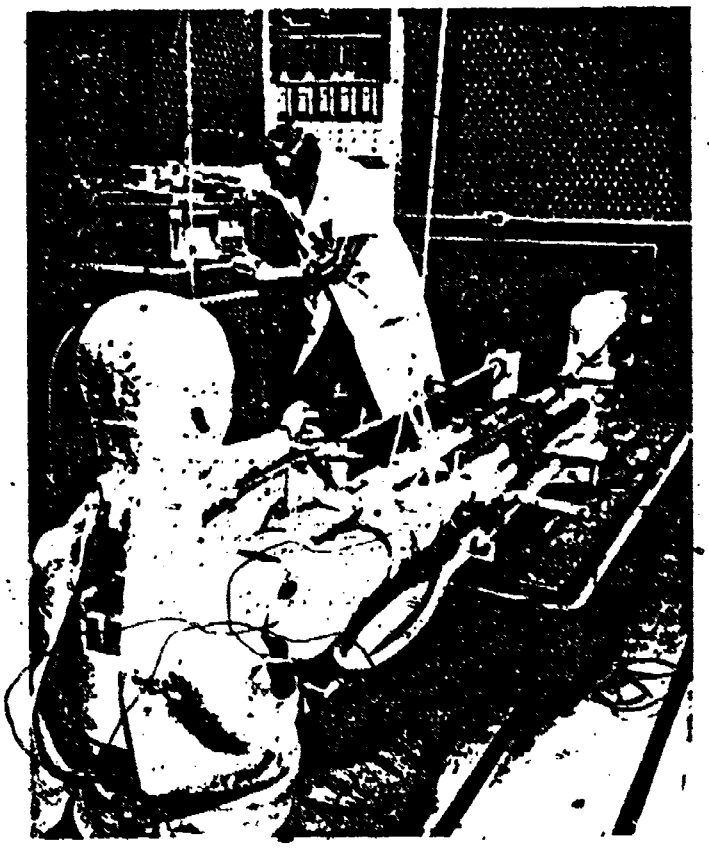
Careers in Engineering

If you decide on a career in engineering, you can choose from a wide variety of fields. They are as diverse as the needs of society. Some types of engineers specialize in a particular industry. *Agricultural engineers*, for example, develop ways to produce, process, and distribute food more efficiently. They might design new harvesting equipment or a better canning process. *Chemical engineers* create plastics, synthetic fabrics, and other new materials through chemical processes. *Mining engineers* locate minerals in the ground, design mines, and make sure they operate safely. They also devise ways to transport the minerals to processing plants. *Petroleum engineers* perform a similar role for oil and gas products.

Other engineers specialize in a particular type of technology. *Mechanical engineers*, one of the largest groups, design and develop machines that produce or use power. Every day we rely on such machines — cars and trucks, refrigerators and TV sets, heaters, air conditioners, factory machines, and countless others. Mechanical engineers help create and produce all these machines as well as gasoline engines, steam turbines, jet engines, and nuclear reactors. Some mechanical engineers specialize by concentrating on a single type of machine (such as a jet engine) while others specialize in a single industry (such as the automobile industry).

Electrical engineers, another large group, design and develop electrical and electronic devices. Anything that uses electricity is electrical. Electronic machines — such as radios, TV's, telephones, and computers — convert electricity into sound, radio waves, or some other form of energy. Like mechanical engineers, electrical engineers work in many different industries and usually specialize in a particular area.

Astronaut Guion S. Bluford, Jr., has a doctoral degree in aerospace engineering.



By studying collisions in the lab, engineers and scientists can design safer automobiles

The world of flight is the world of *aerospace engineers*. They deal with every aspect of aircraft and spacecraft performance, from planning and design to production, testing, and actual use. *Biomedical engineers* use their engineering skills to improve health care in many ways, such as by designing artificial organs or by adapting computers for use in hospitals. *Ceramic engineers* design and develop products from ceramic materials, which are nonmetallic substances processed at high temperatures, such as glass or porcelain. *Metallurgical engineers* cover the broad technology of metals--understanding their properties, extracting them from the earth, refining them, and converting them into finished products.

Other engineers work in construction and a wide variety of industrial activities. *Civil engineers* design large facilities such as highways, railroads, bridges, airports, and water and sewage systems. *Industrial engineers* are "the manager's engineers." They look for ways to make factories and other business operations run more smoothly and efficiently.

We have mentioned only the major categories of engineering. We could not possibly describe each individual specialty. Not only are new ones created all the time, but every engineer's craft is slightly different, depending upon his or her particular training and job. Within the few engineering occupations mentioned there are hundreds of specialties.

