

GIRLS ARE SCIENTISTS, TOO!

What does a scientist look like? A wild-eyed, bespectacled man holding a flask of chemicals seems to be the model scientist for old and young alike.

For 14 years, I have asked my elementary science methods students to ask anyone—young or old, friend or stranger—to draw a picture of a scientist. To guard the artists' privacy, I ask that the students reveal only his or her age—no names. The results have been pretty consistent throughout the past decade and a half.

Regardless of the artist's age or gender, the most popular picture shows a wild-haired man in a lab coat wearing glasses, sporting a pocket protector, and holding a bubbling flask at a table covered by jars of exotic chemicals. I had hoped that by the beginning of the 21st century, the drawings would show a near-equal ratio of women to men. But apparently, there is still much education to be done to convince people that women can be scientists, too.

In one sample of 154 pictures, 84 percent drew male scientists, even though more than half of the artists were female! So even women do not see their gender as being scientists.

Males are even less likely than females to see science as a

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field for females. Of the 16 percent who drew a female scientist, only one artist was male. This disparity has serious implications that educators need to face. Teachers need to find ways to change the stereotypes of who should be and who are scientists. Following are some suggestions of how to start.

Provide Role Models

The absence of women scientists from textbooks, media, and popular literature helps to maintain the masculine image of science. The dearth of role models makes it difficult for girls and young women to see themselves as scientists.¹

- Role models provide a powerful influence on students and the community at large. Invite female scientists to speak to your class and to describe the challenges and rewards of their careers.

- Videos, handouts, and textbooks showing videos of women in the domain of science can also help challenge biased assumptions about science careers.

One useful resource is *Wonderwise: Women in Science*, a series that introduces students to women who have

made science their career. These inexpensive packages contain a video, activity book, biography, CD-ROM and hands-on materials.

Personal visits and media resources will help present a wholistic definition of scientist that is more realistic and better

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suited to the realities of our global community.²

Engage Parental Help

If a child sees positive attitudes at home, these attitudes also come to school. Communicate with the parents of students at all levels, beginning with kindergarten. Encourage them to read books to their children about science and nature, consciously looking for materials that portray females as scientists.

Here are a few books to help you get started. If your school library does not have very many that portray women in science, you may wish to order some as quickly as possible!

- *An Island Scrapbook: Dawn to Dusk on a Barrier Island* (Buffalo, N.Y.: Simon and Schuster, 1998), written and illustrated by Virginia Wright-Frierson. This small book shows an artist and her young daughter exploring the ecosystem of a barrier island. ISBN: 0-689-81563-8. Cost: about \$16.

- *Elephant Woman: Cynthia Moss Explores the World of Elephants* (New York: Atheneum, 1997), written by Laurence Pringle. This 48-page book shows how photo-documentarian Cynthia Moss became an expert on African elephant families. ISBN: 0-689-80142-4. Cost (on the World Wide Web): about \$12.

- *The Science Book for Girls and Other Intelligent Beings* (Buffalo, N.Y.: Kids Can Press, 1997), by Valerie Wyatt. This 80-page book is filled with colorful drawings. Readers can discover how science relates to what we do every day, and explore careers in science through hands-on experiments. Title chapters include: "Be a Physicist," "Be a Geologist," and "Be an Astronomer." ISBN 1-55074-113-6. Cost: about \$9.

- *Earth Keepers*: (San Diego: Harcourt

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Brace, 1993), by Joan Anderson, with black-and-white photography by George Anconia. This hardback book tells about three scien-

tists who have dedicated their lives to encouraging everyone to connect to science. One woman, an environmental educator, works aboard a teaching schooner to get people to befriend the Hudson River. Another woman is creating urban farms. A male biologist makes friends with black bears to protect their habitat. ISBN 0-15-242199-8. Cost: about \$15.

Positive Attitudes

Cynthia Breazeal, a postdoctoral student at the Massachusetts Institute of Technology and designer of Kismet, a winsome robot that uses its expressive face to reflect a number of humanlike emotions, says that girls do not get enough support in pursuing careers in science. She thinks that "more girls would be attracted to the hard sciences if they realized how creative they can be. Contrary to popular conceptions of hard science as dry and rulebound, she sees it as a rich field for self-expression."³

Parents and teachers should consciously encourage both boys and girls to take an interest in science. Children are naturally curious about how things work, so exploring natural phenomena will help them see that science is important and interesting. At the same time, a teacher can help foster positive attitudes by frequently using feminine pronouns to refer to scientists. Bringing in news stories that show women in scientific roles will also encourage acceptance of women in science.

