Denise Myshko

Educating the Scientists of the FUTURE

High-quality science education is critical for the success of pharmaceutical and biotechnology companies, not only to meet the need for scientists in the future but also to foster scientific literacy.

Education reform is a hot-button issue for the nation in general and the pharmaceutical industry in particular. Studies show American students are falling behind other countries in math and science.

In fact, a 2006 study ranked American students 21st out of 30 in science literacy among students from developed countries, and 25th out of 30 in math literacy, according to the Program for International Student Assessment (PISA). PISA found that U.S. 15-year-olds scored below most selected nations, and the U.S. standing among those nations dropped below its rank in 2000 in both math and science.

High-quality science education is critical for the success of many companies, including pharmaceutical and biotechnology corporations. Industry leaders have placed importance on science education to foster awareness of how medications are developed and, hopefully, encourage the scientists of the future.

"If we can help students and teachers learn about biotech in a coordinated fashion, provide stimulating and exciting options, and create clearer pathways for students to take toward careers in STEM (science, technology, engineering, and mathematics), the hope is that this will generate growth in the life-sciences industry for the future," says Janelle Curtis, VP of programs at the Biotechnology Institute. "The more we can all work together and coordinate our efforts, the more successful we will be."

The science and engineering workforce, which includes more than 5 million people, is projected to grow faster than any other sector in the coming years. The Bureau of Labor Statistics projects job growth of 22% for STEM occupations as a whole between 2004 and 2014. Experts predict over the next decade, almost half of all new jobs will require advanced training or a college degree.

In recent years many efforts have been launched to address the need for high-quality science education. In September, President Obama announced the launch of Change the Equation, an effort to improve education in science, technology, engineering, and math. This is part of his Educate to Innovate campaign to raise student achievement in science and math over the next decade. Change the Equation is a nonprofit organization founded by leading CEOs in the United States to help fund public-private partnerships involving companies, nonprofits, and foundations.

In addition, the President's 2012 budget provides $77.4 billion for the Department of Education, of which $835 million is to support a well-rounded education, including reading and science, technology, engineering and math. One goal is to train 100,000 STEM teachers over the next decade and recruit 10,000 STEM teachers over the next two years. Part of this effort will focus on providing educational opportunities for women and minorities.

Pharmaceutical companies also have launched efforts through their own philanthropic organizations and with other organizations to provide both teachers and students with opportunities in science.

Most companies across the United States are concerned about education in general, says Mary Linda Andrews, director of community partnerships at GlaxoSmithKline.

"For GSK and other pharmaceutical companies, it is one of our top priorities," she says. "Science education is directly related to the continued success of our industry and the world's economy."

Ms. Andrews adds that future prosperity depends on a highly educated workforce.

"About 3 million baby boomers will be retiring in the next several years, and we will need to find replacements for those individuals in all disciplines, but especially in science," she says. "We need to make sure that we are able to find very qualified individuals so we can be competitive in a world market."

Margaret Lee, Ph.D., VP of research at Zalicus, adds that it's important to educate students about the various opportunities in the biopharmaceutical industry.

"There are plenty of people working on Ph.D.s, but I'm not sure if they are studying

the things that are most useful for biotechnology and drug discovery innovation," she says.

Educating future scientists is crucial to the success of any company in the biopharmaceutical industry, says Scott Heimlich, senior manager of the Amgen Foundation.

"We know we have a responsibility to give back and inspire the next generation of scientists," he says. "But it's not just about creating more scientists; we want to make sure that we're deepening the scientific literacy of all and providing education to inform the public."

Dr. Lee suggests the industry needs to better communicate the passion, the enthusiasm, the excitement that its scientists have about the work they are doing.

Teacher and Parent Perspectives on Science Education

A survey last October shows large percentages of science teachers and parents strongly agree that demonstrating real-life applications in science (87% and 72%, respectively) can help make science education more interesting for U.S. students. Almost all science teachers (99%) and nine in 10 parents believe that science education is important, if not very important for a child's future, but that it needs to be more engaging to capture the attention of children in America today. The survey was conducted online by Harris Interactive on behalf of iBIO Institute and Astellas Pharma.

Other findings:

- Almost all science teachers (91%) and parents (85%) agree that technology is not being used as much as it should be in science education today.
- Large majorities of science teachers and parents agree that Internet access (89% and 78%, respectively), films/videos (88%, 78%), computer stations (86%, 74%), and smartboards (85%, 60%) are technology resources that should be used in the science classroom.
- Almost all science teachers (96%) and parents (95%) agree science education needs to be improved; in fact, more than three in five science teachers (62%) strongly agree with this.
- Virtually every science teacher (98%) says there is a critical need for more resources in science education today; more than three-quarters (77%) strongly agree. Only 22% of science teachers believe they have the resources needed to conduct hands-on experiments.

Source: iBIO Institute and Astellas Pharma

"Students need to be educated about the industrial scientists, who are the real innovators and discoverers of the drugs that have changed the lives of people with disease," she says.

Ms. Andrews says industry initiatives can do a better job of exposing students to science through more relevant and rigorous technology.