SCIENCE CAREERS PROGRAM
ANNOTATED BIBLIOGRAPHY

A. Women and Minorities in the Labor Force

1. Women's B[redacted], U.S. Department of Labor, Washington, DC 20210.

20 Facts on Women Workers highlights important facts about women in the [redacted]bor force, e.g., their numbers, race/ethnic background, family characteristics, salaries, and unemployment levels; suitable for junior high students and above; published annually (free); other publications on women in the labor force also available.

2. Bureau of Labor Statistics, U.S. Department of Labor, Washington, DC 20212.

Two "Employment in Perspective" newsletters (one on minority workers, one on working women) published quarterly (free). Special Labor Force Reports on employment and unemployment, earnings, marital and family characteristics of workers, etc. also available. One such report, Employment and Earnings, March 1982, includes tables a[redacted] narrative concerning the participation of women and minorities in various occupations during 1981.

B. Sex and Race Role Stereotyping

1. The Racism and Sexism Resource Center for Educators, 1841 Broadway, New York, NY 10023.

This organization, formerly called the Council on Interracial Books for Children, has produced a number of excellent books, filmstrips, and lesson plans for classroom use. For example, Racism in the English Language, 1976 (Robert B. Moore), includes an essay describing the problem, and lesson plans for 5 related student activities. The inexpensive ($5.00 for 100) pamphlet "10 Quick Steps to Analyze Textbooks for Sexism and Racism" is an excellent summary of the issues. Write for their free catalog.

2. The Dissemination Center for the Products of the Women's Educational Equity Act Program, c/o Education Development Center, 55 Chapel Street, Newton, MA 02160 (toll free 800-225-3088).

The Federal Women's Educational Equity Act Program has supported the development of a variety of materials including films, filmstrips, books, and entire in-service educational programs. Write or call the Dissemination Center to request a complete catalog (free).

3. Publishers Guidelines for Eliminating Sexism and Racism in Books:

   a. Guidelines for Creating Positive Sexual and Racial Images in Educational Materials, MacMillan Publishing Company, 866 Third Avenue, New York, NY 10022 (free).

   b. Guidelines for Equal Treatment of the Sexes, McGraw-Hill Book Company, 1221 Avenue of the Americas, New York, NY 10022 (free).

   c. Guidelines for Improving the Image of Women in Textbooks, Scott Foresman, and Company, 1900 East Lake Avenue, Glenview, IL 60025 (free).

   d. Guidelines for the Development of Elementary and Secondary Instructional Materials, Holt, Rinehart, and Winston School Department, 383 Madison Avenue, New York, NY 10017 (free).

4. Programs to Combat Stereotyping in Career Choice, 1980, American Institutes for Research, P.O. Box 1113, Palo Alto, CA 94302.

   Describes a number of exemplary programs aimed at counteracting sex, race, and handicap stereotyping. The goals, target population, activities and materials, costs, and evidence of effectiveness of each program are described along with suggestions for replicating the program.

5. Undoing Sex Stereotypes, Research and Resources for Educators, 1976 (Marcia Guttentag and Helen Bray), McGraw-Hill Book Company, 1221 Avenue of the Americas, New York, NY 10022 ($7.95).

   Describes the results of a major field survey and intervention program for changing sex-role stereotyping in children; includes objectives and curriculum materials for early childhood classes, middle grades, and junior high school grades as well as a comprehensive list of resources for teachers.

6. Nonsexist Curricular Materials for Elementary Schools, 1974 (Laurie Olsen Johnson), The Feminist Press, Box 334, Old Westbury, NY 11568 ($6.95).

   Includes background information for teachers and activities for classroom use; also includes a bibliography of suggested reading for students, both fiction and non-fiction.

7. Characters in Textbooks: A Review of the Literature, 1980, United States Commission on Civil Rights, Washington, DC 20425.

   Summarizes the results of a number of studies of the portrayal of minorities and females in textbooks; includes a section on the effects of these portrayals on student attitudes, achievement, and career aspirations.

8. The Report Card--The Cost of Sex Bias in Schools, 1980 (Myra and David Sadker), The Mid-Atlantic Center for Sex Equity, The American University, Foxhall Square Building, Suite 224, 3301 New Mexico Avenue, NW, Washington, DC 20016($5.00 for 50).

Brief pamphlet highlights important research findings related to sex differences and sex discrimination in schools. Unusual in that it deals with negative effects of sex stereotyping on boys as well as on girls.

9. Dick and Jane as Victims, Women on Words and Images, P.O. Box 2163, Princeton, NJ 08540 ($2.50).

This discussion of sexism in children's books includes a checklist which can be used for evaluating textbooks.

C. Data About the Participation of Women and Minorities in Science

1. The National Science Foundation (NSF), 1800 G Street, NW, Washington, DC 20550.

NSF publishes a number of reports which include data about women and minorities.

a. Women and Minorities in Science and Engineering, 1982.

