

# The Lives of Scientists

*To enhance their interest in science, students read  
biographies and autobiographies of scientists*



*Niels  
Bohr*

**R**EADING AND DISCUSSING WITH STUDENTS THE BIOGRAPHIES and autobiographies of scientists is an interesting and productive way to enhance students' understanding of scientific developments and the roles of individual scientists. Such understanding is especially important in light of current educational reform efforts. Indeed, the *National Science Education Standards* recommends the "use of history in school science programs to clarify different aspects of scientific inquiry, the human aspects of science, and the role that science has played in the development of various cultures" (NRC, 1996, p. 107). Reading biographical material, however, is not common in science classrooms, and teachers may need to review the characteristics and uses of these books.

BY ROB TRAVER

## THE LIFE OF A SCIENTIST

A biography or autobiography emphasizes the life of a scientist, illustrating the importance of personal ownership and commitment to successful inquiry into nature. Furthermore, such literature humanizes and puts into context scientific endeavors, showing how the scientist and his or her work are part of culture. And, because biographies and autobiographies emphasize dedication, imagination, and discovery, they help us understand that science is not a package of absolute, received truths, but is a growing body of justified yet fallible knowledge.

Consider, as an example, the following selection from *Naturalist*: “Not just the ants but everything I saw, every species of plant and animal, was new to me. These creatures were a fully alien biota, and it is time to confess: I am a neophile, an inordinate lover of the new, of diversity for its own sake. In such a place [New Caledonia] everything is a surprise, and I could make a discovery of scientific value anytime I wished.” (Wilson, 1994, p. 171) In this brief passage the act of discovery becomes palpable and personal, and the objects of inquiry (nature, plants, and animals) become accessible. Important, but often omitted, aspects of science become tangible.

Other good choices of books about the lives of scientists include *The Autobiography of Charles Darwin* (Darwin, 1958), *In the Shadow of Man* (Goodall, 1985), *A Feeling for the Organism: The Life and Work of Barbara McClintock* (Keller, 1983), *Surely You're Joking Mr. Feynman! Adventures of a Curious Character* (Feynman, 1989), *Black Apollo of Science, The Life of Ernest Everett Just* (Manning, 1983), and *The Life of Isaac Newton* (Westfall, 1993).

### SELECTING APPROPRIATE LITERATURE

Unfortunately, not all stories about scientists' lives are created equal, and teachers should ask several questions when selecting texts. First, the text must be examined to determine if the science is accurate. Sadly, there are a number of books that include erroneous facts and misconceptions in both the text and in the illustrations. A second question teachers should ask is whether important features of the scientific endeavor and inquiry process are prominent in the text. Students should read about the phenomenon that was studied, how the experimental apparatus was configured, what was done with the findings, what specific errors and corrections were made, where ideas came from, and how the scientist's colleagues, the public, the press, the government, or the funders reacted to the work.

Another feature teachers might look for in a biographical book is whether or not the text is interesting. Specifically, the text should emphasize the human side of



*Madame Curie*

science. Students should be made aware that scientists encounter obstacles and experience setbacks as well as successes. Finally, teachers should choose an array of books that describe the work done by men and women in different areas of science, from various cultures, who lived in different time periods.

It helps to keep in mind that biographies and autobiographies of scientists are written for a range of reading levels. For example, a high school student with a limited reading ability might do well with *My Life with Chimpanzees* (Goodall, 1988), while a better reader could tackle *In the Shadow of Man* (Goodall, 1985). A serious middle school student can handle *Charles Darwin and the Theory of Natural Selection* (Skelton, 1987), while an average high school student can read *The Autobiography of Charles Darwin* (Darwin, 1958), and a sophisticated high school senior might enjoy the exhaustive and award-winning *Darwin* (Desmond and Moore, 1991).

### THE READING CIRCLE

Because teaching narrative accounts of the lives of scientists is not a widespread practice in high school

science classes, teachers may need to consider a new approach to interest students. I like to think of my science class as a reading circle where students discuss their reactions to books—its characters (the scientist and his or her colleagues and significant others), the plot (events in the scientist's life), the theme (what it would be like to live the life of the scientist), key ideas (the nature of science, forces and factors that shaped the scientist's life), and so on.

An especially powerful technique for promoting this discussion is asking questions that will guide the students' reading, subsequent class discussions, and written assignments. Examples of such questions include: What was life like for the person in this book? What characteristics of science are found in this book? What forces and factors shaped the life of the scientist in this book? More specific questions include: How are scientific problems defined or framed? How are scientific problems solved? How are scientific problems discussed or communicated? What constitutes an important scientific discovery? What characterizes clever or definitive scientific solutions? What motivates a scientist?

