MAY 2019

GEORGIA PATHWAYS

MAGAZINE

The STEM of Georgia Agriculture

Dr. *Andrea* Sanchez - VET

TAG Technology Association of Georgia

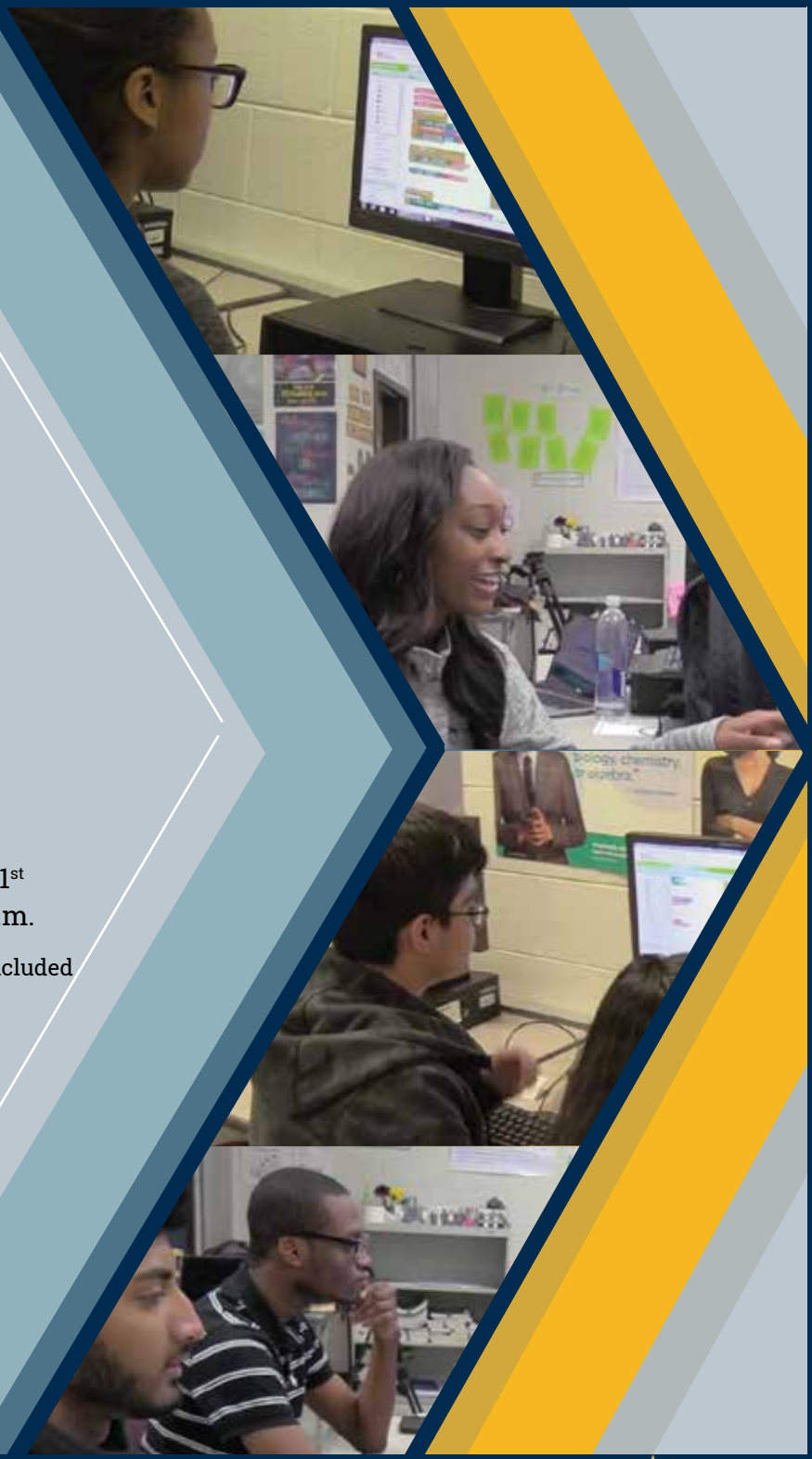
TAG TAG-Ed Education Collaborative

Introduction to Digital Technology

CAPACiTY Summer Professional Development

CULTURALLY AUTHENTIC PRACTICE TO ADVANCE COMPUTATIONAL THINKING IN YOUTH

CAPACiTY is a new curriculum for the Introduction to Digital Technology (IDT) course, developed by Georgia Tech with funding from the National Science Foundation, that enables students to develop digital technology and programming skills as they research and design solutions for a problem of their choice. (See reverse side for details of the course curriculum.)



Come learn how to implement CAPACiTY in your classroom!

WHAT:

40 total hours of professional development

- 10 hours online prior to course
- 30 hours face-to-face on GT's campus

WHEN:

- **Online:** 10 hours between June 3rd – July 21st
- **In Person:** July 22-26, 2019*, 9 a.m.– 3:30 p.m.

*Lunch Included

WHERE: Georgia Tech

COMPENSATION:

Teachers receive **$800 stipend** for course completion

TO APPLY

Send Email Inquiry to Capacity@gatech.edu

Include name, school, and school district.

SPACE LIMITED

CAPACiTY
CULTURALLY AUTHENTIC PRACTICE TO ADVANCE COMPUTATIONAL THINKING IN YOUTH

Georgia Tech

NSF

NSF# 1639946

"Exposure to tomorrow's STEM careers today"

The top jobs of tomorrow are addressed through STEM education today. By introducing STEM education to kids, it affords them the opportunity to be successful in multiple areas of study without having to study them individually.

IMPROVING CS EDUCATION OUTCOMES

PLURALSIGHT one

Helping teachers & students go deeper and bring computer science concepts to life in the classroom

Pluralsight One works to democratize technology skills around the globe to create freedom, equality and opportunity. That's why we've partnered with the Computer Science Teachers Association (CSTA) to build solutions that empower computer science educators and learners, and provide educators with courses that align to national computer science certification exams. With our Code.org partnership, students can access Pluralsight content that builds on the skills they've learned through Code.org's AP and non-AP Computer Science Principles courses.

LEARN MORE AT PLURALSIGHTONE.ORG/PRODUCT/EDUCATION

Welcome to our latest edition of Georgia Pathways™ STEM Magazine.

Across Georgia, and the country, the effort to make STEM education a more consistent part of K-12 curriculum in schools has been increasing steadily.

Importantly, there is evidence that those efforts are paying off. More students are learning valuable skills and going on to select career pathways that are rooted in STEM. In turn, they are advancing technology and innovation.

A recent national report showed that, since 2013, the number of states with at least one policy related to computer science education in K-12 schools has increased from 14 to 44. In 2018, 57% of 8th-graders reported taking one course, which can include robotics, coding or web design, compared with 52% in 2014, the report indicated.

The report went on to say that when 8th-graders take STEM courses they gain confidence in their ability to tackle engineering and technology-related tasks. Colleges and universities are, meanwhile, reporting an increase in demand for computer science courses.