Includes statistics on labor force participation, types of employers, salaries, and unemployment rates of women and minority scientists.

b. Science Education Databook, 1980.

Describes the current status of science education through a series of tables and graphs; includes statistics on attitudes, achievement, degrees, and employment of women and minorities in science.

2. Scientific Manpower Commission, 1776 Massachusetts Avenue, NW, Washington, DC 20036.

a. Professional Women and Minorities--A Manpower Data Resource Service, Second Edition, 1978 with 1980 Supplement (Betty M. Vetter and Eleanor L. Babco), 60.00. Third Edition, 1982 (Betty M. Vetter, Eleanor L. Babco, and Susan Jensen-Fisher), $60.00.

The most comprehensive collections of data on women and minorities in the sciences; may be available in libraries.

b. Opportunities in Science and Engineering, 1980 (Betty M. Vetter).

A sixty-minute slide-tape presentation which highlights the status of women in the sciences; designed for undergraduate women students but also appropriate for teachers and counselors.

3. American Association for the Advancement of Science (AAAS), 1515 Massachusetts Avenue, NW, Washington, DC 20005.

The Office of Opportunities in Science of AAAS serves as a clearinghouse on information concerning women, minorities, and the handicapped in science. Among their publications are the The Double Bind: The Price of Being a Minority Woman in Science, which is the report of a conference of minority women scientists, and Problems and Solutions in the Education, Employment and Personal Choices of Minority Women in Science, which is a report of a survey of these women.

4. National Assessment of Educational Progress (NAEP), Education Commission of the States, 700 Lincoln Tower, 1860 Lincoln Street, Denver, CO 80203.

NAEP surveys the achievement and attitudes of 9-, 13-, and 17-year-old students in a number of subject areas. Reports of particular interest include:

a. Attitudes Toward Science: A Summary of Results from the 1976-77 National Assessment of Science, 1979.

b. Achievement and Participation of Women in Mathematics: An Overview, 1980.

NAEP will supply a complete list of their publications upon request.

D. Role Models

1. Sciente Activity Reader, 1979 (E. Richard Churchill and Linda R. Churchill), J. Weston Walch, Publisher, Portland, ME 04104 ($4.75).

Profiles of 38 famous scientists, including a number of women and minority scientists; each profile is several pages long and is followed by a puzzle to help reinforce what the student has learned. Appropriate for elementary and junior high school students.

2. American Black Scientists and Inventors, 1975 (Edward S. Jenkins, et al.), National Science Teachers Association, 1742 Connecticut Avenue, NW, Washington, DC 20009 ($5.00; 10% discount on orders of 10 or more).

Fairly detailed profiles of 12 Black scientists and inventors. Good source of background information for teachers.

3. Black Contributors to Science and Energy Technology, 1979, U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830 (free).

Half-page profiles and accompanying illustrations of 24 Black scientists and inventors, including a number of men and women who are currently working in industries, universities, and for the government. Appropriate for junior high school and above.

4. Blacks in Science: Astrophysicist to Zoologist, 1977 (Hattie Carwell), Exposition Press, Hicksville, NY 11802.

Brief profiles of a large number of famous and not-so-famous Black scientists and inventors. Black inventors and their inventions are listed in the appendix. Appropriate for junior high and above.

5. Black Americans in Science and Engineering Contributors of Past and Present, 1978 (Eugene Winslow), Afro-Am Publishing Company, 910 South Michigan Avenue, Suite 556, Chicago, IL 60605 ($2.95; quantity discounts available).

Half-page profiles and large illustrations of 27 Black scientists and engineers. Appropriate for grades 4 and above.

6. Seven Black American Scientists, 1970 (Robert C. Hayden), Addisonian Press, Reading, MA 01867.

Lengthy profiles of seven famous Black scientists; appropriate for junior high and above.

7. Black Pioneers of Science and Invention, 1970 (Louis Haber), Harcourt, Brace, and World, Inc., New York, NY.

Lengthy profiles of 14 Black scientists and inventors; appropriate for junior high and above.

8. Hypatia's Sisters: Biographies of Women Scientists--Past and Present, 1976 (Susan Schacher, ed.), Attn. Audra Adelburger, Feminists Northwest, 5038 Nicklas Place, N.E., Seattle, WA 98105 ($2.50).

Includes brief biographies of 17 scientists and a one-sentence description of the notable contributions of approximately 20 additional scientists.

9. Women Pioneers of Science, 1979 (Louis Haber), Harcourt, Brace Jovanovich, New York, NY.

10. American Women of Science, 1955 (Edna Yost), J. B. Lippincott, Philadelphia, PA (Out-of-print but available at many libraries).

Profiles of a number of women who made important contributions to science during the period 1900-1950.