Provide Mathematics Encouragement

Encouraging girls to take advanced mathematics classes in junior high school and

high school will help narrow the gap that currently exists between males and females in completing prerequisites for college science courses.

Many girls and women are inadvertently barred from science career tracks because of their inadequate mathematics background. Women have tended to work in traditionally female and often low-paying careers. This is steadily changing as they enter medicine and engineering. However, perceptions are hard to change. The stereotype of who a scientist is still colors many young women's perceptions and hence, their career choices. The old idea of "I'm female; therefore, in order to be attractive, I must not be perceived as smarter than the boys," lives on, to some degree. Teachers can counteract this stereotype by overtly encouraging girls to enroll in advanced math and science classes and to choose careers as mathematicians and scientists.

Provide Hands-on Learning

In order to develop both the academic

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and relational skills of their students, science teachers should seize every opportunity to allow students to "try it for themselves;" an approach that especially appeals to females.

The narratives of women engineers and scientists share a common theme—at home, they were encouraged to take apart and put together machinery, played math games, and were introduced to science at an early age.⁴

Providing extra classroom time for science and encouraging the use of tools and spatial play, such as Lego building, can also help to promote girls' interest and skill in science.

"Girls in particular suffer from the mistaken notion that boys are naturally more adept at using tools. Starting in the earliest grades, all students should gradually gain familiarity with tools [their] proper use. . . . By the time they finish school, all students should have had supervised experience with common hand tools, soldering irons, electrical meters, drafting tools, optical and sound equipment, calculators, and computers."⁵

Curriculum Development

Assignments and bibliographies that include women scientists' achievements and contributions will enhance history, Bible, English, mathematics, and science classes at every educational level.

Providing mathematics puzzlers for groups to work on and allowing girls-only groups encourages girls to take the lead in problem-solving, rather than having boys assume most leadership positions, as often happens in mixed-gender settings.

Ridding the classroom of stereotypical language helps demolish perceived barriers to women in science. Teachers can encourage girls to choose science as a lifework by reading stories about women in science and

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asking real women in the scientific community to share their experiences with students.

A Last Word

Girls match or surpass boys' achievements in science and mathematics as measured by standardized tests and classroom grades. However, a look at the present gender distribution in the workforce should underscore the need for a stronger commitment to encouraging women to choose science careers. Although women make up 45 percent of the workforce, only 16 percent of scientists, six percent of engineers, and four percent of computer scientists in the U.S. are women. In a recent study, 34 percent of high school-aged girls reported being advised by a faculty member not to take senior math.⁶

Teachers and parents have an obligation to promote science for girls. By doing so, they can change both men's and women's perceptions of who can be a scientist and inspire young women to contribute their talents to the betterment of humankind. ✍



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What Worked for Rita Colwell

At a recent educational computing convention, I listened to Rita Colwell, director of the National Science Foundation, give a presentation on information technology. Colwell earned a Ph.D. in microbiology from the University of Washington and has an annual budget of \$4 billion.

I asked her to tell about her own experiences in science and what educators can do to encourage girls to pursue careers in science. She responded by E-mail.

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Rittenbach: "What or who influenced you to become a scientist?"

Colwell: "There were several influential events/people that guided me into the science path. Having many physicists and engineers visit my home while I was growing up triggered the notion of scientists as folks who ask the 'bigger questions.' (My older sister married a Dutch-born physicist.) Then there was my education at Purdue University, which led me to microbiology—mainly because of an excellent professor of bacteriology, Dr. Dorothy Powelson—a rare creature. . . a woman professor."

Rittenbach: "What can teachers in the elementary school do to promote science for girls?"

Colwell: "Encouragement and attention help a lot. Also, teaching that actively involves girls in 'discovery-based' learning can be inspirational."

Rittenbach: "What are the present impediments to science learning for women?"

Colwell: "The major ones are sociological and cultural. These include the absurd notion that 'girls aren't good in math and/or science,' that 'science is for boys,' and that science and engineering are 'not feminine.' These deflect girls away from science and engineering and restrict their access to high-paying jobs and careers with excitement and power, power to control one's own life. Finally, teachers (usually women) who are not educated in science and engineering only serve to reinforce these invalid messages."

Rittenbach: "As a scientist, what has brought you the greatest satisfaction?"

Colwell: "The satisfaction of discovery, the wonderful satisfaction of having one's own hypotheses fulfilled by experimentation, data gathering, and data analysis. . . to contribute to the understanding of nature and to be able to improve the health and welfare of fellow human beings."