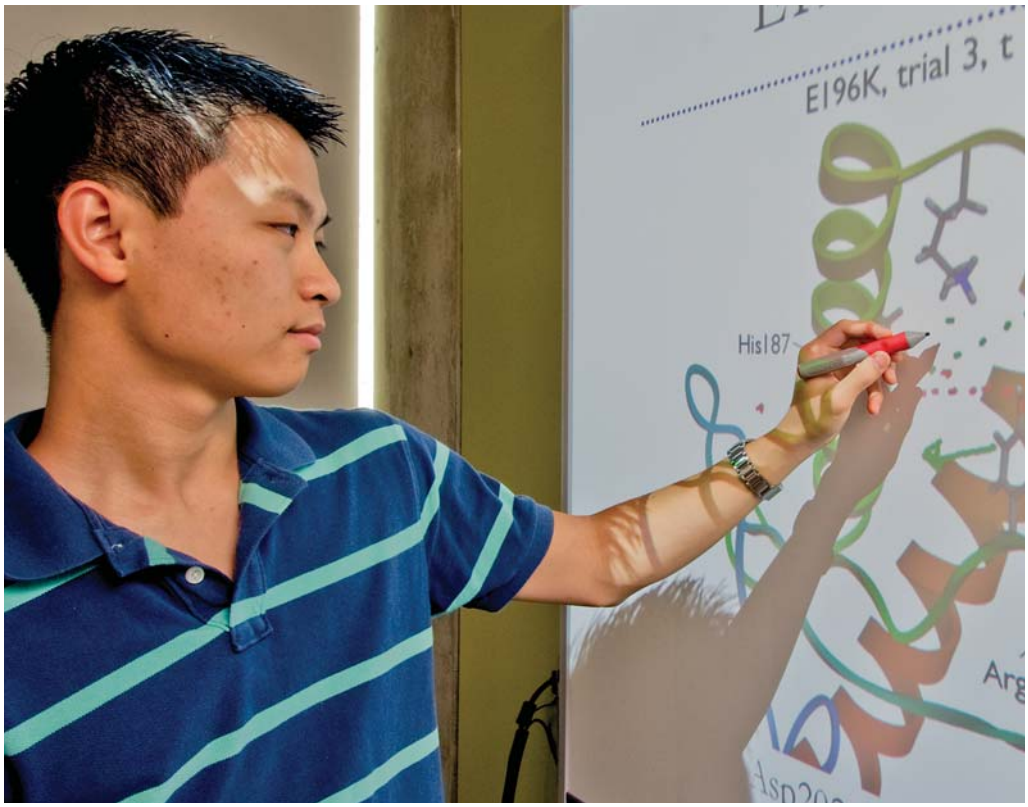
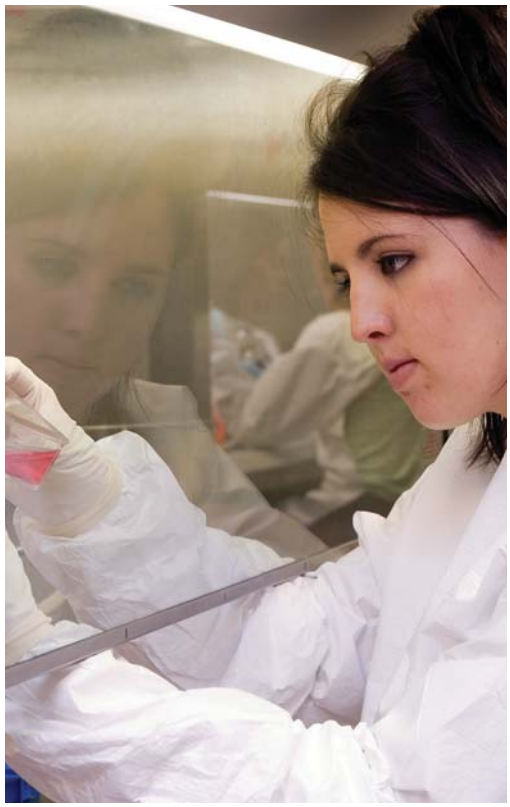
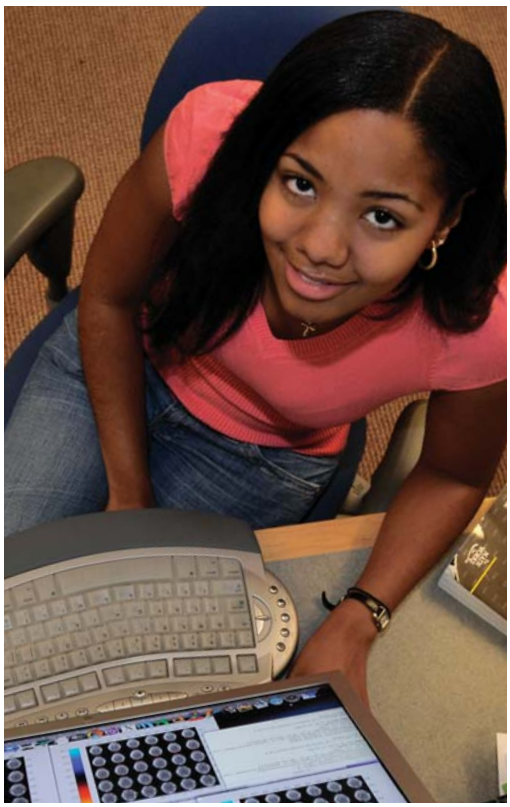
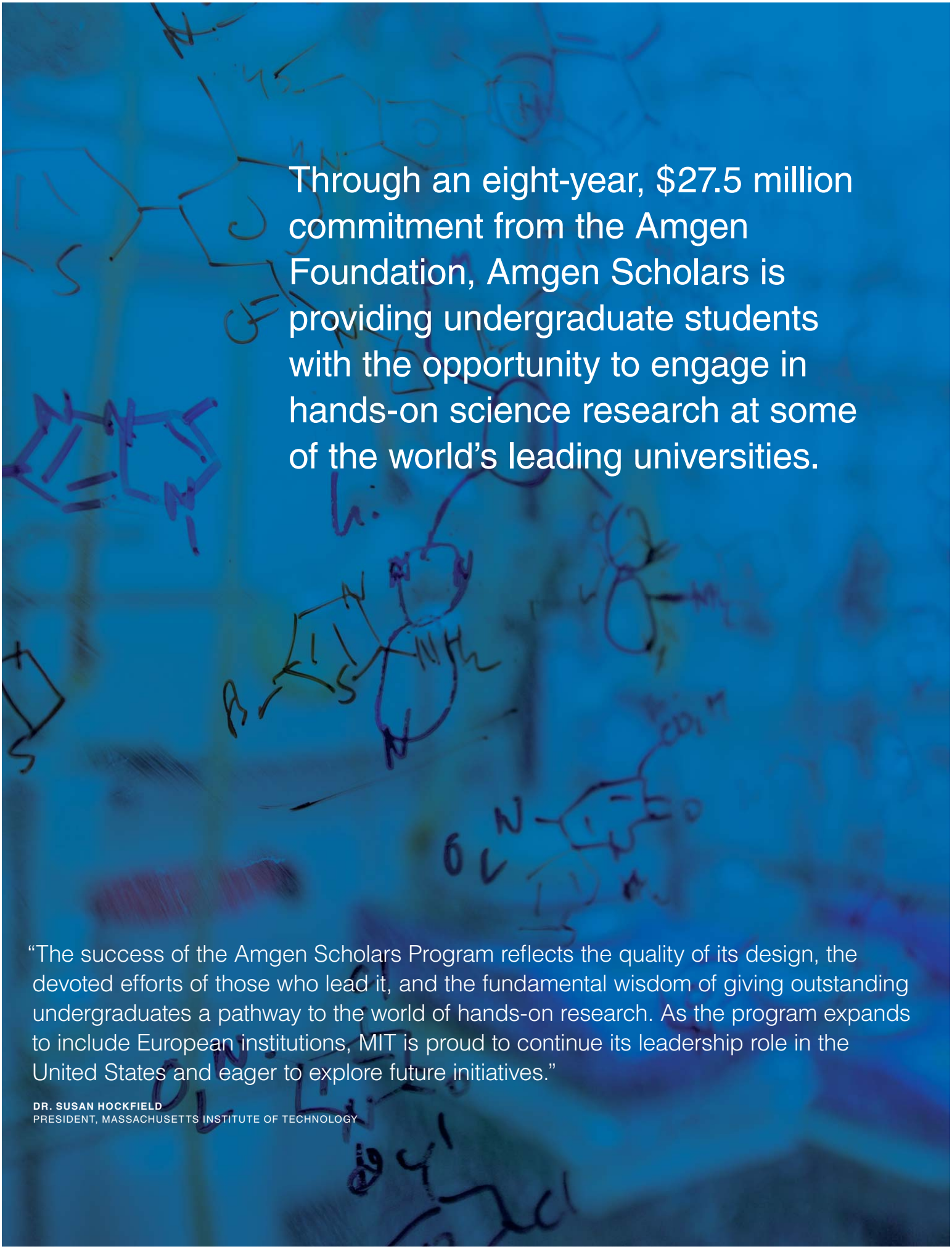






