

science IMPACT

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**CARNEGIE
SCIENCE
CENTER**

One of the four Carnegie Museums of Pittsburgh



A demonstration during Carnegie Science Center's "SolarQuest: Living with our Star" explains magnetic field lines and how they relate to auroras.

SolarQuest Blasts into Orbit Students Visit the Sun Without Ever Leaving Pittsburgh

With a loud “POPI,” a bright orange hydrogen balloon explodes to the delight of dozens of students watching the stage in awe.

What else is big, fiery, orange, and made primarily of hydrogen?

“The Sun! Our ‘neighborhood star,’” as longtime Science Center Education Program Developer **Mike Hennessy** calls it.

Students in grades 1–8 across the region are learning about the power and importance of the Sun at SolarQuest, the Science Center’s newest Science on the Road show. “SolarQuest: Living with Our Star” is presented in partnership with the National Aeronautics and Space Administration.

The show blasts students into orbit around

the Earth with NASA’s Solar Dynamics Observatory. It offers a chance to explore the solar system and learn why Earth is just right for life.

In addition to the exploding hydrogen – always a crowd-pleaser – students see first-hand a model of how photosynthesis works, as emulated by a balloon-popping laser. Student volunteers gleefully raise their hands for a chance to see themselves in infrared. Real images from space guide the assembly program.

The Science Center is one of a number of U.S. science institutions awarded grants from NASA to create innovative interpretations of heliophysics, an environmental science that combines meteorology and

astrophysics in its examination of how the Sun affects the solar system. Carnegie Science Center is the only institution using its grant for a traveling theater-style assembly program.

Carnegie Science Center reaches more than 150,000 students each year through its Science on the Road program, which packs learning and excitement into every show.

Coupled with the traveling show is a portable digital planetarium demonstration. A full-dome planetarium show relating to the Sun will debut in the Buhl Planetarium at the Science Center this Spring.

Schools can choose to have the Science Center add hands-on learning stations, including tabletop explorations for individual students, developed by Education Coordinator **Marilyn Fitzsimmons**, to reinforce and further develop the scientific concepts related to heliophysics.

To Hennessy, it’s important to teach the public about the Sun – something we see and feel every day but may not quite understand.

“Our storyline takes students on a mission with the Solar Dynamics Observatory, our ‘eye on the Sun.’” says Hennessy. “We begin with the Sun’s nuclear fusion and trace the journey of sunlight to Earth, where it warms our planet, jumpstarts photosynthesis, and sustains life. We explore sunspots and solar flares, and learn how “space weather” events can affect our power grid and produce colorful aurorae. The more we observe Sun-Earth interactions, the better we can conserve our natural and technological resources.”

Earth orbits within our star’s “Goldilocks Zone,” making it just right for life. Because of the interplay among the Sun’s radiation, the Earth’s magnetic field, and layers of atmosphere, a balance exists that sustains life on Earth as we know it.

(Story continues on page 3)

directors' note



These days, STEM education is more important than ever.

At the Science Center, STEM (science, technology, engineering, and math) takes center stage in our discussions and programming every day. But we learned recently through a comprehensive regional study that many parents aren't familiar at all with the acronym; they've never heard the term. Parents are, however, passionate about raising problem solvers who can think critically – key tenets of quality STEM education. Parents' underlying attitudes about education and careers match well with STEM as an approach to teaching and learning. We all agree on that. But clearly there's a critical communication barrier we must overcome when talking about STEM education.

Those findings are part of a comprehensive STEM education study we commissioned last year titled, "Work to Do: The Role of STEM Education in Improving the Tri-State Region's Workforce" (see "Study Charts Perceptions About STEM," page 3). The study analyzed perceptions about STEM education among parents, business leaders, educators, and students across 17 counties, including rural areas of western Pennsylvania, Ohio, and West Virginia. One of the key findings of the study is that parents, educators, and business leaders believe schools must do a better job in preparing tomorrow's workforce – and most educators say STEM education is becoming more of a priority. Indeed, there is work to do.

We've taken an important role in helping schools improve their STEM education by developing the Carnegie STEM Excellence Pathway. This past fall, 83 educators from 13 regional schools began their journey

on the Carnegie STEM Excellence Pathway, convening in October for a day-long workshop at the Science Center (see "Carnegie STEM Excellence Pathway," page 4). They are our partners and our advocates in the cause of STEM education and career development, and they are joining the Science Center in our effort to disseminate best practices for integrating STEM into classrooms across the region.