"We need to make sure that students are exposed to science early in elementary schools," she says. "Often there is great focus on the arts, literacy, and mathematics, which are very important, but science can be left out. Sometimes teachers are intimidated by science. That is why it's important for the pre-service education of teachers to be on target for teaching science."

Teaching the Teachers

Current initiatives address STEM education from a variety of fronts, from providing grants and mentoring programs for graduate students in bioscience, to exposing elementary and high school students to high-quality science programs, to providing training and materials for science teachers.

Ms. Andrews stresses the importance of appropriately training science teachers.

"Science and the concepts of problem solving and independent critical thinking are not always incorporated into lesson plans," she says. "Problem solving and working in teams are very important to developing a scientific mind and being able to implement the scientific method. Students need to be taught how to ask a question, do background research, construct a hypothesis, test that hypothesis by doing an experiment, and analyze the results."

GlaxoSmithKline has provided a $1 million endowment that provides financial assistant to science teachers pursuing National Board certification.

Amgen also works with the National Board for Professional Teaching Standards to strengthen the quality of the science-teaching workforce.

"Our latest initiative was a grant to the National Board for Professional Teaching Standards," Mr. Heimlich says. "This grant provides support for science teachers in Amgen communities to become board certified and gain that advanced status and certification. It will also support the creation of new online professional development courses to enhance science teaching nationwide."

In another effort to assist science teachers, the Biotechnology Institute launched Scientists in the Classroom. One component of this program, called Institute Scholars, works with individual companies to develop programs in their communities that recruit company scientists to assist high school biology teachers.

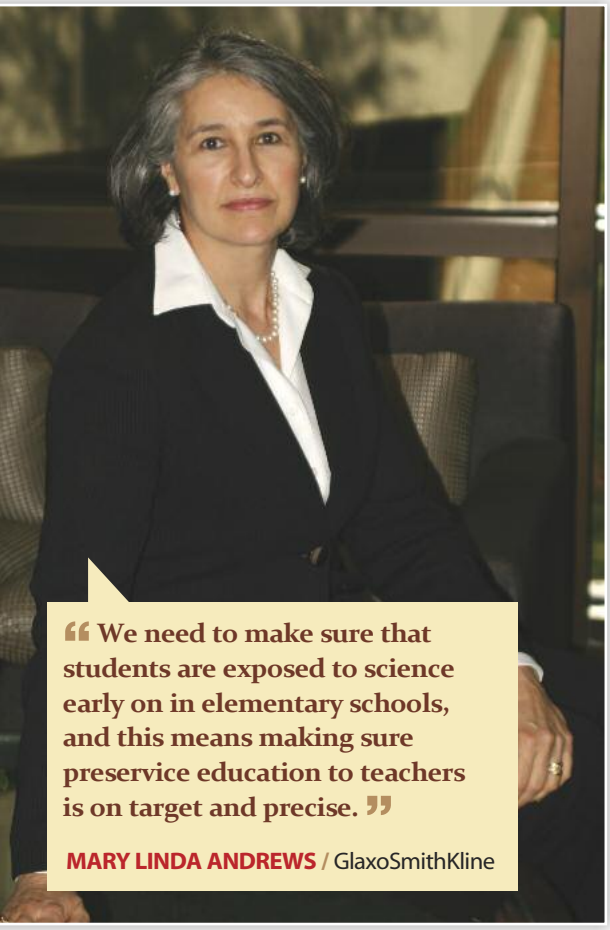
"Many teachers need information, and they need ways to actively engage students, which is what we provide through the Institute Scholars program," Ms. Curtis says. "Teachers need to be able to teach science in a productive way that excites students and still meets the science standards they are required to teach."

Astellas Pharma has partnered with National Science Teachers Association (NSTA). Each year, Astellas supports 12 Chicago-area science teachers to participate as part of the NSTA New Science Teacher Academy, a yearlong program that connects new science teachers to a range of tools and resources.

> "Teachers need ways to actively engage students but they also need to do this in a productive way that meets science standards."
>
> **JANELLE CURTIS**
> Biotechnology Institute

> "To engage students, we need to emphasize the thrill of discovery and hands-on activities in the field."
>
> **DR. MARGARET LEE** / Zalicus

"There is a high turnover rate among teachers, especially in the first five years of a teacher's career," says Jenny Keeney, associate manager of corporate communications at Astellas Pharma US. "The professional development program is designed to provide these teachers with the resources they might not necessarily have and to support them in the early years of their career."



> "We need to make sure that students are exposed to science early on in elementary schools, and this means making sure preservice education to teachers is on target and precise."
>
> **MARY LINDA ANDREWS** / GlaxoSmithKline

Bringing Science to the Classrooms

Industry leaders say many things are going well with regard to science education but there are challenges as well, including limited resources, the quality of labs and materials, the quality of the teacher training and professional development, and the lack of hands-on, science-based activities for students.

Mr. Heimlich says a key Amgen initiative is the Amgen-Bruce Wallace Biotechnology Lab program. Through nonprofit partners, The Amgen Foundation provides research-grade lab equipment, biotech curriculum assistance, and supplies to middle and high schools and colleges. Each year, more than 35,000 high school and college students and hundreds of faculty teachers participate.

