

# science IMPACT

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**CARNEGIE  
SCIENCE  
CENTER**

One of the four Carnegie Museums of Pittsburgh



*Inquiry-based group learning is one of Carnegie Science Center's key elements of quality STEM education – even for the smallest scientists.*

## Science Center Sharing STEM Success

If you're in an industry that relies on science, technology, engineering or math, you've undoubtedly heard about STEM. If you're an educator helping your students plan for a promising career path, you may have talked to them about STEM.

But if you were asked to define STEM education, or how best to prepare tomorrow's workforce for jobs in these critical fields, what would you say?

Recognizing the challenge facing organizations wanting to develop STEM programming, Carnegie Science Center is reaching out and sharing what its educators have learned through years of experience about this vital initiative.

"At Carnegie Science Center, we were strategizing about STEM education long

before the acronym came into mainstream use," says **Ann Metzger**, Henry Buhl Jr. co-director of the Science Center. "Our model is informal science education — hands-on, engaging and inspiring experiences that make kids want to know more."

With strong support and involvement from the region's corporate community, the Science Center launched the Chevron Center for STEM Education and Career Development in November 2011. The STEM Center offers an array of STEM-based competitions and programs for students, teacher professional development opportunities, and a public awareness campaign geared toward parents.

"All of these efforts recognize the challenges our region faces preparing young people for STEM careers," Metzger says. "Unfortunately, though STEM

education has attracted national attention, the conversation around the meaning of STEM education has at times been vague and tentative."

Given the Science Center's experience in STEM education and roster of effective programs, educators from the STEM Center were thrilled to share their successes this summer, when leaders from education and industry gathered for the 2013 Pittsburgh STEM Summit. At the STEM Summit, which highlighted the top STEM partnerships in the western Pennsylvania region, two senior staff from Carnegie Science Center explained how they are making an impact on the next generation workforce in science, technology, engineering, and math.

"Advancing great teaching in STEM education requires a clear, comprehensive definition of STEM education, one that is measurable with the flexibility to work across the STEM education spectrum," says **Linda Ortenzo**, director of STEM programs at the Science Center.

Ortenzo explains that Carnegie Science Center has developed a working definition of high quality, effective STEM education. During the summit, Ortenzo presented the definition, which is supported by research such as the National Research Council's *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*, as well being based on the Science Centers' own extensive experience.

*(Story continues on page 3)*

### **Carnegie Science Center's Keys to Excellent STEM Education**

- Inquiry-based science and math education
- An integrated science, math and technology curriculum
- Project-based group learning
- Career awareness

# directors' note



**E**arlier this year, Carnegie Science Center was named as one of five recipients nationwide of an award from the National Writing Project and the Association of Science-Technology Centers for what is called the Intersections program (see page 6). The funding comes through a grant from the National Science Foundation, and our local partner in the project is the Western Pennsylvania Writing Project, based at Pitt. The goal of the program is to design a program for teachers and kids that integrates science and literacy skills.

It's a great opportunity, and our team is hard at work on the project. But it got us thinking about alphabet soup. Not the real kind of soup, but the acronym debates over which letters of the alphabet to use in describing the very real educational needs in our region — and the nation. Here at the Science Center, we've developed the Chevron Center for STEM (science, technology, engineering, math) Education and Career Development, based on our long-time educational mission— but also in recognition of the tremendous workforce needs of our region if we are to thrive economically. There are those who think the term STEM implies a certain narrowness and instead advocate for STEAM (add the arts) or STEM D (it's really design, not "the arts") or STREAM (add a research component). We've even heard the term SHTEAM, which sounds vaguely Yiddish

and tries to emphasize the important of integrating both Art and History into STEM studies. We say: Stop the madness!

We're a science center, but unquestionably we believe in the value of an integrated education that includes not just science, technology, engineering and math, but also the arts and humanities. So when we use the term STEM, it's not to discount the value of art, literature and the humanities to a well-rounded education and a fulfilling life. We use the term to signal our focus on the sciences, because we're committed to inspiring the next-generation workforce in these fields. Our region faces very real challenges in preparing young people for the jobs of the future, most of which require strong STEM skills.

So let's not quibble over the alphabet. We all have lots of work to do.

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



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[CarnegieScienceCenter.org](http://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  
Henry Buhl, Jr., Co-Directors

*Science Impact* is available online at  
[CarnegieScienceCenter.org/Publications](http://CarnegieScienceCenter.org/Publications).