The collective impact of these STEM education efforts is pushing forward a national goal to make technology careers more accessible, desirable and plentiful. That means the workforce pipeline for technology jobs is expanding, and the rate at which technology advancements and innovations can happen will continue to grow.

That's great news for technology companies, our technology ecosystem and for our economy.

TAG is proud to support STEM education efforts through the TAG Education Collaborative (TAG-Ed). Each month, this publication is distributed to educators, students, parents and technology proponents who want to inspire students and teachers to continue bolstering STEM curriculum.

Inside this edition you will find stories to share, examples of great STEM projects or initiatives at work and ideas that can spark new course plans or learning opportunities.

I hope you will be inspired by what you find and will share this publication with your networks. Thanks for your support!

Larry K. Williams
President
TAG-Ed

Larry K. Williams serves as the President and CEO of the Technology Association of Georgia (TAG) and President of the TAG Education Collaborative (TAG-Ed). TAG-Ed's mission is to strengthen Georgia's future workforce by providing students with relevant, hands-on STEM learning opportunities by connecting Technology Association of Georgia (TAG) resources with leading STEM education initiatives.

The Technology Association of Georgia Education Collaborative (TAG-Ed) strengthens the future workforce by providing students with relevant, hands-on STEM learning opportunities and connecting them to Technology Association of Georgia (TAG) resources. Formerly the TAG Foundation, TAG-Ed is a 501(C)(3) non-profit organization formed by TAG in 2002. Later, the organization's name was re-branded to TAG Education Collaborative to facilitate our role as the leaders for K-12 STEM education in Georgia.

PRESIDENT/CEO
Larry K. Williams

EXECUTIVE DIRECTOR/EDITOR
Errika Moore

PUBLISHER
Wayne Carley

CONTRIBUTORS
Mary Kay Boler, TAG-Ed Staff
Shanice Saunders, TAG-Ed Staff

The Technology Association of Georgia (TAG) and
TAG Education Collaborative
75 5th Street, Suite 625 Atlanta, GA 30308

http://www.tagedonline.org

TAG | TAG-Ed Education Collaborative

From the Executive Director

For the past 18 months TAG Education Collaborative (TAG-Ed) has had the opportunity to engage with several members of Atlanta, Georgia and even national ecosystems.

Connecting with our local and regional ecosystem has provided tremendous insight into our perspective regarding collective impact. Collective impact brings people together people in a structured way to achieve social change or it's also defined more extensively as "the commitment of a group of stakeholders from different sectors to a common agenda for solving a specific social problem, using a structured form of collaboration." So whereas it's exciting to see the impact we can all make individually.

It's even more encouraging to know the enhanced outcomes that can occur when we work together collectively.

Here at TAG-Ed, that gives us hope for the future. An article written by Jon Kania and Mark Kramer in 2011 in the Stanford Social Innovation Review, helped to introduce the concept of collective impact by highlighting how Strive in Cincinnati brought together local leaders to tackle the student achievement crisis and improve education throughout greater Cincinnati and northern Kentucky.

"Within four years of the launch of their efforts, Strive partners demonstrated improved student success in dozens of key areas across three large public school districts. Despite the recession and budget cuts, 34 of the 53 success indicators that Strive tracks have shown positive trends, including high school graduation rates, fourth-grade reading and math scores, and the number of preschool children prepared for kindergarten."

In essence, more than 300 community leaders "including the heads of influential private and corporate foundations, city government officials, school district representatives, the presidents of eight universities and community colleges, and the executive directors of hundreds of education-related nonprofit and advocacy groups decided to abandon their individual agendas in favor of a collective approach to improving student achievement." And they realized that "fixing one point on the educational continuum—such as better after-school programs—wouldn't make much difference unless all parts of the continuum improved at the same time." So the efforts of many [working in synergy] impacted the whole.

To some educational collective impact sounds overwhelming. But in practicality

the measurable accomplishments are astounding, life changing and advance significant measures such as living wages, economic mobility and income equity! So we're encouraged by cites like Cincinnati and other ecosystems that are not only emerging and evolving in their own markets but are developing a national thread through organizations like the STEM Learning Ecosystem Community of Practice.

We're motivated by the successful effects of their efforts on our own Ecosystems right here in Georgia. We are here to support all who are committed to improved and sustainable opportunities for our Georgia students. According to Greg Hills, the co-CEO of FSG, one of the world's leading social impact consulting firms, "Collective Impact moves at the speed of Trust." But I also believe Historian Howard Zinn's quote that states "Small Acts, when multiplied by millions of people can transform the world."

Erika Moore

Executive Director
TAG Education Collaborative

The Importance of Agriculture in Georgia

Agriculture is a STEM Career

Agriculture, or the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products, is critical to Georgia economy.

Agribusiness contributes $74.3B to GA's economy and provides more than 411,500 jobs. This is big business and will continue to be a driving force at the local, state, and national level. Georgia is home to a diverse variety of food and fiber production and a rich assortment of the related economic sectors.

There are more than 42,000 farms in Georgia with more than 9 million acres spread across the state. Sometimes overlooked as part of Georgia's thriving small business community, 88 percent of these farms are considered to be small businesses in terms of annual. It's been reported that there are nearly 35,000 farm proprietors, consisting of both sole proprietors and non-corporate partners as owners.

This vibrant Georgia Agriculture and its related sectors not only contribute to the state, national and world-wide prominence, but comprise a critical part of the small business sector as well. The economic contribution of these food and fiber industries – including landscape services – ranges from a few million to a few billion dollars of county output and includes thousands of jobs for the local agriculture and related sectors.

The University of Georgia College of Agricultural and Environmental Services Center gathers data annually on these production values in the Farm Gate Value Report. CAED economists conduct further analysis to calculate the total economic contribution of all the sectors involved in this production from seeds and fertilizer to processing for the range of different commodities, including row and forage crops, vegetables, fruits and nuts, ornamental horticulture, forestry, livestock, aquaculture, poultry and eggs, and agritourism.

This food and fiber production earns Georgia top ranking in the nation, including the number one spot in blueberry production, broilers, peanuts, pecans, rye, and onions. Georgia ranks second in the nation for cotton, cucumbers, pullets and watermelon; third for bell peppers, peaches, and sweet corn.

The ***science, technology, engineering and math*** required to be a farmer is vast and diverse. A short reflection of what it takes to grow healthy crops includes a broad understanding of soil minerals, herbicides and pest control, crop rotation, and meteorology.

The decision making process, or engineering, infiltrates every portion of farming. Technology has become deeply woven into agriculture, from robotic tractors, drone observations, remote electronic irrigation systems, and a variety of computer software applications. Don't forget the math of all of the above and its critical accuracy that brings crops to market.