Amgen Scholars Program

2008 Annual Report



Through an eight-year, $27.5 million commitment from the Amgen Foundation, Amgen Scholars is providing undergraduate students with the opportunity to engage in hands-on science research at some of the world's leading universities.

"The success of the Amgen Scholars Program reflects the quality of its design, the devoted efforts of those who lead it, and the fundamental wisdom of giving outstanding undergraduates a pathway to the world of hands-on research. As the program expands to include European institutions, MIT is proud to continue its leadership role in the United States and eager to explore future initiatives."

DR. SUSAN HOCKFIELD
PRESIDENT, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Discover Your Potential

"The significant problems that we face cannot be solved at the same level of thinking that we were at when we created them." Albert Einstein spoke those words decades ago, yet they remain equally relevant today.

In 2006, MIT and the Amgen Foundation launched the Amgen Scholars Program and embarked upon an exciting journey to provide scientific research opportunities for hundreds of students from across the United States, in partnership with 10 leading U.S. institutions. The mission of the Program was to raise the level of thinking for the next generation of scientists, and all the evidence indicates that it has been hugely successful in doing just that. To date, 485 students have participated in this exciting endeavor, which fuels their intellectual creativity, raises their scientific aspirations and thinking, and inspires them to be their very best. They have gone on to win numerous scientific scholarships and awards, and many are now entering graduate school around the world. We are very proud of all our Amgen Scholars and will continue to watch with interest as they develop their scientific careers.

The impressive, positive impact of the Amgen Scholars Program on both students and host institutions was evident from an early stage. This recognition, combined with the global scope of both the problems that society faces and the scientific excellence necessary to solve them, compelled the Amgen Foundation to consider extending the program beyond the United States. In 2008, three leading European institutions were selected as host universities: the University of Cambridge in the United Kingdom; the Karolinska Institutet in Stockholm, Sweden; and Ludwig-Maximilians-Universität in Munich, Germany. Led by a European Coordinating Center at the University of Cambridge, they will welcome their first intake of Amgen Scholars this year.

Therefore, 2009 promises to be an exciting year for the Amgen Scholars Program. All 13 program sites across two continents are looking forward to working together for the common purpose of raising the level of scientific thinking among the students of today and, as a result, inspiring the scientific leaders of tomorrow.

NO. OF COLLEGES & UNIVERSITIES REPRESENTED BY APPLICANTS

NO. OF APPLICANTS

NO. OF APPLICATIONS*

* Note: Applicants may apply to multiple Amgen Scholars host universities.

TONY MINSON
DIRECTOR, AMGEN SCHOLARS
EUROPEAN COORDINATING CENTER
UNIVERSITY OF CAMBRIDGE

CHRISTOPHER M. JONES
DIRECTOR, AMGEN SCHOLARS
U.S. PROGRAM OFFICE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

What is Biotechnology?

SIMPLY DEFINED, biotechnology is any technology that relies on living organisms or biological systems to make products. In the context of health care, biotechnology refers to the ways in which knowledge of human biology at the cellular level is being applied to design therapeutics. One of the most common biotechnologies used to produce medicines is recombinant DNA. This refers to the transfer of a gene from one organism into another organism: literally, the recombination of DNA from different sources.

For the production of biotechnological medicines, this usually involves isolating a human gene with therapeutic potential, and then introducing it into bacteria, yeast, or an animal cell line. Without recombinant DNA technology, most of these proteins do not exist naturally in sufficient quantities for therapeutic use. The recombinant systems, however, can be induced to produce the protein in high quantities under controlled conditions. The protein then goes through a rigorous purification process to prepare it for clinical use.

"To unlock the promise of biotechnology and create medicines to treat serious diseases such as cancer, we need to provide the brightest science students with the best training, tools, and opportunities the world has to offer."

DR. JOSEPH P. MILETICH
SENIOR VICE PRESIDENT, RESEARCH AND DEVELOPMENT, AMGEN INC.
MEMBER, BOARD OF DIRECTORS, AMGEN FOUNDATION

A TIMELINE OF MODERN BIOTECHNOLOGY

1953
Drs. James Watson and Francis Crick reveal the three-dimensional structure of DNA.

1958
DNA is made for the first time in a test tube by Dr. Arthur Kornberg at Washington University in St. Louis.

1963
Synthesis of the pancreatic hormone insulin is accomplished by independent groups in the United States, Germany, and China.

1970
Restriction enzymes are discovered.

1972
DNA ligase, which links DNA fragments together, is used for the first time.

1973
Drs. Stanley Cohen and Herbert Boyer perform the first successful recombinant DNA experiment, using bacterial genes.

1975
The first monoclonal antibodies are produced.

1977
Genetically engineered bacteria are used to synthesize the human growth protein somatostatin. For the first time, a synthetic recombinant gene is used to clone a protein. Many consider this to be the advent of the Age of Biotechnology.

1980
The U.S. Supreme Court rules that genetically altered life forms can be patented, opening up enormous possibilities for commercial applications of genetic engineering. This decision allowed the Exxon oil company to patent an oil-eating microorganism that, nine years later, would be used to clean up the *Exxon Valdez* oil spill.

1981
Mice are successfully cloned. In the same year, the first transgenic animals are produced by transferring genes from other animals into mice.

1982
Humulin®, a human insulin drug produced by genetically engineered bacteria for the treatment of diabetes, is the first biologic (or recombinant protein) to be approved by the Food and Drug Administration (FDA).

1983
Dr. Kary Mullis invents a technique for multiplying DNA sequences called the polymerase chain reaction (PCR). PCR is recognized as the most revolutionary molecular biology technique of the 1980s.

1984
The DNA fingerprinting technique is developed.

1986
The first monoclonal antibody treatment, used to fight kidney transplant rejection, is approved by the FDA.

The first genetically engineered human vaccine is approved by the FDA for the prevention of hepatitis B.

1987
DNA microarray technology, the use of a collection of distinct DNAs in arrays for expression profiling, is first described.

1990
The Human Genome Project, a $13 billion international effort to map all of the genes in the human body, is launched.

1996
The GeneChip® is developed by the Department of Biochemistry at Stanford and Affymetrix. The GeneChip is a small glass or silica microchip that contains thousands of individual genes that can be analyzed simultaneously. This is a technological breakthrough in gene expression and DNA sequencing technology.

1997
The first therapeutic antibody is approved by the FDA for treating cancer in the United States. It is used for patients with non-Hodgkin lymphoma.

1998
Two research teams succeed in culturing embryonic stem cells, which are used to regenerate tissue and create disorders mimicking diseases.

A monoclonal antibody therapy used against breast cancer has favorable results, heralding a new era of treatment based on molecular targeting of tumor cells.

