



What do toilet paper and birds have in common? Mike Hennessy explains the science of flight in *Wild By Design*.

Students Going “Wild” For Biomimetics

Six stories above PPG Place, Carnegie Science Center Program Development Coordinator **Mike Hennessy** is balancing on a stepladder, peering over the edge of a building.

“OK, drop the slinky in three... two... one!”

After listening to the count through an earpiece, he releases a giant rainbow slinky, letting it fall into a cordoned-off drop zone six stories below.

“That was great!” says **Matt Fridg**, a photographer and director with PMI, the production company recording the demonstration. Fridg turns to another Science Center educator watching the drop from the ground. “We love working with you guys. No one else does stuff like this.”

The slinky drop is part of a segment for *Wild By Design*, the newest show for the Science Center’s outreach program, *Science on the Road*.

“The show is all about how if you want to build something bigger, better, faster, or stronger, chances are you can find the answer in nature,” explains Hennessy. “Nature has been running field tests for millions of years, and we can take the best of what nature has learned and apply it to new technology.”

Demonstrations like the slinky drop are key to the success of the Science Center’s programming, which marries complex concepts with engaging experiments to get kids excited about science.

“If you use a word like ‘biomimetics,’ you

might not really connect with a gymnasium full of 10-year-olds,” says **Jessica Lausch**, the Science Center’s Director of Visitor Experience. “But if you throw a slinky off a building, and then use it to explain how the tension in the toy is similar to the interplay of muscles in an elephant’s trunk, now you’ve got their attention. Then you can explain how studying those trunk muscles has helped researchers improve the range of motion in robots.”

Wild By Design is filled with creative examples of how human engineers are using nature to develop new technology. By partnering with **PPG Industries** and the **Pittsburgh Zoo and PPG Aquarium**, the show is able to turn school auditoriums into a hands-on research lab, bringing scientists, zoologists, and engineers together for an experience only the Science Center can provide.

“In one segment of the show, we introduce kids to a wonder of natural engineering: the giraffe,” Hennessy says. “On video a zookeeper explains how the giraffe’s heart, blood vessels, and skin keep its blood flowing smoothly, allowing it to eat from the treetops and bend over for a drink of water. Next, students are invited on stage to try out a pump simulating the animal’s massive heart. We bring in scientists and engineers in a ‘video conference’ describing how new developments in medical technology, and even G-suits for fighter pilots, have been inspired by the giraffe’s unique biology.”

Carnegie Science Center reaches some 200,000 students each year through its *Science on the Road* program, which packs a lot of learning and excitement into each presentation. But each program also has to be packed into a van or car for transport. Lausch says Hennessy and *Wild By Design*’s other developers have come up with some unique solutions to offer maximum awe in a minimum amount of space.

“We found giant, inflatable animals to use as part of the show,” Lausch says.

(Story continues on page 3)

directors' note



As we look back on the past year, we're gratified by how many truly inspiring people we've met and worked with. That's one of the great perks of serving as co-directors of Carnegie Science Center: the sheer number of different people with whom we interact.

We've spent a lot of time this past year with science center colleagues from across the country (and the world, for that matter), discussing the role of science centers in their communities. One of our colleagues from the West coast made an observation that made us stop and think. It's interesting he said, that science centers are so often asked by those in industry, foundations, and government to prove that we'll generate more STEM graduates as a prerequisite to support. And science centers try to do so, he said, by developing research about our impact on career choices or longitudinal studies about the value of a science center visit. But, he asked, "When those same funders sponsor art exhibitions or a concert series, do the art museums and symphonies need to demonstrate they will generate more artists, art history majors and first violinists as a result of this funding?" Isn't it enough, he wonders, for science centers to provide a welcome place for anyone to be exposed to science and to walk away a more scientifically literate individual? Isn't that of value in itself? And yet although arts organizations may be largely appreciated for simply being what they are, science centers are appreciated for what they do to help create a better community.