Changing eating patterns open many opportunities for agribusiness entrepreneurs as consumers are looking for new, interesting, and innovative food products. This growing diversity in Georgia and the nation has created opportunities for agribusinesses that supply food products.

For instance, the number of ethnic markets outside of Atlanta alone includes numerous products that are not currently grown in Georgia. This growing ethnic population provides opportunities for addition agra- products and processing of agricultural commodities.

Local foods, produce markets and non-GMO foods continue to grow in popularity across the state and nation, showing up in Georgia restaurants. As the population of Georgia and the world continues to grow, it is estimated that there will be an additional 2.4 billion people on the planet in 2050. To meet the needs of this growing population demand, Georgia farmers will have to produce more products than ever before. We will see a broader variety of food products that can be grown here in Georgia. The growing world population will continue to provide opportunities for farmers across the state of Georgia as well as the STEM applications necessary in every aspect of this endeavor. Georgia agriculture and the STEM that is woven into it will pave the way to meet the needs of a hungry state, nation and globe.

Agriculture is a STEM career.

The STEM Sandwich – Organic with a purpose

By Sara Bakken

1. Prep-Work – Like a good cook, preparing your workspace and making sure everything is clean and ready to go is just the same we must think of our classroom environments. Taking the time to research methods that will work best for your personality, student population, and class schedule are going to make the journey much more enjoyable for everyone.

Take into consideration that just like a variety of types of students will come, a variety of different versions of the "S.T.E.M. sandwich" can and likely will be created. It is ok to enjoy the journey and allow for creativity. Some critical preparations that need to be addressed would primarily be the pre- discussion of expectation and classroom norms that are acceptable during times of PBL (project based learning).

The students should begin practicing mock discussions on how to produce viable arguments, the procedures for talk, safety to make mistakes and trust within the teacher and peers is key for a higher rate of successes in my personal observations among students. It doesn't take but a few days to get the environment set for this...but practicing these concepts is key, the sooner the better.

2. Identify the S.T.E.M. hunger - appropriate to the age group and/or grade level, as well as, read a recent news article on a world issue that needs to be solved or blog to get a pulse on current events...use fresh STEM ideas, teaching methods, etc.

For example, gather from the students using a pre-made engineering survey,

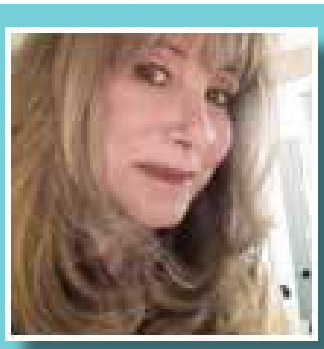
www.ionfuture.org , create your own survey or discussion power point, or create a purposeful discussion to see what topics under the grade level S.T.E.M. umbrella they would like to learn more about, as well as, use input from your grade level teams. – feed the hunger and meet the standards!

3. Plan the layers of your sandwich - Decide what topics are appropriate to be covered via NGSS, as well as the CCSS for Math and ELA, in a given amount of time for the month, grading period, semester, and/or year...Following the Steps in the Engineering Process as a guide for continued improvement of the S.T.E.M. PBL.

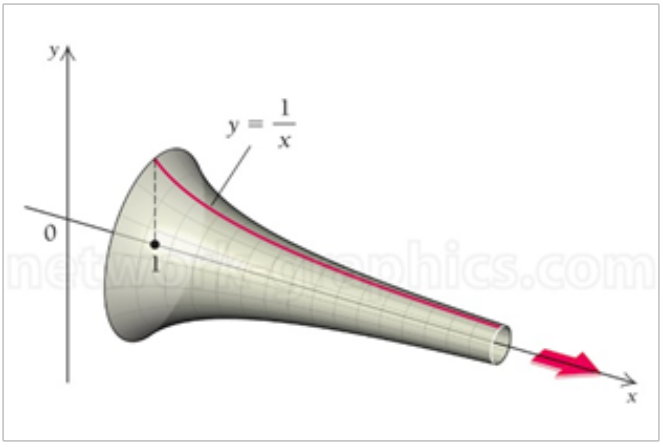
4. Chips on the side? - The ways in which the S.T.E.M. applications meet or exceed diversified learning for all learners. Not all learners fall into S.T.E.M. easily; be prepared with alternatives.

5. Don't forget the drink! – Finally, wash down the activity with a refreshing end to those powerful lessons with student created presentations that promote viable arguments for successes, failures, and improvements. A survey of likes, dislikes, self-reflection and group critique should be a final component to conclude the S.T.E.M. PBL. Educators should remember to provide a dose of empowerment and key on the positive attributes associated with each groups presentation outcomes.

By Kay Howard



Some of my Favorite **STEM** Things



Gabriel's Horn

Gabriel's Horn is a 3D shape with the paradoxical property that it has finite volume and infinite surface area. Which means you can fill it up with paint, but you can't paint it. How cool is that!

Gabriel's Horn is made by rotating a graph of the function $y = 1/x$ $(x \geq 1)$ about the x-axis.

Volume, $V = \pi(1 - 1/x)$

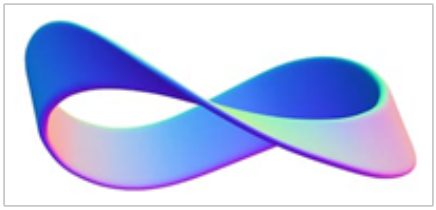
The $\lim_{x \to \infty} (1-1/x)^x = \pi$

Surface area, $S \geq 2\pi \ln x$

The $\lim_{x \to \infty} 2\pi \ln x \neg= \infty$

Volume = π. Surface area = ∞

The Möbius Strip



Unlike Gabriel's horn, the Möbius Strip is a real-life object. One of the most famous surfaces in mathematics, the Möbius (MeR-bee-us) strip can be constructed by cutting a long strip of paper, putting a half twist in it, and gluing the ends of the strip together.

The Möbius strip has several curious properties. A line drawn starting from the seam down the middle meets back at the seam, but at the other side. If continued, the line meets the starting point, and is double the length of the original strip. This single continuous curve demonstrates that the Möbius strip has only one boundary.

Cutting a Möbius strip along the center line with a pair of scissors yields one long strip with two full twists in it, rather than two separate strips; the result is not a Möbius strip. This happens because the original strip only has one edge that is twice as long as the original strip. Cutting creates a second independent edge, half of which was on each side of the scissors.

Cutting this new, longer, strip down the middle creates two strips wound around each other, each with two full twists.

Everyone has been exposed to the Möbius strip on a daily basis, likely without realizing it. How? The universal recycling symbol is a Möbius strip! This Möbius strip has 3 half twists and can be better seen if you imagine that the tip of each of the 3 arrows is connected to the tail of the preceding one. Follow the surface of the object and you will find that it is, indeed, a Möbius strip.