1999
The complete genetic code of the human chromosome is first deciphered.

2000
"Golden Rice," modified to make vitamin A, promises to help third-world countries alleviate blindness.

2001
The sequence of the human genome is published in *Science* and *Nature*, making it possible for researchers worldwide to begin developing treatments.

2004
The FDA clears a DNA microarray test system, which will aid in selecting medications for a variety of conditions. This is a step toward personalized medicine.

2007
Scientists discover how to use human skin cells to create stem cells.

"At Amgen, we believe that we have an ongoing responsibility to inspire and prepare the next generation of scientists. The Amgen Scholars Program is just one of our many investments in science education through which we make that commitment a reality."

JEAN J. LIM
PRESIDENT, AMGEN FOUNDATION

A SUMMER IN A WORLD-CLASS LAB. **A Lifetime of Discovery.**

AREAS OF RESEARCH

- Biochemistry
- Bioengineering
- Bioinformatics
- Biopsychology
- Biotechnology
- Chemical & Biomolecular Engineering
- Chemistry
- Immunology
- Medical Pharmacology
- Microbiology
- Molecular, Cell & Developmental Biology
- Molecular Genetics
- Molecular Medicine
- Molecular Pharmacology
- Neurobiology
- Neuroscience
- Pathology
- Physiological Psychology
- Physiological Science
- Statistics
- Toxicology

WHILE JESSE NICHOLS WAS A TOP STUDENT, he only had limited opportunities to get involved in research at Montana Tech of the University of Montana. This past summer, however, Jesse did research in Biological Engineering under Dr. Peter Dedon at MIT. Jesse was just one of 248 undergraduates who had the opportunity to participate in a hands-on research experience at a prestigious research university through the Amgen Scholars Program.

Launched in October 2006, the Amgen Scholars Program advances science education by placing undergraduate students in scientific labs under top academic scientists and encouraging them to discover their potential. This hands-on research experience at a leading U.S. university, coupled with a national symposium around biotechnology, is proving pivotal in inspiring students to pursue graduate training and a scientific career.

The intensive 8–10-week research program, held in the summer, places students in laboratories at 10 leading U.S. academic institutions for a challenging—and often life-changing—experience.

Recently, the program expanded overseas as well, allowing students throughout Europe to apply to participate in the Amgen Scholars Program at three leading European universities. The global program is supported through the Amgen Foundation's commitment of $27.5 million over eight years.

To ensure that a student's economic status is not a barrier to participation, the Amgen Scholars Program offers financial support. The specific financial details vary by host university. Additionally, the program is evaluated externally through the Center for Evaluation and Education Policy (CEEP) at Indiana University.

In 2008, the Amgen Foundation welcomed to the program 248 new students chosen by the host universities from more than 2,300 applicants. The 2008 class of Amgen Scholars represented nearly 120 different colleges and universities across 35 states, the District of Columbia, and Puerto Rico.

FACULTY MENTOR PROFILE

DR. MARTIN CHALFIE

AS A MENTOR IN THE AMGEN Scholars Program, Dr. Martin Chalfie says his best contribution to budding scientists is to boost their confidence level in his lab.

"It's daunting when it seems everyone knows what they're doing except you," says Dr. Chalfie, the William R. Kenan Jr. Professor and department chair of Biological Sciences at Columbia University. "During the Amgen Scholars Program, we make sure students learn how to move around in the lab, how to think about their projects and get something done. Having confidence in their ability to accomplish something in the lab makes a big difference in students' desire to study science further."

Dr. Chalfie speaks from his vast 40 years of experience, dating back to his own lab stint at Harvard. "I worked in a lab an entire summer and could not get any experiment to work at all," he recalls. "So I simply dropped out of science. It took several years before I got back in."

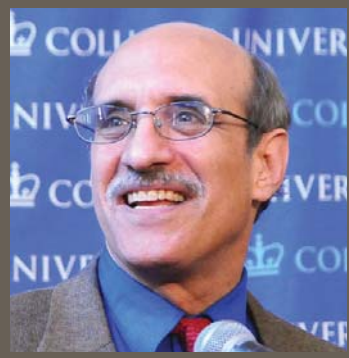
Fortunately for the world, Dr. Chalfie returned to science. This past fall, he won the Nobel Prize in Chemistry for his work in showing how the green fluorescent protein can be used as a biological identifier tag by inserting the gene that produces the protein into the DNA of an organism.

Has he spotted potential Nobel Prize winners among his students? Dr. Chalfie likes to think so, especially when the students are as enthusiastic as Michael Dreyfuss was during the 2007 Amgen Scholars Program.

"He's a wonderful student," Dr. Chalfie says. "But the small stipend we pay doesn't cover housing. The Amgen Scholars Program provided housing at Columbia, allowing Michael to fully concentrate on being in the lab. That's one of the things I really appreciate about the Program. "

"When students come to my lab, almost all say they want to go to medical school because that's what they've heard about," says Dr. Chalfie. "Usually, once they have a taste of research and the chance to be independent and to experiment, many decide they like it. So more and more, we're seeing students pursue both the medical and research fields."

"The Amgen Scholars Program does a great job of showing students what this life is like," Dr. Chalfie adds. "They get to experience the joys of success along with the frustrations. And they learn why the research they're doing is important. The Program is a wonderful addition to what we have at Columbia."



DR. MARTIN CHALFIE
COLUMBIA UNIVERSITY

HOST SCHOOLS 2008

1 CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CA

25 SCHOLARS *FROM*
11 UNIVERSITIES *ACROSS*
4 STATES

2 COLUMBIA UNIVERSITY/BARNARD COLLEGE
NEW YORK, NY

27 SCHOLARS *FROM*
10 UNIVERSITIES *ACROSS*
7 STATES

3 HOWARD UNIVERSITY
WASHINGTON, D.C.

18 SCHOLARS *FROM*
11 UNIVERSITIES *ACROSS*
10 STATES

4 MASSACHUSETTS INSTITUTE OF TECHNOLOGY
BOSTON, MA

28 SCHOLARS *FROM*
15 UNIVERSITIES *ACROSS*
9 STATES

5 STANFORD UNIVERSITY
PALO ALTO, CA

24 SCHOLARS *FROM*
19 UNIVERSITIES *ACROSS*
15 STATES

6 UC BERKELEY
BERKELEY, CA

22 SCHOLARS *FROM*
18 UNIVERSITIES *ACROSS*
12 STATES

7 UC LOS ANGELES
LOS ANGELES, CA

24 SCHOLARS *FROM*
11 UNIVERSITIES *ACROSS*
7 STATES

8 UC SAN DIEGO
SAN DIEGO, CA

30 SCHOLARS *FROM*
16 UNIVERSITIES *ACROSS*
12 STATES

9 UC SAN FRANCISCO
SAN FRANCISCO, CA

23 SCHOLARS *FROM*
21 UNIVERSITIES *ACROSS*
10 STATES

10 UNIVERSITY OF WASHINGTON
SEATTLE, WA

27 SCHOLARS *FROM*
21 UNIVERSITIES *ACROSS*
15 STATES

THE YEAR AHEAD: **European Expansion**

THREE LEADING EUROPEAN UNIVERSITIES will host the Amgen Scholars Program beginning in 2009, offering students throughout Europe the chance to study in the labs of the University of Cambridge in the United Kingdom, Karolinska Institutet in Sweden, and Ludwig-Maximilians-Universität (LMU) München in Germany.

Cambridge and LMU München will each host approximately 25 Amgen Scholars, and Karolinska Institutet will host about 15. Cambridge also serves as the European Coordinating Center and plays a leading role in the program's coordination, technical oversight, and student outreach.