It's an interesting point, for sure, but one that's symptomatic of a society that definitely wants to see results making a positive change in science and math

education. As western Pennsylvania's science center, we embrace that challenge with others in our region. As the head of a local engineering firm recently told us: "We're terrified!" He was referring to concerns about where his company will find qualified engineers to fill the more than 100 current openings in his company. There just aren't enough, he told us. We've had lots of those kinds of conversations in 2013, with leaders from regional companies in technology, chemicals, engineering and throughout the energy sector.

We've also talked a lot with educators, both those in administration and those in the classroom, about the significant challenges of PreK-12 formal education, about the role out-of-school science education plays in inspiring young people. It's fair to say that educators feel beleaguered at times, as if they alone are expected to make the difference in educational outcomes. But as they say, it takes a village, and someone has to convene the village, build good communication vehicles, coordinate efforts, set goals, and measure progress. Carnegie Science Center is the natural organization to convene these stakeholders, and we have taken on that role willingly and with enthusiasm in the past year. It's been gratifying to have other organizations validate us in that role.

The challenges of 2013 remain the challenges of 2014 and beyond, but there are also new opportunities on the horizon that we are ready to embrace and advance. The Science Center is proud to be part of a community working together to make a difference.

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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Science Impact is available online at
CarnegieScienceCenter.org/Publications.

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Shows like *Wild By Design* get kids intensively engaged in science learning.

Students Going “Wild” For Biomimetics

(...continued from Page 1)

“One topic we cover is how the tubercles, the bumps on the fins of humpback whales, help reduce drag in the water. Scientists are using this same design to improve fan and wind turbine design. So we got a twenty-foot-long whale to use as a prop to illustrate this concept.”

Another popular prop is a T-shirt cannon. The same device that launches souvenirs into the stands at sporting events is launching plush turkeys into an audience of ecstatic children.

“The Wright brothers were inspired to develop the shape of the wings on their aircraft by observing the wings of a turkey vulture,” Hennessy explains. “We’re able to offer information about the history of biomimetics in a way that gets students totally excited to be part of the show.”

That kind of excitement is what teachers are looking for. **Tiffany Cross** is a fourth-grade teacher at West Main Elementary School in Ravenna, Ohio. She says she has been booking Science on the Road shows for years because they offer such an entertaining educational punch. And she says *Wild By Design* is no exception.

“The kids were just mesmerized,” says Cross. “I was really impressed with how the show blends animals with technology. I thought it was amazing and the students loved it.”

This sentiment is echoed by the partners who helped make the show a reality.

Sue Sloan, executive director of the PPG Industries Foundation, which has been investing in the Science Center partnership for more than 10 years, says, “Our research associates who work with Carnegie Science Center just love it. They get excited about inspiring young people about science and love to think their work may lead students into choosing a career in science one day,” Sloan says.

Science Center co-director **Ron Baillie** says the support of partners like PPG is crucial to the success of shows like *Wild By Design*.

“Our industry partners provide us with access to their facilities,” Baillie says. “That access enables us to showcase the types of jobs available in industry and shows students the types of opportunities available to them if they choose a career in science.”

“Our partners have been absolutely vital to the success of our extensive outreach programs,” says **Ann Metzger**, the Science Center’s other co-director. “PPG, in particular, has provided long-term support that has enabled us to develop a suite of engaging programs that have reached tens of thousands of students throughout the region and beyond. In addition to the financial support our partners bring, they also provide us access to real scientists who contribute content and inspiration for our programs.”

Wild By Design keeps things inspirational right to the end, explaining how animals on Earth could one day help engineer a mission to Mars. One last look at technology on Earth wraps up the show with an explanation of how pine cones can help crews fight fires — with a big bang, of course.

“I totally jumped at that last explosion,” laughs fourth-grader **Jacob Rible**. “I’m going to look at pine cones a whole lot differently now.” ■



Two telephone books with pages interwoven demonstrate the force that allows animals like geckos to climb a wall.

Summit Energizes Local Students



Karen Foltz, Vox Energy Solutions, explains solar panels to students.

If you're looking for a career with a future, you don't need to look much further than a job in the energy industry. With an economic impact of \$19 billion, some one thousand companies offer tens of thousands of jobs in Pennsylvania.

Numbers like those might seem like pursuing a career in a related field is a no-brainer. But getting today's students excited about tomorrow's job market isn't an easy task.