11. Women of Modern Science, 1959 (Edna Yost), Dodd, Mead, and Company, New York, NY (Out-of-print but available at many libraries).

Profiles of a number of women scientists.

12. Asimov's Biographical Encyclopedia of Science and Technology, 1972 (Isaac Asimov), Doubleday & Company, New York, NY.

Profiles of a few women scientists included among the hundreds of entries.

13. Contributions of Women: Science, 1977 (Diane Emberlin), Dillon Press, Minneapolis, MN.

Profiles of six women scientists; appropriate for grades 4 and above.

14. LIFE Special Report: Remarkable American Women, 1776-1976, 1976, Time, Inc. ($2.00).

A number of women scientists are included, along with pictures and biographical information.

15. Saturday's Child, 1973 (Suzanne Seed), Bantam Books, Inc., 666 Fifth Avenue, New York, NY 10019.

Eight of the 36 women who talk about their jobs are in science-related fields; appropriate for grades 4 and above.

16. National Aeronautics and Space Administration, Office of Public Affairs, Lyndon B. Johnson Space Center, Houston, TX 77058.

Upon request NASA will send biographical information about their women and minority astronauts along with large color photographs of the astronauts (free).

17. Expanding Your Horizons in Science and Mathematics (Joanne Koltnow). Distributed by the Education Development Center/WEEA, 55 Chapel Street, Newton, MA 02160 ($2.50) (toll free 800-225-3088).

A handbook for people who plan to conduct conferences for young women interested in new career options; provides detailed suggestions for planning, financing, publicizing, conducting, and evaluating such conferences.

18. Manual on Program Operations for the Visiting Women Scientist Program, 1979, National Technical Information Service, U.S. Department of Commerce, 5825 Port Royal Road, Springfield, VA 22161 ($7.00).

The Visiting Women Scientists Program involved visits by approximately 90 women scientists to 250 high schools across the United States. This manual describes the program and provides information to help other groups conduct similar programs.

19. Women Scientists Roster, 1979 (compiled by Iris R. Weiss and Carol Place), National Science Teachers Association, 1742 Connecticut Avenue, NW, Washington, DC 20009 ($5.00).

Contains information about approximately 1300 women scientists including mailing address, phone number, area of science, type of employment, and race or ethnic/background.

20. Resource Directory of Handicapped Scientists, 1978, Office of Opportunities in Science, American Association for the Advancement of Science, 1776 Massachusetts Avenue, NW, Washington, DC 20036.

Includes information on more than 500 handicapped scientists, including address, phone number, scientific discipline, most recent position, nature of handicap and an indication of willingness to serve as a role model for students.

E. Science Career Exploration Activities

1. How High the Sky? How Far the Moon?, 1979 (Sharon L. Menard). Distributed by the Education Development Center/WEEA, 55 Chapel Street, Newton, MA 02160 ($14.50) (toll free 800-225-3088).

Includes student activities appropriate for a variety of grade levels as well as information about science careers, information about, and taped interviews with, women scientists and a comprehensive bibliography of both fiction and non-fiction books for students.

2. From Dreams to Reality--Adventures in Careers, 1978, Girl Scouts of the U.S.A., 830 Third Avenue and 51st Street, New York, NY 10022 ($2.00).

A career exploration program aimed at girls ages 12-17, includes a series of "career cards" with profiles of women in a variety of careers.

3. Career Oriented Modules to Explore Topics in Science (COMETS), COMETS Order Department, 205 Bailey Hall, Lawrence, KS 66045 ($28.95).

This set of modules with directions for over 100 activities, and 24 biographical profiles of women in science can be used to enhance the career relevance of science and mathematics classes in grades 5-9.

4. Career Education Activities for Subject Area Teachers (Vol. 1: Grades 1 Through 6; Vol. 2: Grades 6 Through 9;, Vol. 3: Grades 9 Through 12)), Abt Books, 55 Wheeler Street, Cambridge, MA 02138 ($18.00 per volume, $50.00 for set).

This manual contains career education activities for teachers of a variety of subjects including mathematics and science. Objectives, materials, and time needed to complete each activity are clearly labeled.

5. Teacher/Counselor Guide to "Is Science a Possible Career for You?", 1978, Research for Better Schools, Publications Office, 444 North Third Street, Philadelphia, PA 19123 (Filmstrip & Guide, $15; Guide, $10; Filmstrip, $7.00).

While developed specifically for use with deaf students, most of the activities are appropriate for all students; includes sections on what people in science do and how a student can find out if she or he wants to pursue a science career. The filmstrip shows the job and extracurricular activities of 6 deaf people in a variety of science careers.

6. Choices, Decisions, Actions, 1978, Attn: Robbie Smith, Corporate Social Policy Department, Standard Oil Company (Indiana), 200 East Randolph Drive, MC 4308, Chicago, IL 60601 (free).