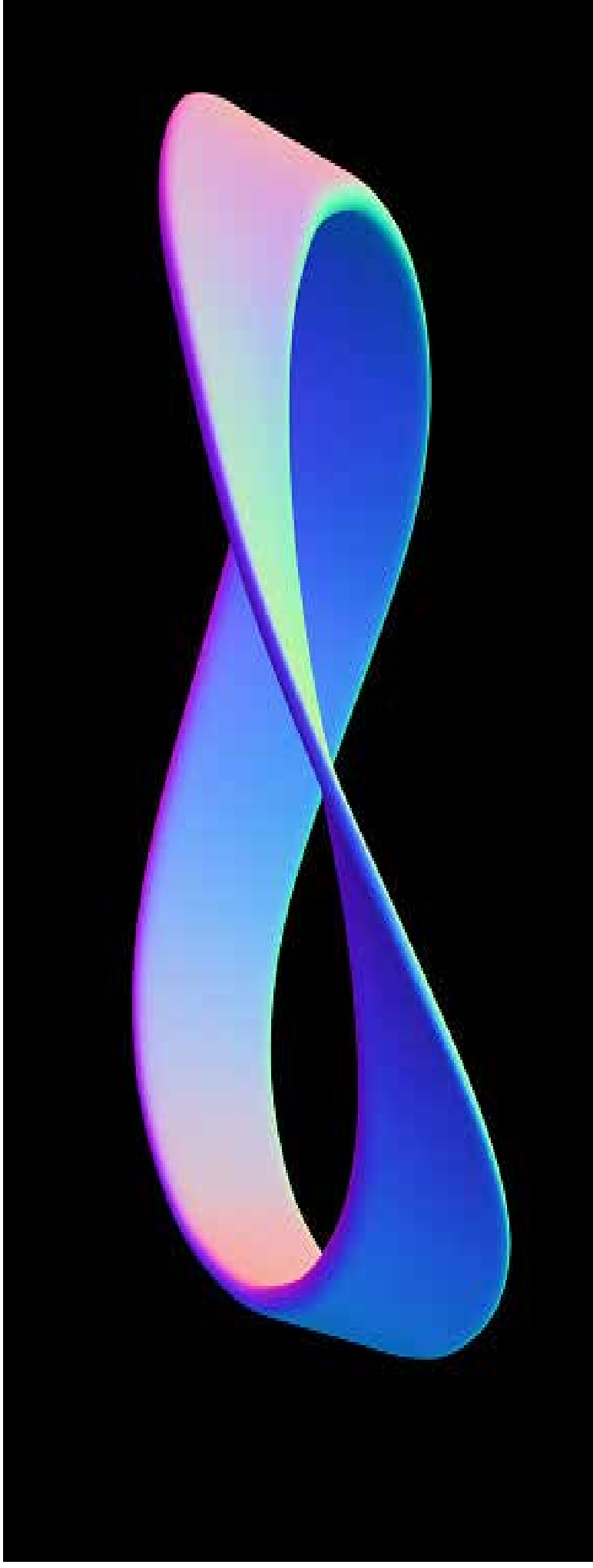
The design for the universal recycling symbol was created in 1970. In light of increasing awareness of humankind's impact on the environment, the Container Corporation of America sponsored a contest challenging high school and college students to create an artwork that conveyed the process of recycling. Gary Anderson, a 23-year-old college student, submitted a drawing of a 3-twist Möbius strip that is now the universal symbol of recycling. Anderson won a $2,500 scholarship for his design.

The Möbius strip has several other intriguing applications:

In 1957, the B.F. Goodrich Co. patented the design for a conveyor belt in the configuration of a Möbius strip. This conveyor belt had the advantage over normal conveyor belts by spreading the wear on the belt over the entirety of both sides. Normal conveyor belts distribute their wear over one of two sides. The Möbius conveyor belt thus lasted longer than a conventional conveyor belt.

In 1949, an abrasive belt in the shape of a Möbius strip was designed. Like the Möbius conveyor belt, the Möbius abrasive belt had the advantage over conventional abrasive belts in that the wear would be distributed over the entirety of the of the belt, rather than over only one of two sides.

In 1920, a man named Lee deForest designed an 'endless sound record' in the shape of a Möbius strip. In the realm of chemistry, a Möbius strip configuration has been observed in molecular structures.



Use Georgia Pathways™ in class this fall. Use the Smartboard. Share the link.

Each issue is appropriate for all grades and all teachers in all subjects.

Curiosity and learning are ageless.

Please enjoy this issue. You have unlimited distribution across Georgia so your students and their families may enjoy it too.

Kevin Field:

Developing Radiation-Tolerant Materials for Nuclear Power Systems

By Dawn Levy

Photo credit: Carlos Jones/Oak Ridge National Laboratory, U.S. Dept. of Energy

In ORNL's Low Activation Materials Development and Analysis Laboratory, Field makes use of a transmission electron microscope to examine a sample made with a focused ion beam.

He investigates the defects produced in a FeCrAl alloy bombarded with neutrons in HFIR.

Kevin Field at the Department of Energy's Oak Ridge National Laboratory synthesizes and scrutinizes materials for nuclear power systems that must perform safely and efficiently over decades of irradiation. "I'm trying to better understand how emerging technologies and materials will perform in nuclear reactors," said Field, recipient of UT-Battelle's 2018 Early-Career Researcher Award.

With techniques including advanced electron microscopy and neutron scattering, Field characterizes materials for reactor structural components and fuel cladding. His primary focus is research that advances the light water reactors supplying approximately 20 percent of U.S. energy needs.

America's nuclear power plants were designed to operate for 40 years but may be capable of running for a century. To ensure their safe, efficient and economical performance, researchers need to know how irradiated materials might behave beyond planned operational lifespans.

"How can we make a material look 80 years old but do it in only 4 hours?" Field asked. That's a big challenge, but ORNL facilities can age a material to end-of-life conditions in less than a year. The key is introducing radiation damage into materials by a mechanism familiar to pool players—displacement. During the break, a cue ball smashes into billiard balls, scattering them. Likewise, a neutron produced in a nuclear reactor collides with the atomic lattice of a material in the

reactor wall, moving atoms and creating defects. The High Flux Isotope Reactor, a DOE Office of Science User Facility at ORNL, speeds the process of atomic displacement—akin to more cue balls smashing billiard balls in the same amount of time.

Easy does it

Field grew up in a farming town in Illinois. His brother's chemistry career inspired him to give science a try. He enrolled in a mechanical engineering program at Michigan Technological University only to discover he didn't like mechanical engineering. He shopped for a new major and picked materials science and engineering.

"I liked it much, much better. Smaller groups, less math. You're going to get a theme here—I like easy," Field said. "Materials science is more about real-world applications. It is broad so you can jump around. If you don't like one topic, you can find another."

For his senior project, Field used simulation to redesign the casting of a differential bell housing [powertrain part] to optimize molten material flows and eliminate porosity.

Continuing on to grad school at the University of Wisconsin, Field explored how radiation-induced defects in iron-based steels move within an atomic lattice.