"It's a great idea to get students excited about science," says **Dr. Karl Johnson**, a chemical engineering professor at the University of Pittsburgh. "Students' experience with science early on will help motivate them to take harder classes -- and they need constant motivation."

Carnegie Science Center hopes some of that motivation will come from its Student Energy Summit. The inaugural Summit, held in October 2013, brought together more than 100 students from across Pittsburgh to learn more about the problems facing energy resources and challenged them to come up with solutions. Support for the inaugural Summit was provided by **Robert M. Thompson, Jr.**, and family, and **Chevron**.

Students participated in hands-on workshops covering a wide range of energy sources ranging from coal, to natural gas, to solar power. Each workshop described how energy is derived from a particular resource. Students were then encouraged

to investigate the pros and cons of different kinds of energy production, sometimes with surprising results.

"I was part of the nuclear energy workshop," said **Brett Sopher**, a junior at North Hills Senior High School. "I found out that there is no pollution put out when nuclear energy is produced, other than the steam that's released, which is pretty cool."

While generating an actual nuclear reaction wasn't possible in a classroom, students were encouraged to try out smaller versions of wind and water turbines, or take apart solar cells to investigate the engineering behind the technology.

Some of the workshops were led by experts currently working in energy-related industries, while other professionals staffed the

Summit's Career Café. The Café gave students a venue for an informal chat with professionals about potential careers and how to direct their studies for work in a STEM-related field.

Dr. Jay Whitacre, founder of Aquion Energy and a professor at Carnegie Mellon University, says he was excited to be part of an event like the Energy Summit because its success is critical for Pittsburgh's future.

"We have redefined this region as a science technology and biology hub, and I think we need to invest as much as possible to continue that trend," Whitacre says.

At the end of the day, the students took to the stage to present what their groups had learned about different energy sources to the rest of the participants.

The Student Energy Summit was developed by the Science Center's Chevron Center for STEM Education and Career Development and is planned to continue as an annual event.

Jacob Burke, a student in the Woodland Hills School District says he left the Summit feeling energized.

"It was really cool. The things that we learned are invaluable. The different resources of energy are really interesting and I didn't know a lot of the things that I learned until I came here today."

View a video about the Energy Summit: CarnegieScienceCenter.org/EnergySummit



The Summit gave students a chance to learn about potential careers in energy-related fields.

BOARD SPOTLIGHT



Joan Peirce

Peirce Family Foundation

When **Joan Peirce** was asked to join Carnegie Science Center's Board, it seemed like a very natural fit. After all, Peirce has been coming to the Science Center with her children and grandchildren for years.

"I have one son and two grandsons, and they are the reasons we got involved with the Science Center. When they were young, we used to bring them here. We'd start on the top floor in the early learner gallery. As they got older, we worked our way down to the bottom."

Peirce, who joined the board in November 2009, says that the Peirce Family Foundation is very interested in promoting education. When they had the chance to make donations, Carnegie Science Center was at the top of their list.

"I think the Science Center is one of the jewels of Pittsburgh. It's right up there with the Natural History and Art museums, Heinz History Center, the cultural trust. It's part of what makes Pittsburgh great."

Peirce, who stays active with tennis and golf, says she loves the activity of the Science Center and appreciates how it allows children of all ages to learn in an exciting, hands-on environment. Peirce also appreciates her role on the board because it allows her a behind-the-scenes glimpse of current and future programming.

"The best thing about being a board member is being able to come to the meetings and learn about all that's going on at the Science Center. In just an hour-and-a-half I learn so much, and I'm absolutely amazed at all of the activities. It's wonderful."