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*In making thermometers, kids integrate the mathematics of calibration with the physics of temperature.*

## Science Center Sharing STEM Success

*(...continued from Page 1)*

“Carnegie Science Center has determined that high-quality PreK–12 STEM education incorporates several essential components,” Ortenzo says. “Inquiry-based science and math education; an integrated curriculum where science, math, and technology teachers work together; project-based group learning; and career awareness are critical to STEM success.”

“Students need to be exposed to an array of exciting, STEM-related jobs and have a chance to meet practicing STEM professionals,” Ron Baillie, co-director of Carnegie Science Center says. “Engaging one-on-one with STEM professionals allows students to relate what they learn in the classroom to real life and also begin to imagine themselves in STEM careers.”

Baillie explains that the Science Center uses this definition of STEM education when developing programs, and he has some good news for educators.

“STEM education built on these principles does not have to cost schools more in these budget-tightening times,” he says. “But it does require schools to view teaching and learning very differently.”

Alana Kulesa, the Science Center's director of Strategic Education Initiatives, also took to the podium at the Pittsburgh STEM Summit. She described how the Science Center is providing greater access to STEM

offerings in southwestern Pennsylvania through the development of STEMisphere—an online central hub for educational STEM resources for students in pre-K through 12th grade.

“STEMisphere will act as a portal, an online searchable database, for parents, educators, students, and potential partners to gain access to the information needed to explore a universe of STEM opportunities,” said Kulesa, who is leading the project.

The long-range mission of STEMisphere is to provide access to exceptional STEM education resources, recognizing that in order to strengthen the next generation STEM workforce it will take collaboration, great teaching, inspired learning and a committed community.

“STEMisphere strives to bring together community stakeholders so they can collectively address STEM education in our region,” Kulesa said. “It also strengthens STEM education by providing resources to educators, inspiring excitement in students, and building relationships with community stakeholders.”

Slated to launch at the end of the year, the STEMisphere site will be managed by Science Center staff in partnership with other key regional and statewide STEM initiatives. Eventually the site will include STEM offerings in additional counties in Pennsylvania, Ohio, West Virginia, and Maryland. ■

**Help us build this community resource!**

Submit resources to the STEMisphere Directory:

**Michele Howard**

*STEM Information Coordinator*

[HowardM@CarnegieScienceCenter.org](mailto:HowardM@CarnegieScienceCenter.org)

412.237.1619



*Career awareness develops as high school students on a Science Center field trip talk with STEM professionals at Career Café.*

# Science Camps Prep Kids in STEM



Niya Ingram and Makhiah Johnson, of the GEMS camp, work as a team on a scavenger hunt probing robotics.

It took only 20 minutes for Giovanna Tatananni and Cami Lingenfelter to bring their “alien robot dog” to life inside a Carnegie Science Center classroom.

The teenagers named their robotic creation “Winky” because the dog’s light-bulb eyes blink one at a time. Wrapped in pink construction paper to cover his robotic parts, the dog also wags his tail when you pet him.

“We got the idea to make Winky when we noticed that the vibration motor looked like a dog wagging its tail,” said 13-year-old Tatananni of New Kensington.

The eighth grader, who wants to pursue a career in engineering, asked her parents to enroll in the Science Center’s girls-only CanTEEN Living It Camp, which explores STEM careers through digital interactives, hands-on activities, and challenges. It also gives campers a chance to interact with female professionals who work in STEM fields.

“I think my parents have a strong interest in science...maybe not so much technology because I’m the technical person in the house,” said Tatananni. “But they’ve always encouraged me to do it even though they don’t do it themselves.”

This summer, the Science Center had a record-breaking science camp enrollment of more than 2,300 campers ages 4–14.

Some were able to attend summer camp at the Science Center for free or at a reduced rate through scholarships provided by Verizon, the Society for

Analytical Chemists, the Frank W. and Helen W. Lang Fund for Science Education, and Suzy Broadhurst.

“Some of the campers’ permanent homes are in Korea, Israel, and England giving the camps a very diverse demographic,” said **Michelle Brooks**, education coordinator of camps, classes, and sleepovers at the Science Center. “Many campers return year after year and some even enroll in multiple camps over the summer.”