"One reason I wanted to be in iron-based alloys is you get really complicated systems with just two elements—iron and carbon," he said. "You can do a lot with that. That's why people are still doing research on steel even though the Iron Age was many centuries ago."

His dissertation work required a tool unavailable in Wisconsin. It was, however, available in Tennessee—at ORNL. Subsequently, Field spent about a week every two months at ORNL. "I literally had a second home here my last three years of grad school," he said.

In 2012, he defended his thesis and accepted a postdoctoral position at ORNL as a Weinberg Fellow on the same day. He studied concrete, which he calls a "living material" that changes with time, water content, chemical composition and irradiation.

"I realized concrete was way too complicated," he said. "Metals are much easier." To unwind, Field likes cooking and fly fishing. At home, he and his wife, Beth, a pharmacist, rehearse their work talks with each other. "She can give just about any technical presentation I've ever delivered because I practice in front of her every time. She has a junior achievement badge in material science and radiation effects," Field joked.

The couple had their first child in November. Field is currently reading a first book to his daughter—Atomic Accidents by James Mahaffey.

The right tools for the job

Defects change how a material behaves. "Trying to understand that process is fairly complicated, and I use a lot of different tools to do that," Field said. He uses a focused ion beam to micromachine specimens. "Downsizing your sample to smaller than a speck of dust reduces the observed radioactivity of the specimen," he said. "Then you can use high-end characterization tools in facilities that don't have to be specialized to handle radioactivity."

To obtain a "snapshot" of a material's microstructure after irradiation, Field uses small angle neutron scattering at HFIR. "You're using neutrons to change your material, and then you're using neutrons to analyze the material," he said.

HFIR staffers have long used lead-lined, soda-can-size containers called "pigs" to transport radioactive samples. Now they've designed "piglets" to move smaller samples. A candy bar–size piglet is transparent to neutrons but blocks gamma rays. "You just take a piglet housing your specimen to HFIR, and HFIR staffers analyze it and you have your data," Field said. Materials can be examined in mere minutes.

For high-throughput characterization and analysis, Field also has started using machine learning to identify and count unique features in more than 10,000 material images that he has amassed working with ORNL colleagues Yukinori Yamamoto to develop new alloys and Kurt Terrani to tailor those alloys for accident-tolerant fuels. "An image can have from five to a hundred different unique features," Field said. Having a machine do the counting is easier than doing it yourself.

"It's awesome to be a nuclear materials scientist at Oak Ridge because we have unmatched capabilities at every stage of an activity," Field said. "From cradle to grave, we can do it here—make alloys, irradiate them, and interrogate them."

Materials at extremes

An ORNL program advances accident-tolerant fuel applications, such as fuel cladding that can endure high temperatures longer than can today's zirconium alloys. For this program, Field works with an alloy system of iron, chromium, and aluminum, FeCrAl.

The eventual goal is to produce, on a large scale, pencil-size fuel tubes from the alloy that can be quickly deployed in nuclear power plants. Because FeCrAl is extremely oxidation resistant in high-temperature steam environments, Field and others believe it may be able to avoid accidents in which material overheating plays a role, such as the Fukushima Daiichi disaster.

The DOE Office of Nuclear Energy and Office of Fusion Energy Sciences suppor Field's research. Additional funders include EPRI, GE and Global Nuclear Fuel UT-Battelle manages ORNL for DOE's Office of Science. The single largest supporter of basic research in the physical sciences in the United States, the Office o Science is working to address some of th most pressing challenges of our time.

For more information, please visit https: science.energy.gov/.

FeCrAl alloys consist of mainly iron, chromium (20–30%) and aluminium (4–7.5 %). The first Kanthal FeCrAl alloy was developed by Hans von Kantzow in Hallstahammar, Sweden. The alloys are known for their ability to withstand high temperatures and having intermediate electric resistance.

Dr. *Andrea* Sanchez
Veterinary Medicine

A Georgia Pathways Magazine Interview

"I can't pinpoint an exact moment when my interest in Veterinary Medicine began, because I have loved animals since I was very young. My interest in veterinary medicine is something that has always been intrinsic, which has grown and was encouraged over time. This interest was encouraged by those around me, particularly the women in my life and my dad.

When I was a seven-year-old girl, my godmother (who actually told this story recently) drove me to the college of veterinary medicine and got me to take a picture next to the big sign on campus. She then gave me the framed photo for my graduation – which was a special moment for everyone involved.

In high school and college, I had always loved my biology classes. Anatomy, life sciences and molecular biology were so fascinating and came naturally to me."

Any special challenges along the way thus far?

For the most part, I had teachers who were very encouraging. My anatomy teacher in high school was very tough on us - she made us memorize every vein, nerve and bone, and I was 15 years old!

I do remember a teacher in college, who tried to explain something to me when I was having trouble in a calculus class. After I said I didn't understand it, he snapped at me and said, "what don't you understand?". I remember the tone, and the impatience, and feeling stupid and as if maybe the sciences weren't right for me. I think I felt that way especially because it was a man saying that to me. I don't know how much gender bias was implied in his tone and impatience, but there is a part of your brain that challenges yourself and says, "maybe I don't get calculus because I'm a girl", which really resonated.

I had a moment where I felt pretty incompetent, so I decided to take that complaint to the chair of the department. I didn't feel that any teacher should be losing their cool and getting impatient at a student who says they don't understand but is interested in learning. Eventually that teacher was let go, not just because of my complaint of course, but I felt incredibly empowered that I had spoken up and defended myself. I eventually understood the concept he was trying to teach me, but I learned it through talking with a helpful classmate (a guy!).

Even though there was a part of me saying, "you're whining, you're making a big deal out of nothing, maybe you just don't get it," I thought it was the right thing to do. I wanted to speak up and say that this teacher, let alone anyone, should not be making any student, regardless of their gender, feel incompetent or like there is no hope for them.

What is most satisfying about your interaction with animals?

My interaction with animals has always been special, particularly as it started when I got my own cat at the age of eight. Although I wasn't aware at the time, I was struggling with anxiety, and having a best friend that listened to me and cuddled me every night without fail provided me with so much support.

This relationship urged me to want to give back to animals in whatever way I could and having that cat has emotionally tied me to the profession. These interactions are so satisfying to me personally, as I feel that through my current role, I'm able to give back in all the ways I wanted to when I was a young girl.

Tell us about your practice/ What excites you most?

Firstly, I personally believe the practice is leading in ways to help get the average family afford veterinary care.

While I love veterinary medicine and always want to practice at the highest quality, I've always been well aware, even in veterinary school, how hard it can be for the average pet-owning family.

I personally think we are on track to be a leader in changing what veterinary medicine looks like in the future. Mobile practices, telemedicine, flexible doctor's schedules, and reducing the compassion fatigue and burnout of traditional medicine are only some of my ambitions.

