Editor's Corner

February 2009, Notes From the Field Editor

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Renaissance Thinking

"If I had to live my life again, I would have made a rule to read some poetry and listen to some music at least once every week" (Charles Darwin, *On the Origins of Species* [1859, p. 443]).

Albert Einstein played the violin. Friedrich August Kekulé was trained as an architect. Max Planck was a gifted pianist, composer, and singer; Werner Heisenberg and Lise Meitner were also enthusiastic pianists. James Watson started out as an ornithologist; his collaborator, Francis Crick, was a trained physicist who also studied chemistry and biology and devoted his final years to neuroscience research. Galileo Galilei was a musician and painter.

When students imagine a scientist, they often conjure up an image of a researcher working in isolation on a narrow and limited investigation. Most students probably do not envision scientists such as Harold Varmus, winner of a 1989 Nobel Prize for his discovery of the proto-oncogene, who recently delivered a presentation at Carnegie Hall titled "Genes and Jazz"—a production interweaving cell biology, evolution, and cancer research with the music of a jazz quintet. Nor do they typically think of another Nobel laureate, Richard Feynman, whose resumé could list artist-musician along with his day job in physics; or Roald Hoffmann, winner of the 1981 Nobel Prize in Chemistry, who has written five books of poetry and two plays.

The history of science is replete with examples of great scientists who had interests beyond a single specific discipline. The prototype "Renaissance thinker"—Leonardo da Vinci—was a scientist, engineer, inventor, artist, botanist, musician, and writer. Swedish writer August Strindberg described the great taxonomist Carl Linnaeus as "a poet who happened to become a naturalist." Sir Isaac Newton was a physicist, mathematician, astronomer, and alchemist. Marie Curie won Nobel Prizes in both Physics and Chemistry. Rachel Carson was an English major, held a master's degree in zoology, studied genetics, and was a naturalist for the U.S. government. These scientists, and untold others like them, all share a passion for knowledge that extends beyond the traditional borders of their work.

What do these famous polymaths tell us about teaching and learning? Perhaps nothing. It may be that such genius—and the ability to think broadly—is extremely rare. Narrowly focused thinking may be the rule, and encyclopedic learning may be the exception. Still, at the very least, Hoffmann, Feynman, Carson, and the others teach us that it is possible to do science at the highest level while maintaining wide-ranging interests, even in a modern, reductionist world.

In our classes, implementing interdisciplinary teaching and learning is fraught with challenges as well as opportunities, as guest editor William F. McComas points out in his lead article (p. 24) in this issue of *The Science Teacher*. In my own experience, implementing a thematic, interdisciplinary curriculum can be a daunting process. For one thing, teachers are rarely trained in more than one specific discipline and often feel uncomfortable teaching outside their limited training. While it can be rewarding to learn alongside students or team-teach with a teacher from another academic discipline, simple logistics often make these approaches difficult. The emphasis on high-stakes testing and discipline-based exams such as the SAT Subject Tests only exacerbates these problems.

For those interested in interdisciplinary teaching and learning, the good news is that we are doing a lot of it already. Every talented science teacher tries to make science more compelling and relevant by drawing on other areas of student interest. Perhaps that budding musician sitting in the back of the science classroom will be intrigued to learn how the physics of sound explains the difference in tone of a piccolo and a bassoon, or, in chemistry class, how the wavelength of an electron is like a vibrating guitar string. Maybe that talented student-artist who professes little interest in science would be interested to learn how the interplay of color and light works to create great painting and sculpture. That student who likes to read novels more than science texts may appreciate science more if introduced to writers such as Anne Dillard, Richard Powers, and Barbara Kingsolver, who regularly include science content in their works of fiction. History aficionados in our classes will be intrigued to learn how discoveries in science and technology—from the Haber process to barbed wire to nuclear fission—have radically changed the course of human history.

Although it may be an old-school habit of mind with roots in the Renaissance, interdisciplinary thinking has never been more important than in the modern world. In their daily lives, our students will need to understand complex problems and evaluate information from multiple sources. Most of our important discoveries and pressing problems—from deciphering the genetic code to improving our health care system—require that scientists work together across disciplines. Emerging new disciplines such as nanoscience and bioinformatics are interdisciplinary at their core. Encouraging students to think outside of rigid disciplinary boundaries can help us create better informed decision makers and more interesting lives.

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