An activity program about careers in engineering and science aimed at students in grades 6 through 9; includes dittomasters for 5 activities and ideas for additional ones.

7. Solving Problems: Engineers at Work, 1979. Free from your local Bell Telephone Company.

Bell system speaker (usually woman or minority engineer) makes presentation regarding women and minority engineers. A kit loaned to the school one week before presentation. Kit includes a filmstrip, activity cards, and profiles of women and minority engineers.

8. What About Engineering? LSR Learning Associates, 4 Newtown Plaza, Plainview, NY 11803 ($17.50; quantity discounts available).

Explores 10 engineering areas; classroom kit includes teacher's guide, 30 student booklets, set of 12 posters for classroom display, and student interest inventory.

9. Mathematics at Work in Society: Opening Career Doors, 1981, Mathematical Association of America, 1529 Eighteenth Street, NW, Washington, DC 20036 (free).

Aimed at students in grades 8 and above. Materials include project book that shows how mathematics is used in a variety of science and non-science careers, and four videotape cassettes on the use of math: "An Actuary--What's That?," "Mathematics in Space," "Mathematics: The Language of Research," "Mathematics: Where Will I Ever Use It?" All materials available on a loan basis but may be copied.

10. Wanted: More Women in Science and Technology, 1981, The Committee on the Status of Women in Physics, American Physical Society, 335 East 45th Street, New York, NY 10017 ($3.00).

Packet includes three pamphlets to help junior high and high school counselors and teachers encourage young women to consider science and engineering careers.

11. Science Career Exploration for Women, 1978 (Walter S. Smith and Kala M. Stroup), National Science Teachers Association, 1742 Connecticut Avenue, NW, Washington, DC 20009 ($5.00).

Aimed at science teachers, counselors, and others who work with young women. The purpose provides tools that can be used to help young talented women students explore science careers.

F. Information About Science Careers

SCIENCE--MULTIPLE FIELDS

1. Occupational Outlook Handbook 1982-83, U.S. Department of Labor Statistics. Order from Superintendent of Documents, U.S. Department of Labor, Room 110, 1371 Peachtree Street, N.E., Atlanta, GA 30367 ($9.00).

This "encyclopedia of careers" provides information about careers in the life sciences, physical sciences, engineering and mathematics, including the natute of the work, places of employment, qualifications needed, earnings, working conditions, and sources of additional information.

2. Exploring Careers, 1979, U.S. Department of Labor. Order from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 (Bulletin #2001; Stock No. 029-001-02224-7, $11.00; reprint on Scientific and Technical Occupations, Bulletin #2001-9, Stock No. 029-001-02234-4, $2.75).

This career education resource is aimed specifically at young people. It attempts to build career awareness by describing a variety of occupations, profiling persons in selected occupations, and providing student activities.

3. U.S. Department of Labor, Bureau of Labor Statistics, 1515 Broadway, Suite 3400, New York, NY 10036.

Free leaflets: "Science and Your Career," "Ecology and Your Career," and "Math and Your Career" describe preparation needed and career opportunities in these fields.

4. I Can Be Anything--Careers and Colleges for Young Women, 1978 (Joyce Slayton Mitchell), College Entrance Examination Board, Princeton, NJ 08540 ($7.95 paperback, $12.95 hardcover).

Describes careers for young women--and certainly all careers are for women. Goes beyond a description of career information and introduces the critical consideration for girls and women: the consideration of life style.

5. I'm Madly in Love With Electricity, 1977 (Nancy Kreinberg), EQUALS, Lawrence Hall of Science, University of California, Berkeley, CA 94720 ($2.00).

Women in engineering, mathematics, physical science, earth science and life science careers provide enthusiastic descriptions of their jobs and life styles; very interesting reading.

6. Women in Science and Technology, 1976, American College Testing Program Publications, P.O. Box 168, Iowa City, IA 52243 ($1.50; quantity discounts).

Excellent booklet describes careers in science and how they can be combined with family life; includes pictures and quotes from women scientists and engineers.

7. Science and Engineering Careers--A Bibliography, 1974, Scientific Manpower Commission, 1776 Massachusetts Avenue, NW, Washington, DC 20036 ($2.00).

Comprehensive bibliography of free and low-cost science career publications.

8. Hi There, I'm Your Exciting Future!, 1981, National Action Council for Minorities in Engineering, Inc., 3 West 35th Street, New York, NY 10001 (free).

Aimed at junior high students. Discusses the high school math, science, and English courses that will enhance future career opportunities.

9. What's It Like to be a Technician, General Electric Company, Educational Communications Program, Fairfield, CT 06431.

Describes various science technology fields. Beautifully illustrated.