My current goals are more for the veterinary industry, to influence the field, and particularly to encourage more students to pursue veterinary medicine as a career, and for vets to have increased quality of life and work-life balance. This excites me as I think my practice is going to be at the leading edge of that.

Who or what was your greatest influence and why?

I can whole-heartedly say my mother, because at the end of the day, she was the person who influenced, and continues to influence me in a million tiny ways, day in and day out over the course of my whole life. I am fortunate enough to have a very good mother, and I will always remember that she used to say that there should be nothing preventing a woman from having a fulfilling career, and there is no reason that a woman's partner cannot be a 50 per cent caretaker in the family and home life. There is no reason women shouldn't have that.

All she has ever wanted is for me to be happy, which has been reinforced as I've made a variety of non-traditional life choices, including being 40 and not married and not wanting to have children. I have an unbelievably fulfilling career and she is extremely supportive of that.

The fact that she completed her master's degree and worked full-time throughout my upbringing provided me with a continuous example of feminism my whole life, and I have to give her credit for that.

Talk to us about the variety of animals you treat.

When a veterinary practitioner leaves school, they can technically be ready to treat just about any animal! This includes anything outside and in, from treating elephants in a zoo to dogs in a clinic down the street.

When I first started, I was working at a PetSmart, where I was mainly working with dogs and cats. As time went on, they would bring us a lot of hamsters and guinea pigs, along with mice and rats, which allowed me to learn an unbelievable amount from those small, specialty pets – which I found very interesting and fun.

Everything from the tiniest little rodent is still really fascinating, not to mention adorable. These days, when I do clinical work, when I go back to the hospital for the day, or when I work at my non-profit for a day, it is almost exclusively dogs and cats.

Depending on what a vet wants to specialize in, and where they want to do an internship and residency, they can see just about anything that is not human!

How does computer science and engineering (decision making) come into play?

Whether I'm in the hospital or at headquarters, I use science every single day in my job! If I'm in the hospital, I'm using x-rays, diagnosing anemia with machines that measure how currents or light-waves run through cells, reading electrical patterns in the heart using electrocardiograms, and much more.

As a clinician in the hospital, science is used every minute of every day. At my job at central team support (our practice headquarters) not a day goes by when we are not reading a report or looking at data. Just last Saturday, I had some work to catch up on, and I was reviewing the rate of irregularities in some of our equipment, and we were trying to verify that the irregularities had gone down. I was looking at spreadsheets and formulas, using a lot of math.

We use a huge amount of statistics in veterinary medicine, don't let it fool you – statistics is a very complex science and can be very challenging, but is really important in research.

What do you hope the "takeaways" are for readers. What are your words of advice or encouragement?

The world absolutely needs more vets! There is an enormously broad range of exciting jobs you can do as a veterinary

practitioner – you can do everything from forensic wildlife management in Africa to exclusively treating cats in your hometown practice. Think of how many animals there are out there, and how extensive the need is for more care and management of animals. The human population is increasing and encroaching so much on their lives – not just for pets but all animals.

In the U.S., veterinary practitioners only have 1% unemployment, mostly by choice, and there is an enormous shortage and need. In general, I am not an expert of other scientific careers, but when women get involved in any STEM career in great numbers and are well-represented, it really changes the perspective of that line of work and can really open people's minds.

I remember, I had a biology professor in college who told us that the area of wildlife management changed dramatically when women started entering the field, because women understood mating rituals from a different perspective. When this more diverse perspective was offered, contrasting to the traditionally male dominated wildlife biology fields; it resulted in a huge amount of new understandings of female behavior and female choice in mating. That blew the minds of all the male scientists! This had led to improved breeding for endangered species – evidence that you never know how significantly women can change a field, truly changing the world.

Dr. Andrea Sanchez has worked in the veterinary medical industry for 19 years and has been a veterinarian in small animal general practice since 2007. Dr. Sanchez also volunteers to provide wellness care to pets in need through preventive care clinics benefiting pets of the homeless and the low-income population. In addition, she leads an annual trip to underserved neighborhoods in New Orleans & Baton Rouge, Louisiana, as well as to several locations in Puerto Rico.

Through the last four years, these trips have taught empathy for animals and responsible pet ownership to thousands of schoolchildren and have provided essential medical care to over one thousand pets in need.

The SCIENCE of Homework:
Tips to engage students' brains

Dr. Judy Willis

If you know a bit about the brain then you can plan homework to suit the needs of students as they develop. During early school years, for example, the brain is focused on getting to grips with the world around us. Memories and understanding grow when new information can be linked to things we already know. Homework that helps with this recognition can build literacy and numeracy skills.

When students reach adolescence, they become more independent and self-directed. There is shift away from rote memorization and single, correct responses. Learning goals are more likely to focus on reading for content and comprehension, revising, report writing, solving problems, investigating and independent or group work.

Well designed homework provides multiple ways for students to engage with what they are learning. They will then be able to use the facts they acquire to be creative and solve problems in class.

When to use online learning games for homework

Most teachers work hard to differentiate homework based on skill level, but with each new topic there may not be time to prepare individual tasks. Online games, in which pupils learn and test their factual knowledge, can be helpful when homework goals are about building a foundation of knowledge.

This tends to be in the early years of school. Computer-assisted learning cannot replace good teaching: it is only from teachers that students can experience rich interactive learning and build conceptual understanding.

But using online learning games for homework tasks lets students gain the necessary level of factual knowledge and learn procedures that need to be memorized. This allows them to then progress in class to the richer subject content. Relieving teachers of essentially being drill directors means students get more class time to understand concepts and apply what they have learned.

Online games also help students to build skills to an automatic level at an appropriate pace for them. Games could be helpful in learning multiplication tables, spelling, remembering dates, names of rivers, foreign language learning, or getting to grips with grammar rules.

Well designed online skill games evaluate each student's ability as the basis for the questions or problems given. A good website for information about hundreds of available programs is ***graphite***. You can browse by subject, grade level and skills, and see rankings of popularity with learners and teacher evaluations.

The importance of homework that students value

In later school years homework is more

likely to focus on reading for understanding, revising and launching investigations. When students know that the effort they put into homework will enhance their participation and enjoyment of class room learning, they become more motivated. Pupils also put more effort into schoolwork or homework when they are engaged in something that is relevant to their studies.

For instance, if the class is studying how to calculate area, good math homework may be to get students to measure parts of their room they want to change (e.g. walls to paint, windows for curtains, doors to cover with cork board for posting photos etc). Those who complete the homework will be able to make sketches to scale of their rooms on graph paper and determine area. Those who don't do the homework will not be prepared for this activity and will have to solve less interesting worksheet problems.

If the assignment is to read a chapter in a social studies or history book for discussion the next day, teachers can inform them that there will be a short quiz of the main points. Students who score high enough to demonstrate that they did their reading will have the rewards, or do independent projects of their choice and move on to new challenges.