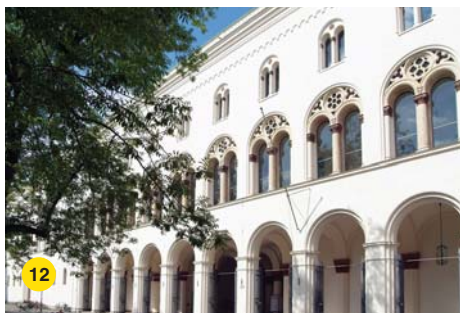
Similar to the Amgen Scholars U.S. Program, students will participate in an annual three-day symposium. They will hear firsthand from leading scientists working in industry and academia, share their summer research projects, and network with other Amgen Scholars from across Europe.

The first Amgen Scholars European Symposium will be held in September 2009 at Cambridge.

To be eligible for the Amgen Scholars Program in Europe, students must be enrolled in—and intend to earn their undergraduate degrees from—European colleges or universities.

"With the launch of the Amgen Scholars Program in Europe, undergraduates from many nations will have the opportunity to immerse themselves in the real world of research and experience firsthand what it takes to contribute to the advancement of knowledge," says Jean J. Lim, president of the Amgen Foundation. "Under the guidance of distinguished faculty mentors, we hope the Scholars will be inspired to discover their potential as future scientists."

"The Amgen Scholars Program will provide undergraduate students across Europe with a fantastic opportunity to experience the scientific discovery process, as well as to network with top scientists and industry leaders," says Professor Tony Minson, Pro-Vice Chancellor of the University of Cambridge and the Director of the Amgen Scholars European Coordinating Center. "We hope that this will inspire more young people to consider scientific careers—at a time when the education of the next generation of scientists is more important than ever."



"Before the program, my depth of knowledge in cellular and molecular biology wasn't that great. But whenever I had a question, Dr. Wang was right there. I really enjoyed learning from someone who knew exactly what he was talking about."

David Nanyes in the Yanmin Yang Lab with postdoctoral scholar, Wei Wang.

SCHOOL
University of Houston-Downtown, Houston, TX

HOST
Stanford University

HOMETOWN
Austin, TX

MAJOR
Biology, Chemistry Minor

DAVID NANYES

JUST SIX MONTHS INTO HIS five-year service in the U.S. Army, David Nanyes received a call that would change the direction of his career. His mother had been diagnosed with breast cancer.

"I knew then that I wanted to do something to help the sick and contribute to the well-being of mankind," Nanyes recalls. "Something medical related."

After he was discharged, Nanyes enrolled in the University of Houston-Downtown to study biology. He caught the attention of Dr. David Kingsley, a Stanford University developmental biologist, during a fall 2007 biomedical research conference.

"I was presenting a poster on the effects of an anti-inflammatory drug on airway hyper-responsiveness using an asthma model," Nanyes recalls. "He said he'd been waiting 30 minutes to hear my presentation. That's how I found out about the Amgen Scholars Program. Afterward, he sent me the application. I applied and was thrilled to be accepted into the Stanford program."

Nanyes was assigned to the Neurology Laboratory at the Stanford School of Medicine, under the direction of Dr. Wei Wang. "Before the program, my depth of knowledge in cellular and molecular biology wasn't that great," Nanyes admits. "But whenever I had a question, Dr. Wang was right there. I really enjoyed learning from someone who knew exactly what he was talking about."

His focus: microtubule proteins and their interactions within the microtubule network. This research can help scientists understand why some cells lose their shape and viability, causing certain cancers. The experience fits right in with his desire to work in the cancer arena. After graduation, he plans to apply to Stanford's graduate school.

That, of course, makes his mom—now in remission—especially proud. "I think about her all the time," Nanyes says. "It's what keeps me going. I want to do something where I can actually make an impact and help people get well."

LINDSAY DAWSON

LINDSAY DAWSON HAS LONG been curious about the physical explanations behind human behaviors—"psychology with a scientific aspect," she calls it.

A behavioral neuroscience major at Lehigh University, Dawson suspects her interest will lead to a scientific career or, thanks to the Amgen Scholars Program, perhaps a career in biotechnology.

She came across the Amgen Scholars Program on the web, and also received an email about the program forwarded to her by one of her professors. She liked what she saw.

"It seemed the program touched on many different fields, but showed how everything could be related to biotechnology," she says. "It was a really interesting combination that I didn't see in other research programs at universities."

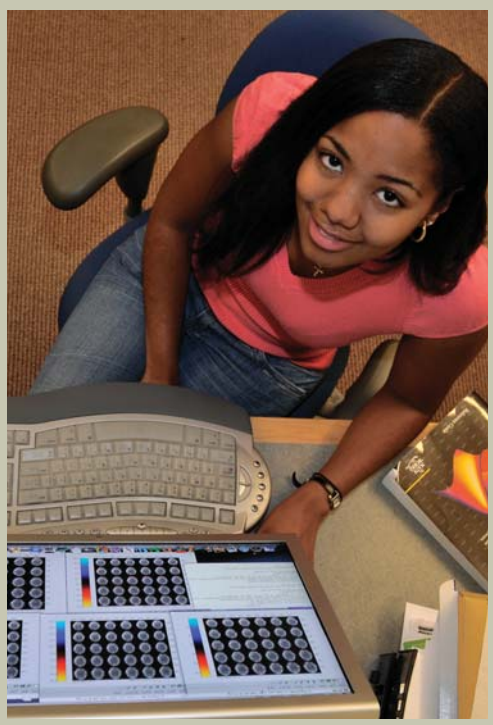
Dawson was accepted to the MIT program where she spent nine weeks working with Dr. Nancy Kanwisher in the Department of Brain and Cognitive Sciences. There, she studied the human visual cortex—specifically how people process what they see in their peripheral visual field.

"This information will help us further understand the workings of the brain and the visual system in particular," Dawson explains. "More knowledge about the functioning of the brain gives us higher hopes of finding ways to override the effects of diseases that affect the visual system."

It was the MIT lab experience that Dawson enjoyed the most. "I do research at Lehigh, but the level of this program was totally different," she says. "It really helped me think more as a scientist and realize that I can create a project and come out with something useful."

Dawson returned to Lehigh with a new boost of confidence in her lab skills. "When I went back, I asked my professor if I could develop my own experiment," she says. "Before Amgen Scholars, I would have just gone along with whatever project my professor assigned. I never would have thought I could design an experiment on my own. Now, I know I can."

Lindsay Dawson in the Kanwisher Lab with faculty mentor, Dr. Nancy Kanwisher.