ENGINEERING

10. The Accreditation Board for Engineering and Technology (ABET), 345 East 47th Street, New York, NY 10017.

a. Women in Engineering, 1978 (single copies free; $6.00/hundred).

Brief description of the need and role of women in the engineering profession.

b. Minorities in Engineering, 1979 (single copy free; $6.00/hundred).

Description of opportunities for minorities in engineering.

c. Brief pamphlets describing areas of engineering such as civil engineering, automotive engineering, etc. Request general career information ($6.00/hundred).

11. Take It From Us You Can Be an Engineer, General Electric Company, Educational Communications Programs, Fairfield, CT 06431.

Profiles of women and minority engineers; includes excellent pictures.

12. Terry's Trip, Boston Section, Society of Women Engineers; contact Pat Quigley, 52 Poole Circle, Holbrook, MA 02343 for copies ($1.50, quantity discounts).

Excellent for grades K-3; also interesting for 4-6 students.

13. Society of Women Engineers, United Engineering Center, Room 305, 345 East 47th Street, New York, NY 10017.

a. WOMENGINEER, Sara Jane Neustadtl ($.35).

Comprehensive description of opportunities for women in engineering.

b. Women in Technology ($.06).

Description of opportunities for women in technology field.

14. National Action Council for Minorities in Engineering, Inc. (NACME), 3 West 35th Street, New York, NY 10001 ($.50).

a. Engineering a Future, 1977, $.50.

A guide to engineering aimed at parents and counselors of minority students; also extremely useful for teachers.

b. Making It in Engineering, 1975, $.25.

Profiles a number of male and female minority engineers; includes pictures.

c. Engineering a Future--A Guide to Engineering for Parents and Counselors, 1978, $.50.

Career guide for parents, teachers, and counselors. Features descriptions of the work of engineers, preparation needed, how parents and advisors can help.

d. Engineering: What's It All About?, 1977, free.

Comic strip brochure aimed at informing junior high school students about engineering.

15. Quotes From DuPont Engineers, College Relations Manager, DuPont Company, Wilmington, DE 19898 (free).

Women engineers at DuPont describe their work; includes pictures.

16. Engineering as a Profession for Women, 1976, Engineering Manpower Bulletin #29, Engineering Manpower Commission, New York, NY 10017 ($2.00).

Discusses misconceptions, current employment picture, barriers, and problems faced by women in engineering, and also talks about why engineering needs women; appropriate for teachers.

17. Engineering--A Career of Dedication and Responsibility, 1978, National Society of Professional Engineers, 2029 K Street, NW, Washington, DC 20006 (free).

Describes engineering careers and steps to take in preparing for them.

18. Women in Engineering at Kodak (Publication No. CR-114), 1975, Eastman Kodak Company, Literature Department-412 O), Rochester, NY 14650.

Profiles and pictures of women engineers.

19. Co-op Program Coordinator, Office of the Dean, School of Engineering, Purdue University, West Lafayette, IN 47907.

a. Thinking About Engineering

Comments by women engineering students.

b. Women in Engineering

Recruiting brochure; describes engineering career opportunities for women.

20. American Society of Civil Engineers, 345 East 47th Street, NW, New York, NY 10017

a. Is Civil Engineering for You? (single copies free; additional copies $.25 each).

A general description of civil engineering.

b. Brief pamphlets about specific careers in civil engineering, e.g., structural, urban planning ($.05 each).

21. A Career for the Future, American Society of Mechanical Engineers, U[redacted] Engineering Center, 345 East 47th Street, New York, NY

[redacted]escribes careers in mechanical engineering, including how to prepare for these careers; emphasizes opportunities for women in engineering.

22. Industrial Engineering: The Humanized Profession, American Institute of Industrial Engineers, Institute Headquarters, 25 Technology Park/Atlanta, Norcross, GA 30092.

Describes industrial engineering careers and how they help solve problems in pollution, energy, health care, etc.

23. Careers in Electrical/Electronics Engineering, The Institute of Electrical and Electronics Engineers, Inc., Service Center, 445 Hoes Lane; Piscataway, NJ 08854.

Describes the work of electrical engineers and some of the new developments such as laser beams.

24. Careers in Petroleum Engineering, Society of Petroleum Engineers of AIME, 6200 North Central Expressway, Dallas, TX. 75206.

Describes the petroleum industry and the work of petroleum engineers.

25. Minority Engineers in the Chemical Industry, Manufacturing Chemists Association, 1825 Connecticut Avenue, NW, Washington, DC 20009

Profiles and pictures of a number of minority engineers.

LIFE SCIENCES

26. Careers in Biology, Education Department, American Institute of Biological Sciences, 1401 Wilson Boulevard, Arlington, VA 22209 ($.75).