How much time should homework take?

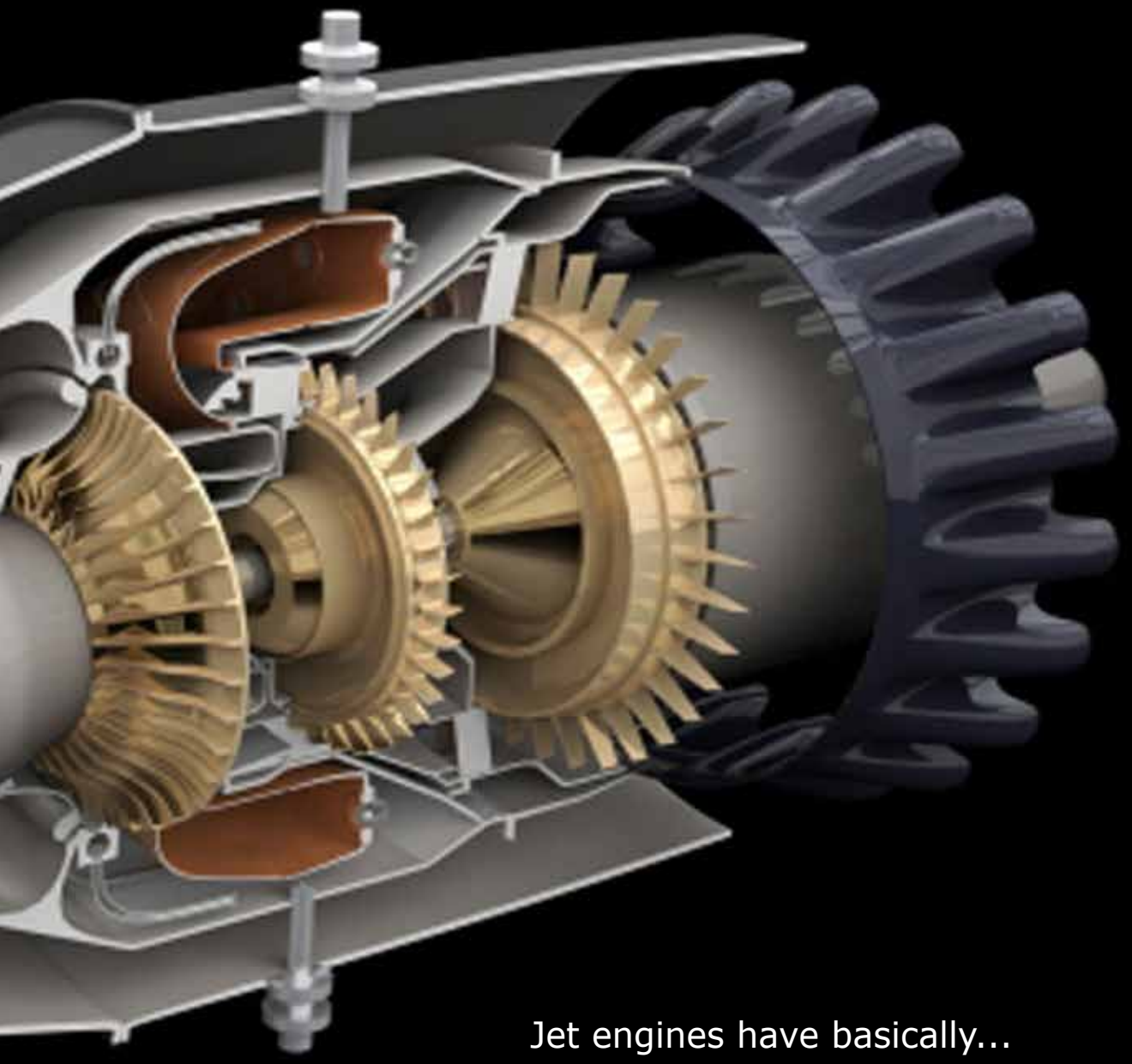
The amount of time spent on homework will always vary depending on the age of students and what task you have set.

After about 15 minutes of learning and practicing something - such as the Pythagorean theorem in math - the regions of the brain activated in spatial-numerical learning get fatigued and need to rebuild the neurotransmitters, such as dopamine, that ***get depleted.***

This is why teachers need to plan brain breaks in class time and for homework. It doesn't mean the child needs to run around or play a game. It just means another part of the brain (or body) should be doing the activating while the other area rests. The restoration only takes a few minutes if the break is timely, but if they are pushed to stay with that same process for too long, stress builds, neurotransmitters drop way down and it will take twice as long to restore full efficiency to that area of the brain.

The good thing about getting students to do something that will enhance their classroom experience is that they are more likely to engage in it, so they don't mind spending time on it. Online games for learning basic knowledge usually have set timings. You can assign a specific amount of time to be spent on the skill building program for homework and confirm students' compliance by checking the teachers' pages.

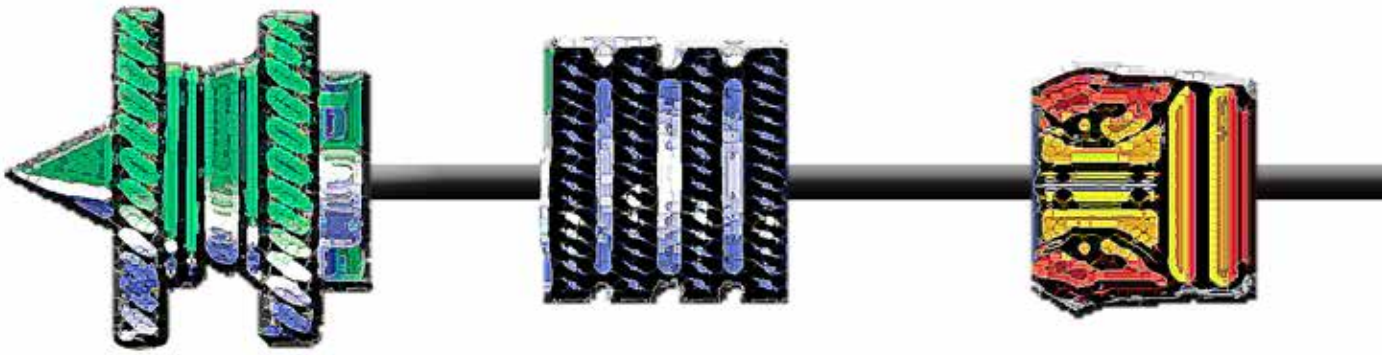
Why are Jet Planes so safe?



Jet engines have basically...
one moving part.

The average car engine has about
200 moving parts.

The #1 cause of plane crashes is...
pilot error.