GRANTS & AWARDS

- **The Jack Buncher Foundation** has donated \$50,000 to allow Carnegie Science Center to offer a free-admission day to the general public in summer 2014. The Foundation's support allows the Science Center to reach out to residents of the region who might find the admission price a challenge financially.
- Carnegie Science Center received a grant of \$75,000 from **EQT Foundation** in support of Engineer the Future. Engineer the Future is a program to inspire young people in middle school and high school to pursue careers in engineering, as well as engage a broad public audience with the professional opportunities and challenges facing our region. EQT was the presenting sponsor of the event, on Feb. 14 and 15, featuring more than 50 tables with presentations, hands-on activities, and demonstrations from regional corporations, organizations, and universities. A significant portion of the grant supported the attendance by 1,400 students from underserved schools.
- **Carnegie Science Center** has been awarded a two-year \$150,000 grant from **The Grable Foundation** in support of STEM programming. This grant will help further the Science Center's ongoing efforts to inspire students to pursue careers in science, technology, engineering and math-related fields. Programs like SciTech Days and ChemFest and competitions like Chain Reaction Contraption and Future City provide rich experiences to middle and high school students and help connect STEM to everyday life.
- **Citizens Bank Foundation** is the new presenting sponsor of the Miniature Railroad & Village®.

Science Center Launches Resource Website Into STEMisphere

Carnegie Science Center has launched a new website that developers hope will take information about science, technology, engineering, and math resources into the STEMisphere.

"The mission of STEMisphere is to provide access to all of the exceptional STEM education opportunities available in southwestern Pennsylvania," says **Alana Kulesa**, the Science Center's director of Strategic Education Initiatives. "We want families looking for STEM education opportunities to have a one-stop shop to find the programs available in our region."

The STEMisphere is a searchable directory where partners can list their STEM resources free of charge. Parents of children from Pre-K through 12th grade can use the search engine to connect with providers. Kulesa says there are also categories that will appeal to educators, and anyone with STEM-related resources can partner with the Science Center for a free listing.

The first year of STEMisphere's development was supported by grants from the **Claude Worthington Benedum Foundation**, **Shell Oil Company**, and the **Alcoa Foundation**. The Alcoa Foundation has extended the funding for the next two years.

Visit STEMisphere at: STEMisphere.CarnegieScienceCenter.org

Submit resources to the STEMisphere Directory:

Michele Howard, *STEM Information Coordinator*
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PARTNER SPOTLIGHT

Sev McMurtry, FedEx Ground

Senior Vice President, Operations Planning and Engineering



Sev McMurtry joined FedEx Ground's predecessor company in 1985 as an operations engineering analyst and advanced through the ranks. He held a series of management positions with increasing responsibility before being named a vice president in 2003 and then assuming his current role in 2008.

Besides his involvement with Carnegie Science Center, McMurtry is active in the community and industry. He served as the 2013 Chairman for the March of Dimes Signature Chef Auction and is active with Casey's Clubhouse.

As an accomplished leader, McMurtry attended the FedEx Executive Leadership Institute and has completed the FedEx Excel Leadership Program. He has also been honored three times with the company's most prestigious award, the Five Star Award.

A native of State College, Pa., McMurtry earned his B.S. from Penn State University and his master's from Carnegie Mellon University. He and his wife Lisa have three children.

Why is a STEM-prepared workforce important to FedEx Ground?

The world continues to rely more and more on technology. To me, this means that everyone can benefit from a basic knowledge of technology and the engineering behind it. As senior vice president of engineering at FedEx Ground, a company with several hundred engineers, I am keenly interested in engaging children as early as possible with science and math, so they can build a lifelong interest in these areas. Ultimately, it'd be good if they wound up working for FedEx Ground or other area companies. Having a strong STEM base will benefit the Pittsburgh region as it continues its evolution into a technological center of excellence.

How much is technology used at FedEx Ground?

The entire FedEx Ground operation is built on technology and engineering. In fact, we were the first ground delivery company to use bar codes for scanning packages. Information embedded in those bar codes is used in many ways and helps FedEx Ground to:

- make real-time online tracking possible
- help make sorting decisions in microseconds as packages are sorted in our fully automated sortation centers
- support a network capable of making more than 9 billion transactions per business day
- use routing models, cameras, and GPS technologies that help us cost effectively deliver more 4 million packages a day across the United States and Canada

What does FedEx Ground see as the value of its support of Carnegie Science Center?