The Pathway fosters thinking about long-term, strategic goals with a focus on continuous growth. It helps identify the components of quality STEM education and then implement them. And one of the key components of the Pathway is parental involvement – a need validated by the Work to Do study.

When we launched our Chevron Center for STEM Education and Career Development three years ago, it was with the belief that strong community collaboration was needed to move the needle in STEM education. We convened a STEM Center Advisory group – which comprises representatives from corporations, K–12 education, higher education, and foundations. This Advisory, along with other key partners, are taking on the challenge of improving STEM education. While we believe we've made progress, as our STEM study discovered, there is still work to do. We'll continue to collaborate with the region's parents, educators, and business leaders as together we meet that challenge.

Ron Baillie and Ann Metzger
Henry Buhl, Jr., Co-Directors



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CarnegieScienceCenter.org

Carnegie Science Center delights, educates and inspires through interactive experiences in science and technology. By making science both relevant and fun, the Science Center's goal is to increase science literacy in the region and motivate young people to seek careers in STEM (science, technology, engineering and math).

The Science Center also serves as a town square for community dialogue on science and its social implications and seeks to showcase regional science and technology advances.

One of the four Carnegie Museums of Pittsburgh, the Science Center is Pittsburgh's premier science exploration destination, reaching more than 700,000 people annually through its hands-on exhibits, camps, classes and off-site education programs.

Ron Baillie and Ann Metzger
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Study Charts Perceptions about STEM

How is STEM education perceived? What are the attitudes and concerns of corporate leaders, educators, and parents? These are the questions that Carnegie Science Center sought to explore in Summer 2014, in a study spanning a 17-county region in south-western Pennsylvania and adjacent areas of Ohio and West Virginia.

The study, titled “**Work to Do: The Role of STEM Education in Improving the Tri-State Region’s Workforce**,” was conducted by Campos, Inc., with funding from Chevron and additional support from Nova Chemicals.

The results of the study strongly bear out the promise of STEM education. Educators and business leaders are adamant that STEM education is for all students. They identify key prerequisites for robust STEM education, emphasizing that it must be engaging to students—collaborative, hands-on, problem-solving, and project-based.

Business leaders consistently say STEM education holds the promise for closing the workforce gap of skilled workers in the region, and educators say STEM education is becoming more of a priority in the region. They are excited about STEM-related jobs and careers, particularly in rural areas.

But there is work to be done in fulfilling this promise. The study found that parents’ awareness of and understanding about STEM education is low throughout the region, and at its lowest in rural areas. Only 2 in 5 parents (42%) have heard of STEM education and only 1 in 5 (20%) have talked to a school official about it.

Most importantly, the current language around STEM education is not resonating with parents. Parents—particularly those in rural areas—need significant help in

understanding what STEM education is and how it can help their children achieve their goals. Commonly expressed misperceptions include that STEM is only for smart students, that only college-bound students benefit from STEM, and that STEM is about math and science and therefore not for girls.

Educators understand the importance of STEM—particularly in rural areas—but cite significant obstacles to overcome both inside and outside the classroom.

“**Business leaders say STEM education holds the promise for closing the workforce gap of skilled workers in the region...**”

“This study affirms our established model: hands-on, project-based science learning with components that illuminate real-world career connections,” says **Ann Metzger**, co-director of Carnegie Science Center. “It validates our new Carnegie STEM Excellence Pathway initiative (see page 4), which includes teacher professional development and parental involvement.”

“The study also demonstrates a need for us to continue to work to connect educators and the business community,” says **Ron Baillie**, the Science Center’s other co-director. “It challenges us to find new ways to communicate to parents.”

KEY STUDY FINDINGS

Public misperceptions:

- STEM is only for smart students
- Only college-bound students benefit from STEM
- STEM is about math and science and therefore not for girls

Teacher misperceptions:

- STEM requires a lot of training; certification is difficult
- STEM is difficult to teach and align with state standards
- STEM is way too expensive to implement

School-related obstacles:

- Culture of apathy and teaching to the test
- Teachers lack time to incorporate STEM
- Teachers are inexperienced with STEM
- Declining education budgets
- Lack of STEM curriculum aligned with state standards
- Lack of business support
- Too little collaboration with higher education
- Lack of extracurricular activities that support STEM education

SolarQuest Blasts into Orbit (...continued from Page 1)

The Science Center’s \$764,000 proposal for the traveling show was selected by NASA from a pool of 75 proposals vying for a grant through NASA’s Education and Public Outreach for Earth and Space Science Program.