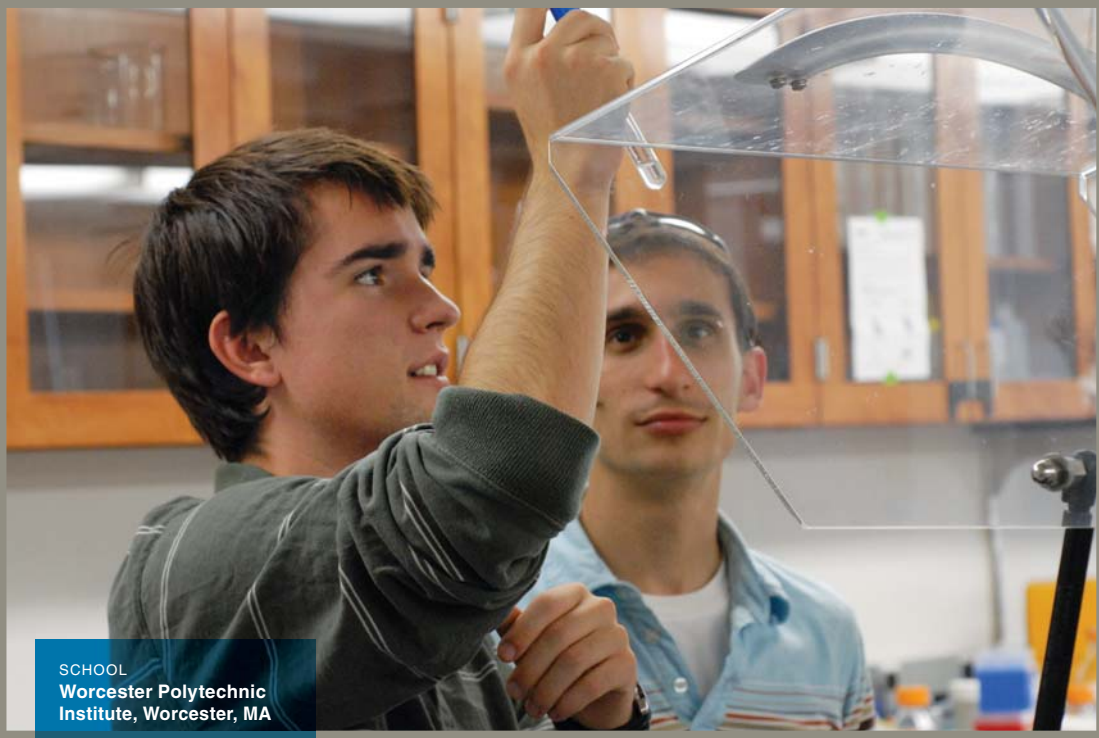
SCHOOL
Lehigh University, Bethlehem, PA

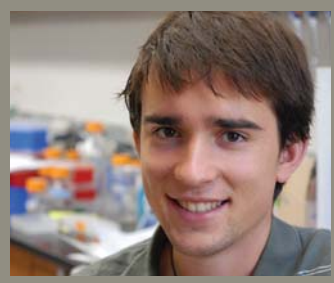
HOST
MIT

HOMETOWN
Monroe, NY

MAJOR
Behavioral Neuroscience

"Before Amgen Scholars, I would have just gone along with whatever project my professor assigned. I never would have thought I could design an experiment on my own. Now, I know I can."





Doug Tischer in the Smolke Lab with graduate student, Chase Beisel.

SCHOOL
Worcester Polytechnic Institute, Worcester, MA

HOST
California Institute of Technology

HOMETOWN
San Anselmo, CA

MAJOR
Chemistry, Biochemistry Minor

DOUG TISCHER

"I enjoyed the responsibility of coming up with a problem to tackle and designing experimental approaches to solve it."

DOUG TISCHER KNOWS ALL ABOUT *Escherichia coli* (*E. coli*). The good kind already living symbiotically inside of us that, with a little lab engineering, can shield the large intestine from infectious pathogens. His summer research in the Chemical Engineering Department labs at the California Institute of Technology (Caltech) could lead to the prevention of food poisoning and cholera infections.

"We found that, like white blood cells, when *E. coli* overproduce hydrogen peroxide, they can kill competing bacteria—even if the bacteria is antibiotic resistant," Tischer explains. "This research is a good proof of principle that bacteria can be engineered to kill other bacteria."

Tischer was one of 25 Amgen Scholars spread among various Caltech labs this summer. His mentor, Dr. Christina Smolke, oversaw his work—but provided enough leeway for Tischer to explore his own curiosity and intuition.

"This was the first time I was responsible for designing my own research project from start to finish," Tischer says. "It was exciting to have that kind of freedom. I enjoyed the responsibility of coming up with a problem to tackle and designing experimental approaches to solve it."

"I came out of the project thinking I could handle my own research—I don't have to rely on others to suggest ideas to me," Tischer adds.

Tischer had extra incentive to succeed. He and his lab partners learned their related probiotic bacterial projects had been accepted into the International Genetically Engineered Machine (iGEM) competition held this past fall at MIT.

"It just took a lot of hours in the lab to finish everything by the end of the summer, but we had to come up with something significant to present at the competition," Tischer says. "During the competition, we only had 15 minutes to present many weeks' worth of research. But I think we had a really strong project."

Along with gaining expertise in *E. coli*, Tischer found time for a little fun. Several Amgen Scholars were housed in the same dorm, making it easy for everyone to become friends.

"Every now and then, we'd go to the beach and to Disneyland," he says. "Having that smaller community meant that I could get to know people better. It made the research more enjoyable."

Would he recommend the Amgen Scholars Program to others? "Absolutely. It was a fantastic experience—especially if you're looking for a lot of depth in a summer research program. Summer internships are a chance for undergraduates to learn and to explore their options. The Amgen Scholars Program offers that and a lot more."

The program definitely made an impression. After graduating next year from Worcester Polytechnic Institute, Tischer plans to pursue a graduate degree in biochemistry. Among his top picks: Caltech.

JANELLE RUIZ

WHEN HER MOTHER BEGAN suffering from muscle weakness, severe fatigue, and cardiovascular problems, Janelle Ruiz, then 12, pored over online medical journals and databases to help determine the cause. It took four years before doctors came up with the diagnosis: mitochondrial encephalomyopathy, a very rare form of muscular dystrophy.

These early experiences prompted Ruiz's passion for medicine, but it was the Amgen Scholars Program this past summer that opened her eyes to the possibilities of science as a potential career choice.

A double major in biology and psychology at Loyola Marymount University, Ruiz came across the Amgen Scholars Program while researching summer internships. She was drawn to the chance to work in a prestigious lab, and spent nine weeks in the Department of Immunology at the University of Washington in Seattle. There, under the guidance of Dr. Michael Gale Jr., Ruiz investigated how the immune system initially responds to a hepatitis C viral attack and identified undiscovered ways that the body might fight against it.

It was an experience, Ruiz says, that completely changed her view of science.

"I came in thinking science was straightforward—that when you thought of a hypothesis, you'd get answers," Ruiz says. "What I discovered was even if you have a good idea and a good experiment, it might not work out for one reason or another."

"The Amgen Scholars Program gave me a realistic sense of what being a scientist is. And despite the challenges, I discovered that a career in science is something I should seriously consider."

Along with working in the lab, participating in weekly seminars, and attending the Amgen Scholars National Symposium, Ruiz commented that "it was powerful to recognize the kind of contribution you can make in this field. It made me realize I have more opportunities than I imagined."

"Before this program, I wouldn't have seriously considered going into biotechnology," she adds. "Now, I'm planning to pursue an M.D.–Ph.D. in hopes of making a significant contribution to the discovery of new medicines. It was an amazing summer."

Janelle Ruiz in Dr. Michael Gale's Immunology Lab with graduate student, David Owen.

SCHOOL
Loyola Marymount University, Los Angeles, CA

HOST
University of Washington

HOMETOWN
Tucson, AZ

MAJOR
Biology and Psychology

"The Amgen Scholars Program gave me a realistic sense of what being a scientist is. And despite the challenges, I discovered that a career in science is something that I should seriously consider."

Notable Alumni Achievements

JEFFREY CLOUTIER
MARSHALL SCHOLAR
HOST SCHOOL
University of Washington, 2007
UNDERGRADUATE
Middlebury College
GRADUATE
University College London

MICHAEL DREYFUSS
FULBRIGHT SCHOLAR
HOST SCHOOL
Columbia University, 2007
UNDERGRADUATE
Columbia University
GRADUATE
University of Toulouse II

DAWN ERIKSEN
NATIONAL SCIENCE FOUNDATION FELLOW
HOST SCHOOL
California Institute of Technology, 2007
UNDERGRADUATE
University of Massachusetts, Amherst
GRADUATE
University of Illinois, Urbana Champaign

TODD GINGRICH
RHODES SCHOLAR
HOST SCHOOL
California Institute of Technology, 2007
UNDERGRADUATE
California Institute of Technology
GRADUATE
Oxford University

DOUG TISCHER & VICTORIA HSIAO
THIRD PLACE, iGEM INTERNATIONAL COMPETITION
HOST SCHOOL
California Institute of Technology, 2008
UNDERGRADUATE
Worcester Polytechnic Institute & Franklin W. Olin College of Engineering

ANYA YERMAKOVA
RHODES SCHOLAR
HOST SCHOOL
University of Washington, 2008
UNDERGRADUATE
Northwestern University

UNDERGRADUATE SCHOOL
Ramapo College Mahwah, NJ

HOST
UC San Diego, 2007

GRADUATE SCHOOL
University of Pennsylvania

DEGREE PROGRAM
Ph.D., Biochemistry

ALUMNI PROFILE

GLEN LISZCZAK

A DOUBLE MAJOR IN CHEMISTRY and biology at Ramapo College, Glen Liszczak knew he was earning a solid education that would prepare him for graduate school. But when it came to lab experience, the small Mahwah, N.J., liberal arts college's offerings—especially in biological chemistry—were limited.