Students should be encouraged to support their opinions with passages from the book in a similar way to how a scientist supports his or her explanations with evidence. For example, if a student claims that Isaac Newton fits the contemporary definition of a nerd, then he or she needs to show where in the text there is evidence to support this view. The student must also present any evidence in the book that suggests Newton was not a nerd. In this way, interpretation and discussion become more than just an arena for the expression of unsubstantiated opinion. Students also should be alert to those parts of the book that surprise, annoy, or puzzle them or make them



*Albert Einstein  
and Charles St. John*



*Isaac  
Asimov*

skeptical. These responses, akin to the reaction of scientists to unexpected experimental results, are critical intellectual junctures that are rich entry points for a teacher to probe and a student to consider. These are the places from which a deeper understanding of science and scientists will emerge.

As an example of what reading biographies and autobiographies can do for a science class, a group of preservice secondary science teachers developed the following list of essential features of science after reading a few of the texts listed above. They said science is characterized by:

- A focus on the natural world rather than the cultural or supernatural worlds;
- Successful prediction;
- Discovery of undocumented things such as natural phenomena and organisms;
- Replicable experiments;
- Conjectural thinking, such as making hypotheses;
  - Written communication, especially juried publication;
  - Explanations that rely on observation and physical tests and that do not invoke supernatural or immaterial forces;
  - General principles, especially those that account for a wide range of phenomena through an economical and succinct formal abstraction such as  $F=ma$ ;
  - Public scrutiny, review, and verification of observations and explanations; and
  - Knowledge that is fallible, in principle, and subject to error.

In another exercise, based on the book *Black Apollo of Science* (Manning, 1983), the same preservice teachers identified these forces and factors that affect a scientific career:

- Peer review and evaluation;
- Gender, race, and class;
- Mentees, who are trained by a scientist and often go on in their careers to promote the views of the scientist, thereby extending his or her influence and career;
- Mentors, in addition to the general quality and prestige of academic training;
- Institutional and financial support for research;
- Psychological attributes and values such as determination, energy, and ambition; and
- Scientific fashion and research topic savvy.

For each of these features, the preservice teachers could point to places in the text that support its inclusion in the list. They also noted that reading about and discussing science in this way was rarely part of science classes. They were quick to criticize and happy to redress this omission. Perhaps most importantly, the preservice teachers said that such readings were enlightening complements to other ways of knowing science.

There are many good biographies and autobiographies of scientists that high school students should find interesting and entertaining. Examples appear from time to time in the periodical *Science Books and Films*, in the series called *Science Superstars* published by *Scientific American*, and in a list printed by the author of this article.



*Carl Sagan*

#### REFERENCES

- Darwin, C. 1958. *The Autobiography of Charles Darwin: 1809-1882*. N. Barlow, ed. New York: W. W. Norton and Company.
- Desmond, A. and J. Moore. 1991. *Darwin*. New York: W. W. Norton and Company.
- Feynman, R. P. 1989. *Surely You're Joking Mr. Feynman! Adventures of a Curious Character*. New York: Bantam.
- Goodall, J. 1985. *In the Shadow of Man*. Boston: Houghton Mifflin.
- Goodall, J. 1988. *My Life with Chimpanzees*. New York: Simon and Schuster.
- Keller, E. Fox. 1983. *A Feeling for the Organism: The Life and Work of Barbara McClintock*. New York: W. H. Freeman.
- Manning, K. 1983. *Black Apollo of Science: The Life of Ernest Everett Just*. New York: Oxford University Press.
- National Research Council. 1996. *National Science Education Standards*. Washington, D.C.: National Academy of Sciences.
- Skelton, R. 1987. *Charles Darwin and the Theory of Natural Selection*. New York: Barron's Educational Series.
- Westfall, R. F. 1993. *The Life of Isaac Newton*. Cambridge, England: Cambridge University Press.
- Wilson, E. 1994. *Naturalist*. Washington, D.C.: Island Press.



*Lynn Margulis*

This list is a 40-title, annotated bibliography that readers can order by sending a self-addressed, stamped envelope to the author. And, of course, public and school librarians will be immensely helpful once they know of a teacher's interest. In the end, this enriching learning experience is simply a matter of picking a book and sitting down to read it with students. ✧

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