Describes careers in biology and allied disciplines such as the health professions and natural resources management.

27. Microbiology in Your Future, 1977, American Society for Microbiology, 1913 I Street, NW, Washington, DC 20006 ($.50).

Describes a variety of careers for microbiologists.

28. Conservation Careers, National Wildlife Federation, 1412 Sixteenth Street, NW, Washington, DC 20036 (single copy free, additional copies $.15 each).

Describes conservation jobs in industry, goverment, and universities.

29. Careers in Animal Biology, American Society of Zoologist, Box 2739, California Lutheran College, Thousand Oaks, CA 91360.

Describes the variety of opportunities for zoologists in universities, museums, wildlife service, and government agencies.

PHYSICAL SCIENCES

30. American Chemical Society, Department of Educational Activities, 1155 Sixteenth Street, NW, Washington, DC 20036.

    a. Careers in Chemistry--Opportunities for Minorities ($.20).

       Describes career opportunities in chemistry; includes profiles of male and female minority chemists.

    b. Careers in Chemistry Today ($.20).

       Describes where chemists work; also provides data on salaries, employment outlook.

31. Women in Physics, American Physical Society, Committee on the Status of Women in Physics, 335 East 45th Street, New York, NY 10017 (single copy free; multiple copies $.50 each).

    Describes career opportunities in physics; provides information on combining marriage and a career; includes profiles and pictures of women physicists.

32. Physics--A Career for You?, American Institute of Physics, 335 East 45th Street, New York, NY 10017 (single copy free; additional copies $.40 each).

    Describes career opportunities in physics.

33. American Geological Institute, 5205 Leesburg Pike, Falls Church, VA 22041.

    a. Geology, Science and Profession ($1.00).

       Describes careers in geology and the preparation needed for them.

    b. Brochures on a number of different specializations within geology.

34. Careers in Geology, American Association of Petroleum Geologists, P.O. Box 979, Tulsa, OK 74101 (up to ten copies free; additional copies $.135 each).

    Describes career opportunities in geology.

35. Careers in Exploration Geophysics, Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, OK 74101 (up to five copies free; additional copies $.50 each).

    Describes entry level jobs and advancement oportunities in geophysics careers.

36. A Career in Astronomy, Attn.: Dr. Harry Shipman, The Education Officer, American Astronomical Society, Physics Department, University of Delaware, Newark, DE 19711 ($.25).

Describes careers in astronomy and preparation needed for these careers.

37. Space for Women, 1975, Smithsonian Astrophysical Observatory, Publication Department, 60 Garden Street, Cambridge, MA 02138 (free).

Report of a symposium for women on careers in astronomy, astrophysics, and earth and planetary sciences; describes career opportunities in these fields; includes a discussion of combining career and family.

38. The Challenge of Meteorology, 1977, American Meteorological Society, 45 Beacon Street, Boston, MA 02108 ($.50).

Describes careers in meteorology; also discusses how to combine the study of meteorology with other disciplines for interesting career opportunities.

MATHEMATICS AND COMPUTER SCIENCE

39. The Math in High School You'll Need for College, Mathematical Association of America, 1225 Connecticut Avenue, NW, Washington, DC 20036 (5 copies free; additional copies $.20 each).

Provides information about the number and types of mathematics courses students should take in preparation for various careers.

40. Careers in Statistics, Committee of Presidents of Statistical Societies, c/o American Statistical Association, 806 15th Street, NW, Suite 640, Washington, DC 20005 (free).

Describes career opportunities in statistics.

41. Data Processing Careers at the Traveler's, Attn. Al Penland, Assistant Director of Employment, Traveler's Company, One Tower Square, Hartford, CT 06115 (free).

Provides information on data processing career opportunities.

42. What's It Like to Work With Computers, General Electric Company, Educational Communications Program, Fairfield, CT 06431.

Describes what computers do and computer-related job opportunities.

G. Non-Print Materials About Science Careers

FILMS

1. "Science: Woman's Work," 1982 (free loan). Distributed by Modern Talking Picture Service, Film Scheduling Department, 5000 Park Street North, St. Petersburg, FL 33709.

Women scientists emphasize the skills needed in pursuing a science career and offer encouragement and advice for those considering a science career.

2. "Sandra, Zella, Dee, and Claire: Four Women in Science" (color). (19 minutes, 16mm color film, $120.00 purchase or $8.00 three-day rental; color videotape cassette, 3/4", $32.00 purchase or $5.00 three-day rental). Distributed by Education Development Center/WEEA, 55 Chapel Street, Newton, MA 02160 (toll free 800-225-3088).

Follows an astronomer, a mechanical engineer, a veterinarian, and a laser physicist; includes discussions about career opportunities, life-style discussions, etc.