"Graduate schools like to see a broad exposure to different techniques and instrumentation, both which go hand in hand with lab experience," Liszczak says. "There's no doubt I needed to go somewhere else to get that. When I found the Amgen Scholars Program at the University of California, San Diego (UCSD) on the web, it looked perfect. I wasn't sure I'd be accepted since I would be coming from such a small school. So, I was thrilled to get in."

Liszczak spent the summer of 2007 in the lab of Dr. Michael Sailor, a professor in UCSD's Department of Chemistry and Biochemistry. His project: to work on a drug delivery system/diagnostic tool by first figuring out how to attach silicon to a peptide that would then make its way to cancer cells. Once he did that, the next step would be to insert medicine or exploit other properties of the silicon, transforming the silicon/peptide combination into an effective drug delivery system—or a way to help magnetic resonance imaging (MRI) machines detect small tumors that would otherwise go unnoticed.

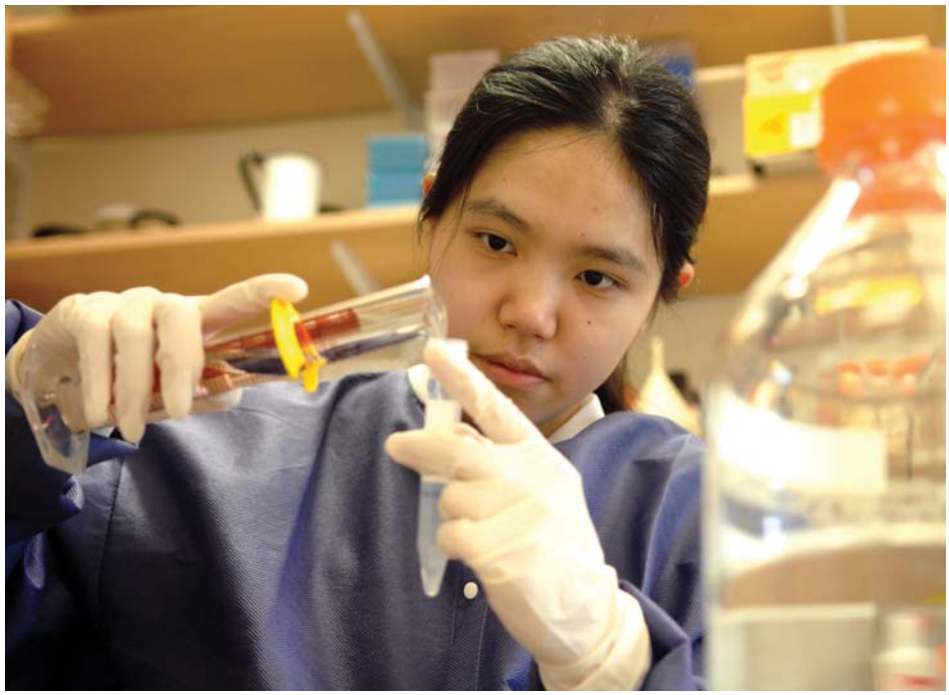
"The research was extremely challenging," Liszczak says, recalling the many hours he spent poring over research papers and conducting experiments. "Dr. Sailor and Jennifer Park, the graduate student I worked for, let me do my own research and experiments—that was, by far, the best part."

"It was great to do research in the field of biochemistry," Liszczak says. "There's no doubt that without my Amgen Scholars experience at UCSD, I'd have been much less marketable."

The University of Pennsylvania certainly agreed, accepting Liszczak into its Chemistry Ph.D. program this past fall. Liszczak is convinced that he's on the right educational path.

"The Amgen Foundation gave me the opportunity to prove to myself and to other people that I am passionate about scientific research and that it indeed has become an integral part of my life," he says. "Whether I wind up working in industry or in academia, this is exactly what I want to do."

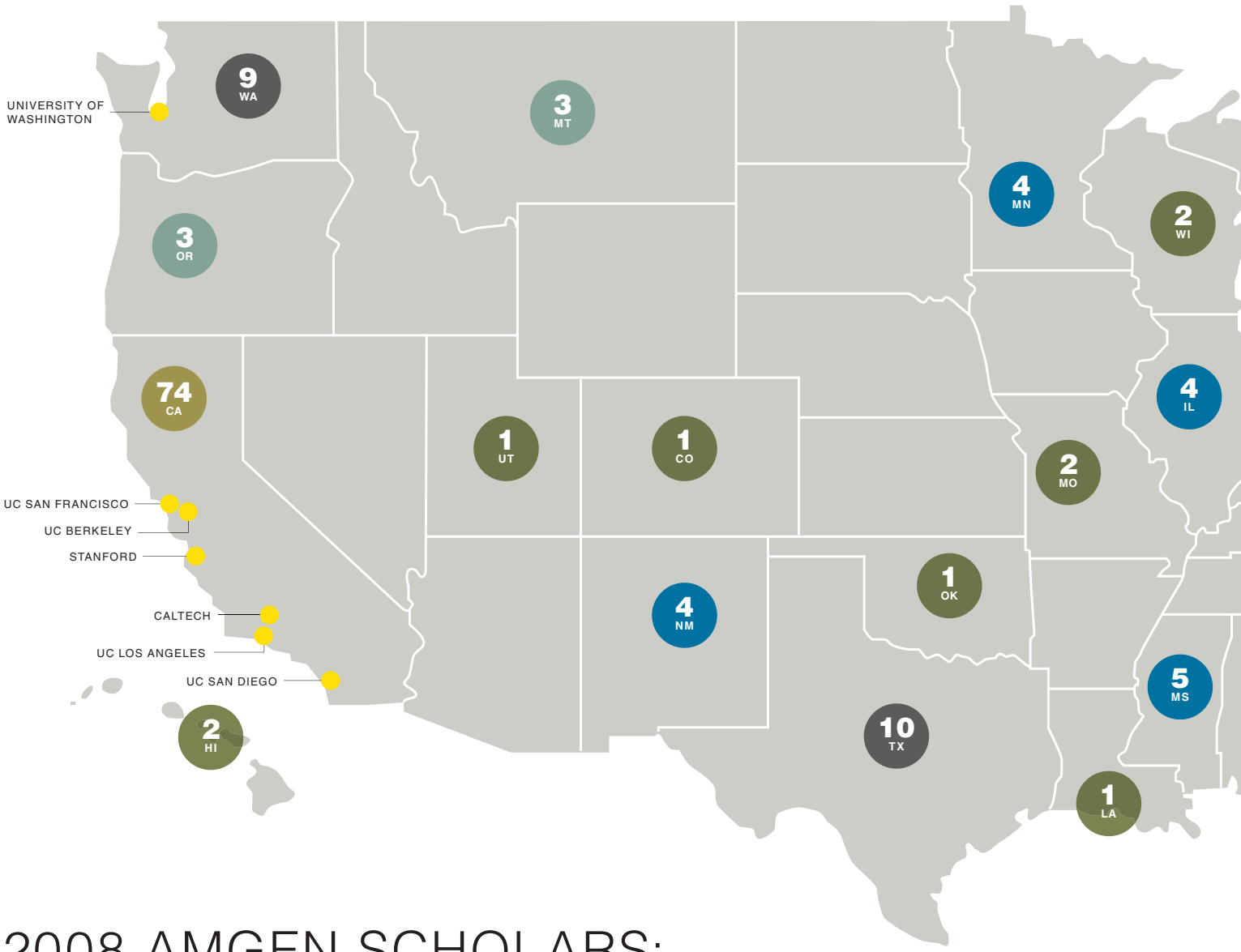
"There's no doubt that without my Amgen Scholars experience at UCSD, I'd have been much less marketable."