Emily Rybicki, 8, participated in four Science Center camps this summer – Monster Science, Science with a Sparkle, Kennywood Science, and River Camp.

Rybicki, of Pittsburgh, worked in Monster Science with fellow campers, Luke Smarra of McKees Rocks and Catie Bonnar of Irwin, to create a blueprint of a zombie-proof home. They gathered inspiration for the design by first exploring the Science Center

to figure out the best and worst places to hide during a zombie outbreak.

More than 20 girls from Carnegie Science Center’s Girls Engaged in Math and Science (GEMS) afterschool program at Pittsburgh King and Allegheny Magnet School attended the free GEMS summer camp, which offered lunch as well as transportation to and from the Science Center each day.

Stephanie Pergantis, school counselor at Pittsburgh King, has watched the girls’ confidence in math and sciences grow throughout the school year. She’s thrilled the learning process doesn’t have to stop in the summer.

“The biggest difference I’ve noticed with these girls is their willingness to try new things,” she said. “Everything is uncool in middle school at first, but once they try it, they want to learn more. They’re opening themselves up to new things.”

This summer, the Marshmallow Challenge experiment was a favorite among the girls. The task was simple: in 18 minutes, teams had to build the tallest free-standing structure out of 20 sticks of spaghetti, one yard of tape, one yard of string, and one marshmallow. The marshmallow needed to be on top.

Niya Ingram, 13, whose team completed the tallest tower in the challenge, has a strong interest in engineering.

Shawntae’ Green, 14, said her team struggled with the challenge at first, but they didn’t let that discourage them.

“We failed the first time, but got it the second,” she said. ■



Kids at Monster Camp work hard at drafting a zombie-proof house.

# BOARD SPOTLIGHT



## Jerry Whitaker

Carnegie Science Center Board

**Jerry Whitaker** will never forget the time Carnegie Science Center's Science on the Road team visited his daughter's sixth grade class. The engineering graduate watched the students' faces light up when they learned how electrical transmission systems work through a live demonstration.

"The kids were enthralled!" he said.

Whitaker, who retired last year as President of Eaton Corporation's Electrical Sector, has always recognized the importance of educating younger generations in the areas of science, technology, engineering, and math.

"I could not think of a better place to invest time, energy, and money than Carnegie Science Center," said Whitaker, who joined the Board in 1999. "Their recognition of how important science is to our future and their drive to develop engaging STEM programming for our young people is simply outstanding."

Every year, Whitaker looks forward to the annual Carnegie Science Awards event, which recognizes and promotes innovation in science and technology across western Pennsylvania. Through the support of major sponsors like Eaton Corporation, the Science Center has celebrated the accomplishments of more than 400 committed individuals and organizations, including students and educators, since 1997.

"I am always amazed at the outstanding people I meet at this event," he said. "I believe that western Pennsylvania, specifically Pittsburgh, is developing into a world-class incubator of new technology and associated new companies."

# GRANTS & AWARDS

■ The Chevron STEM Center received \$150,000 grant from **The Heinz Endowments** to develop the **STEM Education Pathway**, a guide for schools seeking to strengthen PreK–12 STEM education through effective instructional strategies. The Pathway, still in development, will include self-assessment and a rubric for incorporating inquiry-based, hands-on teaching strategies, real-world applications of technology, team-based instruction, and career awareness. This proposal builds on the successful pilot program, "Panic at the Point," held in summer 2012, also supported by The Heinz Endowments, for a unique approach to STEM education.

"The Science Center wishes to encourage and support the adoption of best practices and effective techniques, while also recognizing the schools that are embracing,

and moving toward, effective STEM education," said **Alana Kulesa**, director of Strategic Education Initiatives at the Science Center, who is leading the pathway project.

In addition, the Pathway will support teacher professional development through real-world externships with STEM-based employers and district-to-district mentoring so that those school districts just beginning the STEM journey can benefit from the experience of districts much further along the Pathway.

When complete in 2014, the STEM Pathway will be used by school districts to integrate high-quality, high-impact STEM education. This project has the potential to create a model for both well-resourced and underserved schools and school districts to achieve systemic change in STEM education, and may be replicable as a national model.