According to Stephanie Stockman, lead for education and public outreach at NASA headquarters, “[This] proposal’s high intrinsic merit, in combination with a consideration of the relevance, available funding, program balance, and program goals, led to a recommendation for selection.”



STEM Excellence Pathway partners meet at Carnegie Science Center in October for a workshop.

Carnegie STEM Excellence Pathway Already Reaching Half-million Children

Imagine you're a high school chemistry teacher. You want your school to offer more STEM opportunities for students, but how?

Carnegie Science Center's STEM Excellence Pathway offers a roadmap. The project has created a model for schools and districts – both well-resourced and underserved – to achieve systemic change in STEM education. The Carnegie STEM Excellence Pathway includes a unique self-evaluation rubric tool as part of a continuous improvement process.

Since its launch at the beginning of the 2014–15 school year, the Pathway has reached about 300 educators from 1,123 schools representing 725,924 students from Pennsylvania, Missouri, Kansas, and Vermont.

Teachers are already lauding the program, and interest is spreading.

“The electronic version of the rubric is fabulous,” Dr. Judith Bulazzo, director of curriculum and professional development

at Upper St. Clair School District said.

“I would recommend this to any school district!” North Hills School District Counselor David Barkovich said.

Science Center STEM Center staff spoke about the Pathway at the STEMathon conference in central Pennsylvania as well as at the Missouri Math and Science Coalition in August. In September, Director of Strategic Education Initiatives **Alana Kulesa** conducted a workshop for educators from Missouri and Kansas in partnership with the Kansas City STEM Alliance. In October, 13 school district partners met at the Science Center for a day-long workshop to begin their Pathway journey. Another Pathway Partner workshop is scheduled for February in St. Louis, MO.

The program provides a rubric for each Pathway partner to assess their own school's, or district's, current performance in six areas: instructional practices, teacher qualifications, curriculum, assessment and

demonstration of skills, family engagement, and real-world connections. Within each area are specific criteria – a total of 20 in the full rubric – and descriptions of levels of performance. The criteria reflect Carnegie Science Center's definition of quality STEM education: inquiry-based and project-based learning, involving teamwork, and incorporating career awareness. The rubric is a positive, non-critical, progressive growth model ranging from pre-emerging to leading (see image below).

The Carnegie STEM Excellence Pathway is available online – therefore accessible internationally – through STEMisphere, an online directory created by Carnegie Science Center as a community service to provide a portal to educational STEM resources for students in pre–K through 12th grade, their families, and their teachers. To access the Pathway, visit STEMisphere.org/educators

The planning work has been made possible through a grant from **The Heinz Endowments**.

	Pre-Emerging	Emerging	Progressing	Advancing	Leading
INSTRUCTIONAL PRACTICES					
8 Inquiry- Based Teaching	There is no current action in this area.	STEM coursework occasionally is based on student- or teacher-initiated questions that are clearly linked to their learning experiences.	STEM coursework is frequently built on student- and teacher-initiated questions that are clearly linked to their learning experiences.	STEM coursework is built largely on student and teacher initiated questions that are clearly linked to their learning experiences.	STEM coursework is nearly always built on student and teacher initiated questions that are clearly linked to their learning experiences.

Using the Carnegie STEM Excellence Pathway rubric, districts or schools evaluate themselves on 20 criteria, like this one.