3. "Conceive It, Believe It, Achieve It" (28 minutes, color; free on a ten-day loan basis). Attn.: Robbie Smith, Corporate Social Policy Department, Standard Oil Company (Indiana), 200 East Randolph Drive, MC 4308, Chicago, IL 60601.

Goes behind the scenes of the Chicago High School Science Fair; shows how the combined efforts of parents, teachers, and the business community have helped a number of minority students. Includes a discussion with the Reverend Jesse Jackson.

4. "The Real McCoy," 1980 (free on 10-day loan, minimum handling charge). Distributed by National Action Council for Minorities in Engineering, Inc. (NACME), 3 West 35th Street, New York, NY 10001.

Discusses the achievements of past and present Black scientists and inventors.

5. "Keep the Door Open..." (18 minutes, color). Review copy sent upon request. Distributed by Sandia Laboratories, ORG 3153, Box 5800, Albuquerque, NM 87185.

A discussion by 13 professional women of the problems involved in combining careers with marriage and a family, stereotypes and obstacles to be overcome, along with the joys experienced in a career. Women portrayed represent such areas as chemistry, law, zoology, engineering, math, and biology.

6. "Women's Work: Engineering," 1975 (26 minutes, 16mm film or color videotape; Catalog #25-0001, $391.00 purchase or $52.00 five-day rental). MIT, Center for Advanced Engineering Study, 77 Massachusetts Avenue, Room 9-234, Cambridge, MA 02139.

Explores the experience of being an engineer and a woman--through the professional and personal lives of students and working engineers.

7. "The Women's Prejudice Film" (18 minutes, color, $345.00 purchase or $34.50 for five-day rental). Review copy sent upon request. Distributed by BARR Films, 3490 East Foothill, Pasadena, CA 91107.

Specific prejudices and stereotypes are voiced by both men and women. Included are short profiles of women in traditionally male careers. The film states that women must overcome their own self doubts and worries as well as wade through male chauvinism. While this film is not specific to science, it is a particularly good consciousness-raising device for females who have not considered problems of discrimination against working women.

FILMSTRIPS, SLIDES, CASSETTES

8. "Challenging Careers: New Opportunities for Women" ($149.50 for set of 4; contact Judy Piazza for prices on separate components). Guidance Associates, communications Park Publishing Group, Mount Kisco, NY 10549 (toll free 800-431-1242).

Set of four filmstrips on women in science, women in engineering, women in politics, and women in business. Interviews with a number of women in science and engineering careers, includes pictures of women both at home and on the job. Approximately 15 minutes each. The four filmstrips include cassettes or records and are available separately through Judy Piazza. Lifetime replacement guarantee.

9. "Women in Science," 1975, Dinah Moché ($35.00, cassettes and slides), National Science Teachers Association, 1742 Connecticut Avenue, NW, Washington, DC 20009.

Audiotaped interviews with six women scientists accompanied by thirty-three 35mm slides and an article about each scientist; appropriate for teachers.

10. "They Did It So Can You," 1977 (15 minutes, color; slides and cassette tapes, $14.95; also available as filmstrip and cassette tapes, $7.95), National Action Council for Minorities in Engineering, Inc., 3 West 35th Street, New York, NY 10001.

Features four minority engineers (Black, Mexican-American, Puerto Rican, and American Indian) describing how they achieved success in their engineering careers. Includes a teacher's guide with ten spirit duplicating masters for student activities related to engineering careers. Excellent filmstrip and activities.

POSTERS

11. Marie Curie , TABS Orders, 744 Carroll Street, Brooklyn, NY 11215 ($2.00 plus postage).

Attractive 17" x 11" poster showing Marie Curie in her laboratory. Caption: "Indeed Marie Curie is the Columbus who has discovered a new continent in science."

12. Eminent Mathematicians, Springer-Verlang New York, Inc., 175 Fifth Avenue, New York City, NY 10010 ($2.00 per poster).

Posters available of Sonya Kovalevski and Emmy Noether. Size: 20" x 32".

13. Wall Posters on Engineering, LSR Learning Associates, 4 Newtown Plaza, Plainview, NY 11803. Set of 12 posters $19.50; quantity discounts available.

Twelve areas of engineering. Example: Cartoon of children looking out into space with slogan "It's not over your head! Look into an aerospace engineering career;" conversation between two aerospace engineers shown below.

14. Science and Invention, Portfolio #4, Afro-Am Publishing Company, 910 South Michigan Avenue, Suite 556, Chicao, IL 60605 ($10.95).

Portfolio of 24 11" x 14" prints of Black scientists and inventors.

15. Wall Poster on Black Scientists, Attn.: Mr. Jack Wiggin, Community Relations, Nabisco Brands, Inc., East Hanover, NJ 07936 (free).

Poster depicting Black men and women scientists.