Select Amgen Scholar Alumni in Graduate School

AMGEN SCHOLAR	UNDERGRADUATE SCHOOL	HOST SCHOOL	GRADUATE SCHOOL	CONCENTRATION	DEGREE
Dawn Eriksen	UMass, Amherst	CALTECH	UI Urbana Champaign	Chemical Engineering	Ph.D.
Erin Lamb	Duke University		Caltech	Chemistry	Ph.D.
Taylor Lenton	Wellesley College		Caltech	Chemistry	Ph.D.
Krastina Petrova	Caltech		UCLA	Chemistry and Biochemistry	Ph.D.
Kathryn Schaefer	Mount St. Mary's College		Caltech	Biochemistry and Molecular Biophysics	Ph.D.
Shawn Yu	Caltech		University of Washington	Medical Scientist Training Program	M.D.–Ph.D.
William Joo	Brown University	COLUMBIA	Stanford University	Developmental Biology	Ph.D.
Christopher O'Conor	Columbia University		UNC	Medical Scientist Training Program	M.D.–Ph.D.
Allison Lau	Pennsylvania State University	MIT	Harvard University	Biological and Biomedical Sciences	Ph.D.
Lena Pernas	UCLA	STANFORD	Stanford University	Microbiology and Immunology	Ph.D.
Cristian Aguilar	CSU Pomona	UC BERKELEY	UC Irvine	Biological Sciences	Ph.D.
Julian Codelli	UC Berkeley		Caltech	Chemistry	Ph.D.
Yang Li	Georgia Institute of Technology		MIT	Biological Engineering	Ph.D.
Cristina Lopez-Fagundo	University of PR, Mayaguez		Brown University	Biomedical Engineering	Ph.D.
Michelle Lozada-Contreras	University of PR, Mayaguez		UC Davis	Chemical Engineering	Ph.D.
Krystal Morales-Rivera	University of PR, Rio Piedras		Texas A&M University	Biochemistry and Biophysics	Ph.D.
Suraj Pradhan	Northwestern University		Stanford University	Neuroscience	Ph.D.
Miguel (Michael) Sanchez	San Francisco State University		UC Berkeley	Molecular and Cell Biology	Ph.D.
Greg Timblin	NE Wesleyan University		UC Berkeley	Molecular and Cell Biology	Ph.D.
Seychelle Vos	University of Georgia		UC Berkeley	Molecular and Cell Biology	Ph.D.
Azriel Ghadooshahy	UCLA	UCLA	MIT	Brain and Cognitive Sciences	Ph.D.
Eduardo Caro	University of PR, Rio Piedras	UCSD	UCSD	Chemistry	Ph.D.
Thomas Gamage	Virginia Commonwealth		Virginia Commonwealth	Pharmacology	Ph.D.
Glen Liszczak	Ramapo College of New Jersey		University of Pennsylvania	Chemistry	Ph.D.
Freddyson Martinez	Inter American University of PR		University of PR	Medical Scientist Training Program	M.D.–Ph.D.
Darren Miller	Mount Union College		University of Kentucky	Neurobiology	Ph.D.
Zakary Singer	UCSD		Caltech	Computational Neurophysics	Ph.D.
Jeffrey Cloutier	Middlebury College	UW	University College London	Molecular Biology	Ph.D.
Jennifer Hadley	Washington University, St. Louis		UA, Birmingham	Medical Scientist Training Program	M.D.–Ph.D.
Kok Shuen "Iris" Pang	University of Washington		Yale University	Biological and Biomedical Sciences	Ph.D.
Lianna Wood	University of Washington		University of Washington	Medical Scientist Training Program	M.D.–Ph.D.

PARTICIPANTS BY STATE*



2008 AMGEN SCHOLARS: **A closer look**

In the second year of the Amgen Scholars Program, 2,312 undergraduates from around the country applied for one of the coveted spots at the 10 participating U.S. host universities—California Institute of Technology, Columbia University/Barnard College, Howard University, Massachusetts Institute of Technology, Stanford University, University of Washington, and four University of California campuses: Berkeley, Los Angeles, San Diego, and San Francisco.

In all, 248 scholars representing nearly 120 U.S. colleges and universities—and 37 U.S. states and territories—participated in the 2008 program, which offers a rare glimpse into the day-to-day life of a research scientist. Participating scholars represented a wide range of ethnic and socioeconomic backgrounds.

"Our goal is for this program to be a pivotal experience in the academic life of an undergraduate, exposing students to world-class research and inspiring them to pursue scientific careers," says Scott Heimlich, Amgen Scholars senior program officer at the Amgen Foundation.

LIST OF PARTICIPANT HOME SCHOOLS

AL
Alabama Agricultural and Mechanical University

CA
Biola University
California Institute of Technology
California Polytechnic State University
California State University, Fullerton
California State University, Los Angeles
California State University, Northridge
Loyola Marymount University
Pomona College
San Diego State University
San Francisco State University
San Jose State University
Stanford University
University of California, Berkeley
University of California, Davis
University of California, Irvine
University of California, Los Angeles
University of California, Riverside
University of California, San Diego
University of California, Santa Barbara
University of California, Santa Cruz
University of Southern California

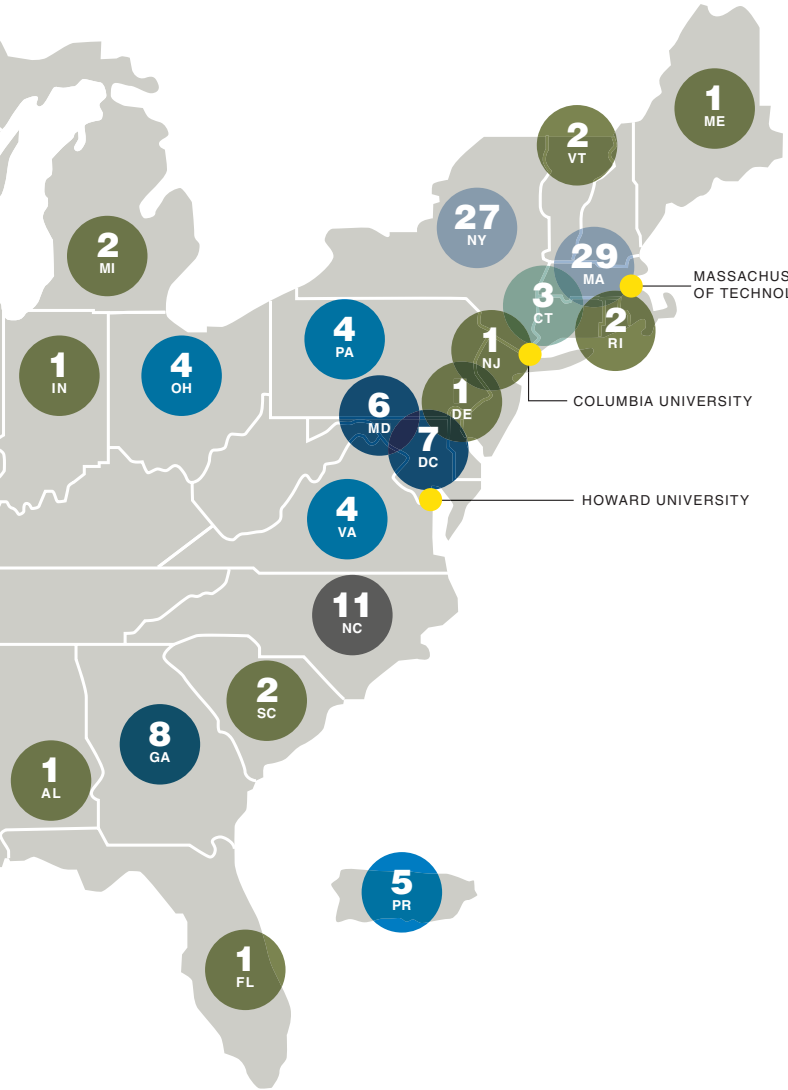
CO
University of Colorado, Boulder

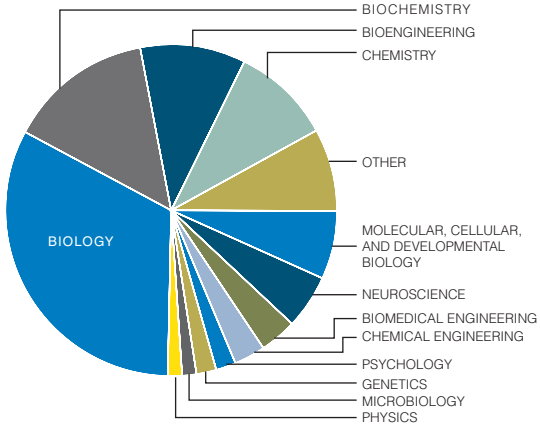
CT
Trinity College
Yale University

DC
George Mason University
Georgetown University
Howard University

DE
Delaware State University

*Map is based on the participants' home schools.