"What's unique about it is that students get to use real scientific equipment," he says. "Students are using the actual equipment and learning the techniques that would be used in the biotech industry. It effectively brings real-world science to the classroom."

The Amgen Foundation also has partnered with 13 leading universities to provide undergraduate students an opportunity to engage in a hands-on research experience each summer. Amgen Scholars is a $34 million, eight-year program that provides research experiences for undergraduate students from across the U.S. and Europe who are interested in pursuing a graduate degree and a career in science. So far, more than 1,100 students have participated.

"About 80% of the students who have gone through the program and graduated completed their undergraduate studies are now pursuing an advanced education degree or a career in science and engineering," Mr. Heimlich says.

Astellas Pharma also is working to bring science to the classroom. In 2010, the company established Science WoRx, a local mentoring program and online resource network for science teachers and their students.

> "We have a responsibility to to inspire the next generation of scientists."
>
> **SCOTT HEIMLICH** / Amgen Foundation

Science WoRx focuses on hands-on education with Astellas scientists who are made available to the local community to engage with students and teachers in the classroom by conducting presentations and/or experiments pertaining to human health and medicine.

"Astellas provides the funding, and we connect the teachers with the scientists," Ms. Keeney says. "Our scientists sign up to be Science Pros, and we provide them with the resources they need to go into the schools, from kindergarten to high school. Bringing the real world of science to the classroom can help to excite students."

Science WoRx is supported by the NSTA and iBIO Institute, the education arm of Illinois Biotechnology Industry Organization (iBIO).

Innovation Talent is nother program Astellas participates in with iBIO Institute.

"We worked with iBIO Institute to take scientists into three different classrooms in local areas," Ms. Keeney says. "We asked students to consider where there might be new areas of focus in transplantation research. We asked them to study different research methods and medicines in development and come up with their own answers on what we should do. We then put those students together with the scientists to discuss the students' presentations and projects."

Another STEM initiative of the Biotechnology Institute is International BioGENEius Challenge. This annual high school research competition connects scientists with students from around the world to provide mentoring for student research projects. PV

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EXPERTS

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Denise Myshko

Women and Minorities in SCIENCE

> "Mentoring is a key component to advancing women in the sciences."
>
> **MARY LINDA ANDREWS** / GlaxoSmithKline

Mary Linda Andrews, director of community partnerships at GlaxoSmithKline, says science education needs to address the 30% of our overall high school population — and 50% of minority students — who drop out of school.

"Many of these students may have a propensity for science if they were exposed to it and nurtured," she says.

In fact, women have earned 58% of all bachelor's degrees since 2002, and they have earned about half of all science and engineering bachelor's degrees since 2000. But major variations persist among fields, according to the National Science Foundation. In 2007, men earned a majority of bachelor's degrees awarded in engineering (81%), computer sciences (81%), and physics (79%). Women earned half or more of bachelor's degrees in psychology (77%), biological sciences (60%), social sciences (54%), agricultural sciences (50%), and chemistry (50%).

Minority academic institutions enroll a substantial fraction of minority undergraduates, although the percentage of African Americans earning science and engineering bachelor's degrees and the percentage of Hispanics earning S&E bachelor's has declined over time, according to the National Science Foundation.

"In the past, women and minorities had not been encouraged to pursue technology or the sciences," Ms. Andrews says. "With our Science in the Summer program, we try to provide children with a high-quality investigative science curriculum and through the curricula, and we are providing hands-on, inquiry-based science experiments. This can benefit girls, who sometimes are not nurtured in the same way that boys are nurtured through technology. We want to get them excited about studying science. They need to understand that it is not hard. It's not threatening. It can be fun and it can be applied to every day life."

The Science in the Summer is a free library program in Philadelphia, Pittsburgh, Pa., and Research Triangle Park, N.C., that has been supported annually by GSK since 1986. It offers elementary school children programs in bioscience, chemistry, genetics, oceanography, physical science/electricity, and learning how simple machines work. About 95,000 children have taken part in this program.

GSK has another program, Women in Science Scholars Program, that offers educational opportunities to North Carolina students. The program couples scholarships with a mentoring program in which professionals mentor the scholars through possible career paths. The North Carolina GlaxoSmithKline Foundation has funded more than $1.4 million in endowed scholarships at 29 North Carolina colleges and universities.

"The Women in Science program is one of the flagships of GlaxoSmithKline's North Carolina Foundation," Ms. Andrews says. "The program was launched in 1993 because GSK knew that women were underrepresented in science. We also knew that mentoring was a key component to advancing women in the sciences."

Ms. Andrews says this has been a very successful program.

"GSK has already invested $1.6 million with the universities to provide the scholarships," she says. "It's always fascinating to me to see these women who may have an undergraduate degree in biology and don't know what they are going to do with it. After going through this program, they sometimes end up going on to do a Ph.D. Women need to be exposed to the many possibilities in science and nurtured by a woman who understands the struggles of women in science."

At Amgen, the company has a $5 million, five-year partnership with Teach For America, which is a targeted effort to dramatically improve math and science education, especially in low-income communities.

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