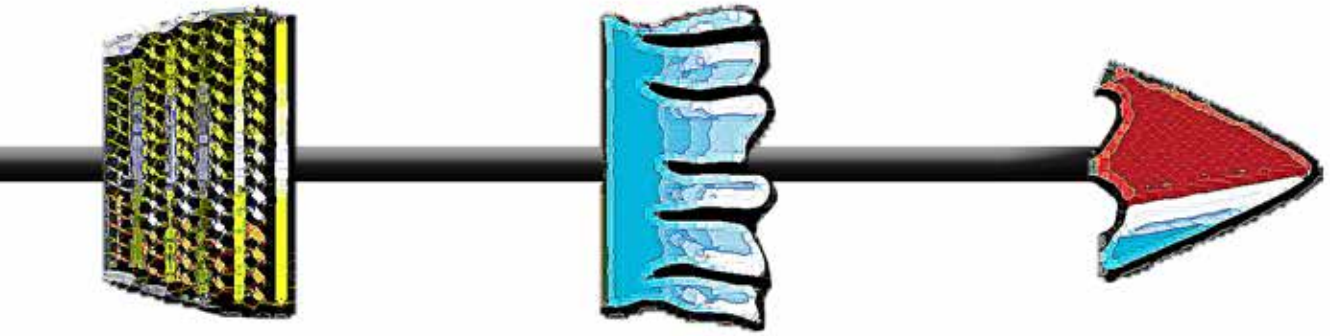
Fan **Compressor** **Combustor**

The **FAN** blades spin at high speed (because of air rushing in) and **COMPRESS** or squeeze the air in the compressor.

The compressed air is then sprayed with fuel in the **COMBUSTOR** and an electric spark lights the air, fuel, mixture. The burning gases explode and blast through the **TURBINE,** then the **MIXER** out through the **NOZZLE**, at the back of the engine. As the jets of gas shoot backward, the engine and the aircraft are thrust forward.

Note that all of the major parts are connected to one single rod or shaft....making our engine one, big moving part.

When the TURBINE spins because of the COMBUSTOR blasting air and fuel through it, it turns the shaft, which is connected to the front fan, turning it faster and pulling in more air.



Turbine **Mixer** **Nozzle**

Careers in aviation and jet engine maintenance are great opportunities. Parts just wear out and have to be replaced or repaired. With thousands of jet in the sky, safe and dependable aircraft are important.

There are many more reasons why flying in general is safe, but jet engine technology continues to improve with new materials and innovations.

Many of these STEM jobs do not require college, but rather trade school, specialized aviation schools or aircraft company education programs.

In the past 50 years, the world's commercial airliners have racked up nearly one billion flight hours, providing an industry meticulous about record keeping with a steady stream of information that is used to constantly improve the design of airplanes and engines.

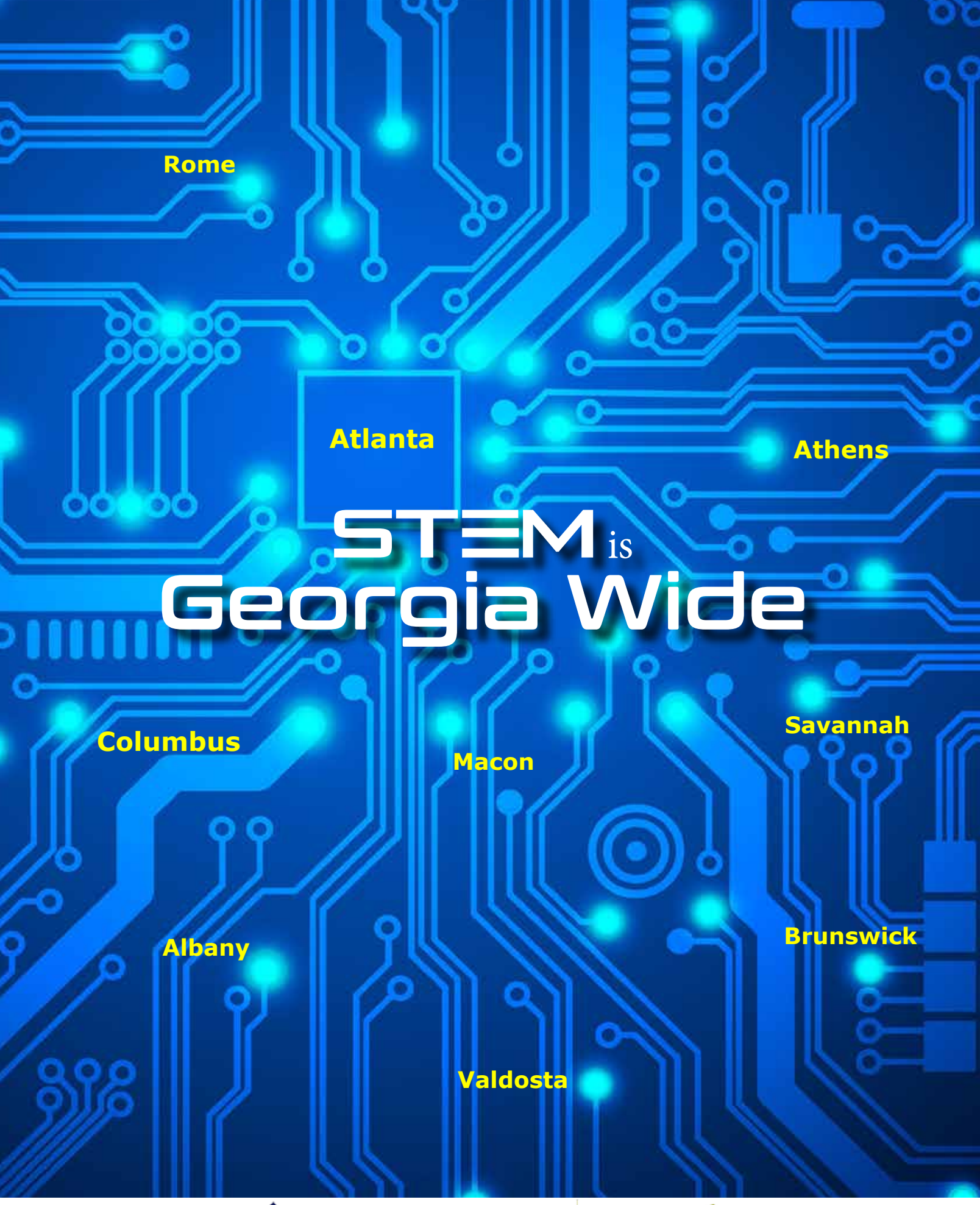
Starting salary for a certified jet mechanic is about $50,000 per year.

We need you to continue the innovation and improvement of jet engine technology that will save fuel, run quieter, be cheaper to build, be safer and last longer.

Jet engines may be advanced, but you will make them revolutionary.

Jets are not perfect and need replacement parts, updated materials, new software and new ideas we haven't thought of yet.... ***but you will.***

Are you curious about this career? That's where you start regardless of your age.
Google it.....



TAG Technology Association of Georgia

TAG TAG-Ed Education Collaborative