GRANTS & AWARDS

- **Chevron Corporation** has added to its title sponsorship of the Chevron Center for STEM Education and Career Development with \$252,675. The funds will support continued development of the Science Center's STEMisphere website, sponsorship of the 2014 Student Energy Summit, and the "Work To Do" research study, evaluating the regional relationship between STEM education and workforce development.
- **PNC Foundation** has awarded a \$198,500 grant for the "BUZZWORD Pittsburgh" project, which will incorporate vocabulary and comprehension into the Science Center's early learner outreach activities in Homewood over a two-year period. The project is part of a collaboration among the Pittsburgh Cultural Trust, Opera, Ballet, Parks Conservancy, and Children's Museum.
- The **Colcom Foundation** has provided \$300,000 to fund a new exhibit, titled *H₂Oh!: Why our Rivers Matter*. The exhibit will debut in February.
- **Laurel Foundation** has provided a \$50,000 gift to assist in development of *H₂Oh!: Why Our Rivers Matter*, set to debut in February.
- With a \$100,000 gift, **Eaton** will support 2015 STEM programming, events, and initiatives through Carnegie Science Center's Chevron Center for STEM Education and Career Development. Eaton will also serve as presenting sponsor of the 2015 Carnegie Science Awards.
- **EQT Foundation** has renewed support for the Science Center's Engineer the Future program as presenting sponsor with a \$75,000 gift. Select funds from the gift will be used to support students from Greene, Fayette, and Washington counties, who would otherwise not be able to attend the Engineer the Future event in February.
- Carnegie Science Center celebrated the Buhl Planetarium's 75th anniversary with special events and the launch of the Buhl Academy, thanks to a \$75,000 grant from the **Buhl Foundation**. The innovative Buhl Academy pairs students and teachers with local astronomers for inquiry-based instruction in the classroom. The Academy will also showcase the Buhl Planetarium not just as a forum for standard planetarium shows, but as a curriculum resource for area educators.
- With a \$60,000 gift, **FedEx Ground** supported SciTech Days programming in November 2014 and will continue their support in March 2015. FedEx will also serve as an award sponsor at the 2015 Carnegie Science Awards.
- With a \$25,000 gift, **Lionel** supported Lionel Days during the holiday season. Lionel is also presenting sponsor of the Science Center's Miniature Railroad & Village®.
- A \$50,000 gift from **Duquesne Light** hosted Duquesne Light Conservation Day, a "free day" at Carnegie Science Center on January 19. Nearly 6,000 people visited Carnegie Science Center and viewed an Omnimax film at no cost. Visitors had an opportunity to explore special programming and learn about the everyday choices that they can make to conserve energy and therefore conserve natural resources. Conservation Day programming educated visitors about saving energy and money and featured environmentally-themed shows.



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Submit resources to the
STEMisphere Directory:

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BOARD SPOTLIGHT



Trip Oliver

With a background in politics and government, **Trip Oliver** understands how quickly technology is evolving and how important it is for science centers to maintain cutting-edge technological relevance.

"The pace of change that has occurred in technology over the last 50 years is accelerating exponentially, and science centers need to keep up to remain relevant," he said.

Oliver, who serves as manager of policy, government, and public affairs for Chevron's Appalachian/Michigan Business Unit joined the Science Center's board in June 2014.

He said he enjoys engaging with board members and learning about the Science Center's vision for the future.

"The value of the Science Center is most obvious to people in the City of Pittsburgh and the surrounding area," Oliver said. "I think it's important to make sure that people who live in more rural parts of the region have a shared sense of that value. Bringing the programs of the Science Center to rural areas is a focus of mine, as well as Chevron's."

A Fox Chapel native, Oliver holds a bachelor of arts in Political Science from Vanderbilt University and a law degree from the Catholic University of America Columbus School of Law.

Oliver and his wife Amy have two children, Matthew, age 4, and Emma, age 2. On their Science Center visits, the Aspinwall family spend their time exploring the Miniature Railroad & Village®, playing in the water features, and enjoying the basketball robot.

PARTNER SPOTLIGHT

THE BUHL FOUNDATION
Henry C. Frick Educational Fund

Frederick W. Thieman President, The Buhl Foundation



Frederick W. Thieman has served as President of the Buhl Foundation, Pittsburgh's oldest multi-purpose foundation, since 2007. He is a former United States Attorney for the Western District of Pennsylvania who graduated from the University of Pittsburgh School of Law. He earned undergraduate degrees in Journalism and English at Pennsylvania State University.

What is the Foundation's mission?

The mission of the Buhl Foundation is to create community legacies by leveraging its resources to encourage people and organizations to dream, to innovate, and to take action.

Why is a STEM-prepared workforce important to the Foundation?

This region is very important to The Buhl Foundation.

An educated workforce, especially in the STEM arena, is one of the largest challenges that this region will face over the next 20 years because of an aging population and retirements and because of the explosion in eds-meds technology. A STEM-prepared workforce is not only important to advanced degrees but virtually all degrees, from manufacturing and machining to construction.

There is an increasing gap in the needs of employers and the skillsets of employees. The bigger that gap grows, the less competitive this region becomes. The better and more talented the workforce, the more it attracts employers to the region.

In what ways has the Buhl Foundation supported the Science Center?