Through its hard work and programming, with permanent exhibits such as roboworld™ and temporary exhibits like GUITAR and BIKES, the Science Center puts a WOW factor into science and math. I believe the Science Center plays a unique role in sparking an interest in children who will someday choose to work as engineers, IT developers, or financial analysts helping companies like FedEx be efficient and competitive. An organization that can accomplish that deserves the support of all area companies that employ people in the STEM disciplines. FedEx Ground works year round with the Science Center, and I am especially proud of our partnership, along with WTAE and the Math & Science Collaborative, in the math + science = success campaign, which encourages children and parents to become more interested in STEM subjects.

Do you have any personal favorites at the Science Center?

I have a personal goal of someday winning at robot air hockey. My kids claim it can be done. ■



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

Local Students Excel At National Science Competition

Two local participants in Carnegie Science Center's Pittsburgh Regional Science & Engineering Fair were among 30 national finalists in the Broadcom MASTERS (Math, Applied Science, Technology, and Engineering for Rising Stars) competition. **Mihir Garimella**, an eighth grader at Dorseyville Middle School, won first place in Engineering/Robotics with his project, *Scenllt: Digitally Recreating Smells*. Two years ago, as a sixth grader, he won a Carnegie Science Award for his science fair project on using a robot to tune a violin. The other local finalist, **Emma Ashley Burnett**, a seventh grader at The Ellis School, presented her project, *Elements of Fluorescence*, during the event. Honors for the finalists included a tour of the White House with President Barack Obama.

Videos Feature Preschool Activities

Carnegie Science Center has been providing classroom activities and leave-behind kits to local preschool Head Start classrooms for years through programs developed by **Wendy Brennerman**, the Science Center's early education coordinator, for PNC's Grow Up Great With Science program. PNC funding has also supported the production of videos showing these science activities both in classroom and in home settings. Kids explore with a parent or a teacher why different objects sink or float in a bowl of water; experiment with color mixing; delight in bubbles; and learn about surface tension by dropping soapy water, plain water, and oil on a penny.

The videos can be viewed at: CarnegieScienceCenter.org/GrowUpGreat



The Pittsburgh King STEM Stars team won awards for Creative Model Design and Best Interior Environment at the Future City competition. Teacher Jennifer Kilmer is at far right.

Afterschool Program Aims to Make Girls STEM Stars

Education in science, technology, engineering and math is a great way to set students on the path to success. But access to quality STEM education isn't available in every community. The Science Center, in partnership with the YWCA, is working to change that.

In October 2013, the Science Center launched STEM Stars. This afterschool program for under-served middle school girls combines the Science Center's GEMS program with the YWCA's TechGYRLS program. STEM Stars is currently running in 10 schools, and the partnership will serve nearly 1,000 girls throughout all middle schools in the Pittsburgh Public School District over three years.

"The program takes what we've been doing to bring STEM education to at-risk girls and expands it," explains **Nina Barbuto**, program manager for the Science Center's girls' programs.

Girls attend the program two days per week at each site and receive academic support in math and science through Skills Tutor, an online resource. They also have the chance to meet women who are working in STEM careers and are guided through hands-on STEM activities. Along with STEM-related field trips, the participants also attend Life Skills Academies at Chatham University, which features more STEM activities.

Barbuto says the girls also use the Science Center's CanTEENgirl.org website to help foster even more STEM engagement.

"The girls love the social media aspect of the website. Each group has a place on the CanTEEN site, and they can journal and blog and ask questions about what they've been learning. Then girls from other groups can respond in this safe online space, which is accessible only to STEM Stars participants."

The Science Center's Future City engineering competition is also part of the curriculum, and teams from all 10 sites participated at the event in January. **Jennifer Kilmer**, a teacher at the Pittsburgh King STEM Stars site, speaks enthusiastically about the Future City experience for the girls. "This was a very exciting, imaginative project integrating engineering, technology, math—because the city had to be to scale—and even art," she notes.

STEM Stars is supported by a \$40,000 two-year grant from the **Alcoa Foundation**. ■



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***Mysteries of the Unseen World* Interactive Kiosks**

Carnegie Science Center's exhibits team designed and built 15 interactive kiosks for National Geographic to accompany the release of its film *Mysteries of the Unseen World*, at locations including Washington D.C., Raleigh, Dallas, and San Diego. The kiosk in Carnegie Science Center's main lobby is popular with visitors.