## Early Learners programming in West Virginia

Carnegie Science Center recently received a grant of \$160,000 from the Claude Worthington Benedum Foundation to create and implement a family engagement component to complement West Virginia Department of Education's (WVDE) professional development modules for early learner programs. Grant monies provided by the Benedum Foundation will be applied to development of the "Science of Art" family engagement backpacks, which will be piloted to a small group of classrooms for feedback before complete rollout to 1,200 classrooms across the West Virginia's 55 counties. Carnegie Science Center will be working with the WVDE Continuing Quality Improvement Advisory Council to build these early-learner resources for engaging children and families with the arts and with physical development. ■

## microbits

### Intersections Science and Literacy Project

Carnegie Science Center and the Western Pennsylvania Writing Project (WPWP) are one of five pilot sites developing a unique program that will combine formal and informal science and literacy learning.

“Building Informal Science Education and Literacy Partnerships” is a two-year National Science Foundation-funded program through the Association of Science-Technology Centers (ASTC) and the National Writing Project.

The Science Center will be partnering with the WPWP on a Digital Literacy project to develop enhancements to the i5 Digital Video Competition.

“Our goal is to effectively integrate science learning and literacy skills in a challenge that encourages middle and high school learners to create a short film and explore how STEM is personally relevant. We want to ensure they have rich science knowledge as well as the capacity to communicate it,” said **Alana S. Kulesa**, director of Strategic Education Initiatives at Carnegie Science Center, who is heading the program.

“The program also addresses the vital priority of helping students maintain enthusiasm for science at an age when many lose interest,” said **Linda Ortenzo**, the Science Center’s director of STEM Programs.

**STEM jobs nationally in the past 10 years have grown at three times the pace of non-STEM jobs.**

## PARTNER SPOTLIGHT



### Dr. Robert Clemens

Vice President, Chief Technical Officer  
Kennametal Inc.

**Robert J. Clemens**, PhD, is responsible for leading Kennametal’s global Research, Development and Engineering organization.

Prior to joining Kennametal, Clemens was vice president, Corporate Technology at Eastman Chemical Company in Kingsport, Tenn., where he established a joint industrial/academic research program with North Carolina State University and the University of North Carolina to help enable students to work on real industrial problems as part of their education. He has more than 35 years of experience in research, technology, and new business development.

Clemens joined Kennametal and moved to the region at the beginning of this year. He presented the Advanced Manufacturing and Advanced Materials awards at the 2013 Carnegie Science Awards program in May, and visited the Science Center and met with leadership in July to better understand their mission and offerings, and to seek additional ways that Kennametal and Carnegie Science Center can help each other and raise awareness and enthusiasm for science.

### How important is Kennametal’s partnership with the Science Center?

Kennametal’s focus on continuous improvement of our products and our manufacturing processes requires scientists, engineers, and a community that is comfortable with and supportive of technology-based companies. Our partnership with Carnegie Science Center is important because of its mission to expose the public to science and its benefits, and to help ignite the innovative interests of the students.

### What else is Kennametal doing to benefit the region?

While we employ 13,000 in more than 60 countries, the southwest Pennsylvania region serves as the backdrop for our world headquarters in Latrobe. In addition to providing good, high-tech jobs that support families and communities, we take great pride in supporting the communities where we are located. Last year alone, Kennametal employees dedicated more than 2,000 hours of time collecting food, giving blood and mentoring students as part of our *Kennametal in the Community* program. We are also a strong supporter of the United Way of Westmoreland County and numerous other charitable organizations.

### How does support of Science Center programs aid in Kennametal’s corporate vision and goals?

The Kennametal Foundation is a Founding Partner of the Chevron Center for STEM Education and Career Development, and we’re the Associate Sponsor of the Carnegie Science Awards program. Kennametal and the Kennametal Foundation are committed to helping our employees build relationships that encourage and promote secondary technical education opportunities. Through our TechEdNet and Young Engineers Programs, we encourage young people to consider a career path that includes manufacturing or a technical field. Our relationship with Carnegie Science Center helps us build awareness around the opportunities available in the manufacturing sector. ■



Anishaa Sivakumar, Rishi Mirchandani, and Ryan Maurer represented the Pittsburgh region at ISEF.

## Local Students Excel at International Science Fair

Three local students who represented Carnegie Science Center's Pittsburgh Regional Science & Engineering Fair at the INTEL International Science and Engineering Fair (ISEF) in Phoenix brought home significant awards in May.