The Buhl Foundation is Pittsburgh's oldest foundation, founded in 1927. One of its first projects was to build the Buhl Planetarium — one of five in the country at that time. When the Buhl merged with Carnegie Science Center, the Foundation transferred a multimillion-dollar endowment and has since provided a gift to fund the Science Center's co-chairs.

In addition, the Foundation has provided a million-dollar grant to update the current Buhl Planetarium to its digital format. It has given hundreds of thousands of dollars to support program elements, especially STEM activities.

Even now as the Buhl Foundation's focus changes to more of a place-based strategy on Pittsburgh's North Side, we anticipate that Carnegie Science Center will continue to be a key partner.

Why does the Foundation see as value its support of Carnegie Science Center?

As far back as the building of the original Buhl Planetarium, the Foundation believed that science was at the heart of education and youth development. Since that time, generations of young people have been excited about science and launched STEM-related careers because of the experiences they had at the Buhl Planetarium and now the Science Center. That's the essence of youth development, of K-12 education, and of regional economic development — all pursuits that are as important today as they were at our founding.

Do you have any personal favorite exhibits/activities at the Science Center?

The excitement of the planetarium never gets old. Every time I walk by the Zeiss there in the Science Center's lobby, it brings back a lot of pleasant memories of my youth having visited the Buhl Planetarium as a child.

“There is an increasing gap in the needs of employers and the skillsets of employees. The bigger that gap grows, the less competitive this region becomes.

The better and more talented the workforce, the more it attracts employers to the region.”



The original Buhl Planetarium on Pittsburgh's North Side.

Buhl Extends Planetarium Mission

To celebrate the 75th anniversary of Buhl Planetarium and Institute of Popular Science, the Buhl Foundation made a grant of \$75,000 to Carnegie Science Center to support the creation of the Buhl Academy. This innovative initiative will educate students and teachers alike about issues in astronomy, as well as showcase the Buhl Planetarium not just as a forum for standard planetarium shows, but as a curriculum resource for area educators.

Carnegie Science Center's Buhl Academy, launched in January 2015, will connect teachers, students, and real-world astronomers in local science classrooms. Educators and astronomers will collaborate in the development and team-teaching of inquiry-based astronomy lessons.

Buhl Academy students will visit the Science Center for more astronomy-focused inquiry, a planetarium show, and a question-and-answer session with the Buhl's director, astrophysicist **Dr. Brendan Mullan**. In culmination, Buhl Academy students will create short digital videos about an astronomy topic they discovered during the academy. Selected videos will be shown as trailers for planetarium shows in the following months.

The state-of-the-art Buhl Planetarium and Institute of Popular Science on Pittsburgh's North Side opened in 1939. The planetarium featured a 492-seat "Theater of the Stars" with a 65-foot diameter dome.

The original structure was built for \$1,070,000 by the Buhl Foundation, which was established in the will of local department store owner and philanthropist Henry Buhl, Jr. (1848–1927). The building and its contents were a gift to the City of Pittsburgh.

The Buhl Planetarium became the Buhl Science Center and a component of Carnegie Museums of Pittsburgh years later. In October 1991, The Henry Buhl, Jr. Planetarium & Observatory opened in the newly established Carnegie Science Center.



The Zeiss projector used 1,000 watt lamp to project the stars. Today, it's displayed at Carnegie Science Center.



Jo Ellen Parker Takes the Reins at Carnegie Museums of Pittsburgh

Jo Ellen Parker is the new president of Carnegie Museums of Pittsburgh. Dr. Parker comes to Carnegie Museums of Pittsburgh from Sweet Briar College, a liberal arts college for women in Virginia, where she had served as president since 2009. At the college, she increased applications, fostered a more diverse student body, achieved greater transparency at all levels of governance and administration, and encouraged a more entrepreneurial approach to liberal education.

She previously served as executive director of the National Institute for Technology and Liberal Education. Before that, she served as president of the Great Lakes Colleges Association, a consortium of 12 liberal arts colleges.



Jerry Whitaker Leading Science Center Board

Jerry Whitaker, who is a Carnegie Museums trustee and has served on the Science Center Board since 1999, has taken the role of Board chairman. He has been a passionate supporter of the Science Center's mission and is strongly committed to its success. For many years, he served as the Chair of Carnegie Science Awards, an annual fundraiser through which the Science Center honors outstanding regional individuals and corporations in science, technology, and education. Mr. Whitaker is retired from Eaton Corp.