PARTICIPATION BY MAJOR

FL
Florida International University

GA
Georgia State University
Mercer University
Morehouse College
Spelman College
University of Georgia
University of West Georgia

HI
Chaminade University of Honolulu
University of Hawaii, Manoa

IL
Knox College
Loyola University, Chicago
Northwestern University
University of Illinois, Chicago

IN
University of Indianapolis

LA
Tulane University

MA
Boston University
Franklin W. Olin College of Engineering
Hampshire College
Harvard University
Massachusetts Institute of Technology
Mount Holyoke College
Williams College
Worcester Polytechnic Institute

MD
Loyola College
University of Maryland, Baltimore County
University of Maryland, College Park
University of Maryland, Eastern Shore

ME
Bowdoin College

MI
Calvin College
Central Michigan University

MN
Carleton College
Concordia College
Minnesota State University, Mankato

MO
St. Louis University
Washington University, St. Louis

MS
Alcorn State University

MT
Carroll College
Montana State University
Montana Tech of the University
of Montana

NC
Davidson College
Duke University
Guilford College
University of North Carolina, Chapel Hill
Winston-Salem State University

NJ
Rutgers University

NM
University of New Mexico

NY
Bard College
Barnard College
College of Staten Island
Columbia University
Cornell University
Hunter College of CUNY
Rensselaer Polytechnic Institute
University of Rochester

OH
Kenyon College
Oberlin College
Ohio State University
Xavier University

OK
Langston University

OR
Oregon State University
Portland State University
Reed College

PA
Lehigh University
Pennsylvania State University
Swarthmore College
University of Pennsylvania

PR
Universidad Metropolitana
University of Puerto Rico-Humacao
University of Puerto Rico, Mayagüez

RI
Brown University

SC
Clemson University
Erskine College

TX
Rice University
Texas State University-San Marcos
Texas Tech University
University of Houston
University of Texas, Austin
University of Texas, El Paso
University of Texas-Pan American
University of Texas, San Antonio

UT
Brigham Young University

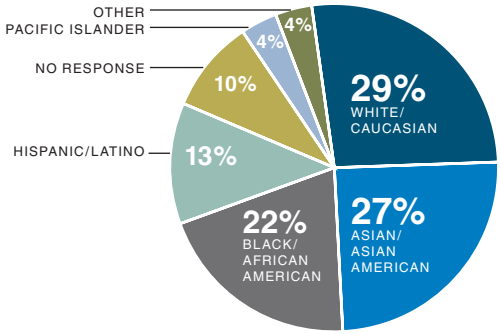
VA
Hampton University
University of Virginia
Virginia Commonwealth University

VT
Middlebury College

WA
Seattle University
University of Washington
Whitworth University

WI
Lawrence University
University of Wisconsin-Madison

All data for the Amgen Scholars Program is collected and evaluated externally through the Center for Evaluation and Education Policy (CEEP) at Indiana University.



PARTICIPATION BY ETHNICITY/RACE*

* Total may exceed 100% as some participants identified with more than one ethnicity/race.

AMGEN SCHOLARS U.S. SYMPOSIUM 2008

IMAGINE A ROOM WITH 250 OF THE BEST AND brightest undergraduates meeting one another and sharing their summer research projects, networking with leading scientists in industry and academia, and hearing presentations that inspire them to pursue graduate studies and careers in science and biotechnology.

That was the scene at the second annual Amgen Scholars U.S. Symposium, held July 19–21, at UCLA. The symposium is a key component of the Amgen Scholars Program in which promising scholars are selected—this year representing nearly 120 schools from across 37 states and territories—to spend the summer divided among 10 prestigious U.S. universities. There, they explore areas of research beyond what they may be able to do as part of their regular undergraduate education.

On the opening day of the symposium, Dr. Joseph P. Miletich, senior vice president of Research and Development at Amgen, gave the opening keynote address on the impact of biotechnology on drug discovery and development. He also shared his personal reflections on the past and future of scientific research and the promise of advances in biotechnology.

"I am envious of all the great discoveries and opportunities you will experience throughout the span of a scientific career," Miletich told the students. "We are in a time of remarkable evolution of what is possible, and it is astounding to imagine what is available to you."

During the weekend, students heard a variety of presentations from industry and academic scientists. Dr. Charles Craik, professor of biochemistry, pharmaceutical chemistry, and cellular and molecular pharmacology at the University of California, San Francisco, spoke about the multitude of career paths for a scientist with a Ph.D.

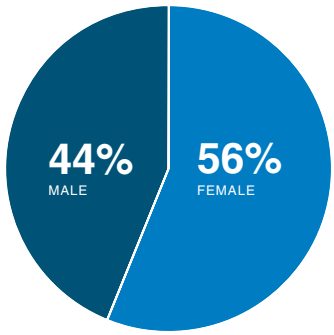
Amgen Chairman and CEO Kevin Sharer spoke to the students about the importance of leadership in all endeavors, while other industry scientists presented on various stages of the drug discovery and development process, from identifying drug targets to the evolution of protein therapeutics.

To provide a perspective on commercial manufacturing, Alison Moore, vice president and Amgen Fremont site head, discussed the process of manufacturing therapeutic proteins.

In addition, more than 25 scientists and engineers from industry and academia volunteered their time to host roundtable and panel discussions, giving the students an insider's view of a day in the life of a scientist.

The industry scientists were joined by more than 30 faculty and staff from the 10 host universities.

"It's the Amgen Foundation's hope that this program will encourage these students to pursue graduate training and, eventually, scientific careers," says Jean J. Lim, president of the Amgen Foundation.



PARTICIPATION BY GENDER

"It was incredibly encouraging to hear other people's experiences when it comes to a career in science. It helped give me confidence that even though research isn't going to be the easiest path to follow, if you really enjoy it, it's going to be fulfilling."

UCLA AMGEN SCHOLAR

Amgen Foundation
One Amgen Center Drive
Thousand Oaks, CA 91320-1799
www.amgen.com

Massachusetts Institute of Technology

77 Massachusetts Avenue
Cambridge, MA 02139-4307
web.mit.edu

The Old Schools
Trinity Lane
Cambridge CB2 1TN, UK
www.cam.ac.uk

TO LEARN MORE ABOUT THE AMGEN SCHOLARS PROGRAM, VISIT WWW.AMGENSCHOLARS.COM.

The paper used in the printing of this publication contains 10% post-consumer waste, with the balance from responsibly managed mixed sources.

DESIGN: Moore Moscowitz Design PRINTING: Universal Millennium PHOTOGRAPHY: Eileen Barroso, Steve Fisch, Barry Hetherington, Justin Knight, Mary Levin, Felice Macera, Robert Paz, Lisa Sze, and Todd Wawrychuk WRITING: Mary Thorsby EDITING: Linda Walsh