**Anishaa Sivakumar, Rishi Mirchandani, and Ryan Maurer** were among more than 1,700 students from 70 nations and territories vying for scholarships, tuition grants, internships, and scientific field trips at the world's largest international pre-college science competition. Intel ISEF provides an annual forum for students in grades 9–12 to showcase their independent research as they compete for more than \$3 million annually.

Sivakumar, a 14-year-old freshman at Franklin Regional High School, presented *Dictyostelium Discoideum- Novel Diagnostic Tool for Lung Cancer using VOCs*. She was awarded a Grand Award of \$500, an American flag and a framed copy of the first patent granted in the United States of America from the Patent and Trademark Office Society.

Mirchandani, a 16-year-old sophomore at Fox Chapel Area High School, presented *Superadditivity and Subadditivity in Fair Division*. He was awarded 4th Place Grand Award in Mathematics, carrying a prize of \$500. He also won the 3rd Place, \$1,000 award from Mu Alpha Theta, National High School and Two-Year College Mathematics Honor Society. The Mu Alpha Theta Award is given to the most challenging, thorough, and creative investigation of a problem involving mathematics accessible to high school students.

Maurer, an 18-year-old senior at Frazier High School (Perryopolis), presented *Rocket Motor Test System -7000*. He received the 3rd Place Grand Award, which carries a \$1,000 prize, in the Engineering- Electrical and Mechanical category. He also was awarded a four-year renewable tuition scholarship of \$12,500 from West Virginia University (WVU). WVU awarded Academic Excellence or Presidential Scholarships to students whose research and academic aptitude align with WVU's institutional goals and research interests. ■



## microbits

### Buhl Planetarium hosts NASA Scientist

This summer, Buhl Planetarium hosted **Dr. W. Dean Pesnell**, project scientist of the Solar Dynamics Observatory. A spacecraft developed at NASA's Goddard Space Flight Center, the Solar Dynamics Observatory is exploring where the Sun's energy comes from, how the inside of the Sun works, and how energy is stored and released in the Sun's atmosphere. Dr. Pesnell explained how this mission is helping us better predict and forecast space weather, providing earlier warnings to protect our astronauts and satellites. The audience also watched "Solar Quest," a full-dome planetarium short film that was produced by the Science Center with funding from a \$765,000 grant from NASA's Education and Public Outreach for Earth and Space Science program. The grant aims to demonstrate how the Sun and Earth are interconnected and will explore heliophysics, an environmental science that combines meteorology and astrophysics.

### Science in the Library

Carnegie Science Center and GlaxoSmithKline teamed up for the eleventh consecutive year to offer Science in the Summer, a program that provides free science education to students at local libraries.

Twenty libraries in Allegheny, Beaver, and Westmoreland counties hosted the classes, which gave children a look into the world of genes, cells, and DNA. Students received a certificate of completion presented at a ceremony attended by parents and family members.

**Marilyn Fitzsimmons**, education coordinator of the Science Center's Science on the Road programs, says these programs make a big difference. "It's not every day that kids experience safe, fun, and exciting experiments with hands-on activities—especially at no expense to them. It's a positive experience for everyone involved."



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*USS Requin veteran John Stewart explains fine points of the submarine's technology to Admiral CJ Jaynes and Commander Ron Harding.*

## Admiral With Local Roots Visits Carnegie Science Center

Rear Admiral CJ Jaynes, program executive officer for the U.S. Navy's Air Anti-Submarine Warfare, Assault & Special Mission Programs, came to Pittsburgh in a visit coordinated by the Navy and Carnegie Science Center as part of the Navy's 50/50 outreach program. She is the first female admiral at the Naval Air Systems Command, which is based at the Naval Air Station in Patuxent River, Md. Jaynes is the first woman to reach the rank of admiral at that base.

The Navy's 50/50 outreach program features 50 senior Navy leaders in 50 cities throughout the country, and is designed

to help build on the Navy's efforts to increase Americans' understanding of the Navy's mission, capabilities, and relevance to national security.

A native of western Pennsylvania, Jaynes has a strong interest in STEM education programming, particularly for girls. As part of her Science Center visit, she interacted with summer campers and took a tour of USS *Requin* with *Requin* veteran **John Stewart**. The Science Center also arranged for her to deliver a brief address at the Pittsburgh Technology Council STEM Summit and to appear on WESA's *Essential Pittsburgh*. ■