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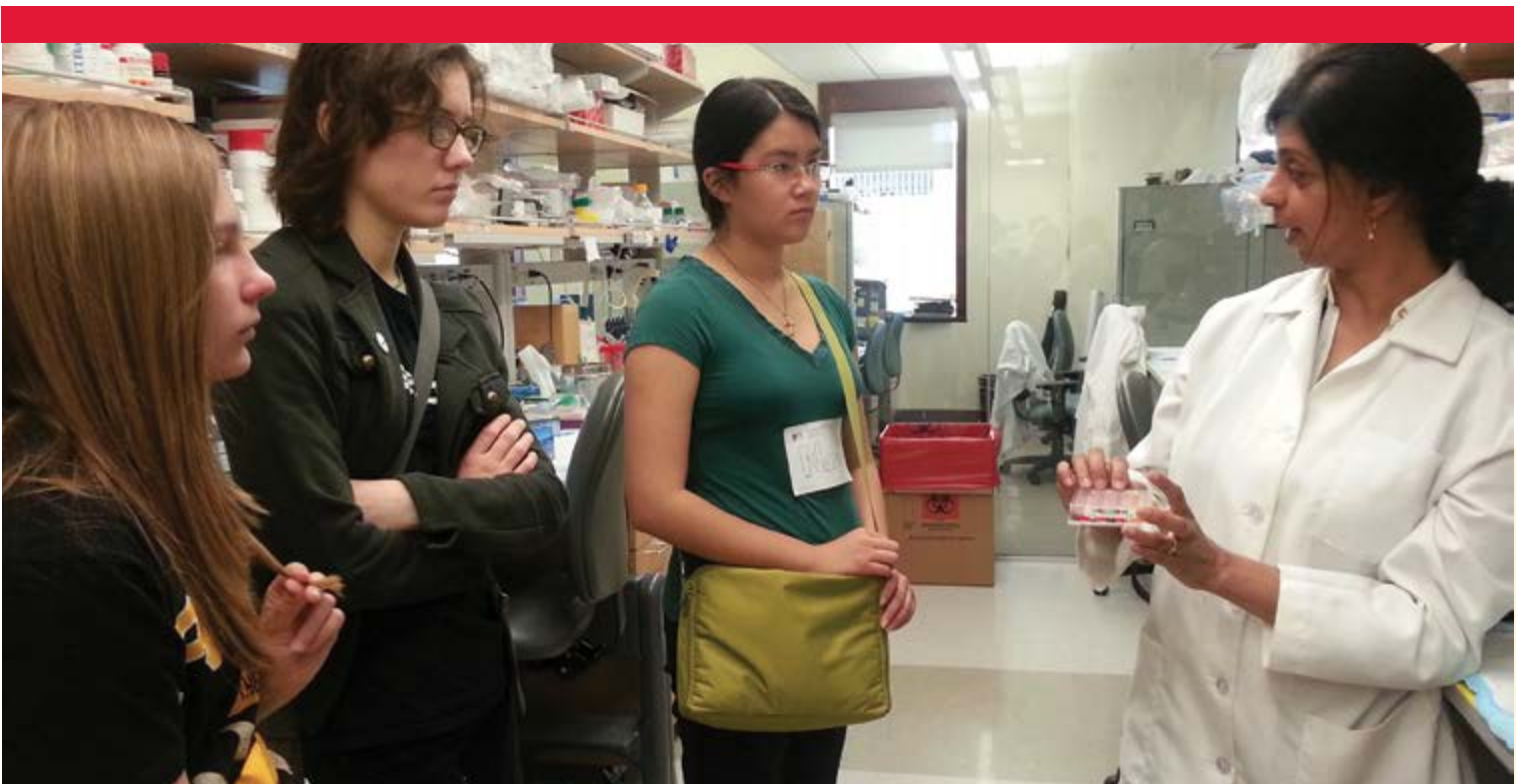
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Allegheny Regional Asset District



During a visit to the Vascular Institute, girls explore medical careers.

Girls Learn First-Hand about STEM Careers at Tour Your Future

Tour Your Future is a career exploration program for girls that give tweens and teens, ages 11–17, an opportunity to meet female professionals at their worksites. The program is a part of Carnegie STEM Girls, the Science Center's girl-focused programming. Tour Your Future shows girls that they can find a place in science by introducing them to diverse STEM careers, from zoologists to accountants, software engineers to surgeons, at their work sites.

Recent worksite visits included Valspar, ModCloth, CyLAB at Carnegie Mellon University, Schell Games, and Aquion Energy.