

IT STARTS HERE ★

ASHA HALL:
HEARING A CALL TO INVENT
A BETTER FUTURE

8 INSPIRING STORIES
of STEM professionals

JONATHAN GRATCH:
VIRTUALLY
AMAZING





Hearing a call to invent

A BETTER FUTURE

DEAR FUTURE STEM STAR:

Welcome to the first ever edition of **IT STARTS HERE!** from the Army Educational Outreach Program. The goal of this magazine is to highlight some amazing individuals who are working in science, technology, engineering and mathematics (STEM) careers throughout the Department of the Army.

Did you know that the Army is one of the largest STEM employers in the world? And that most of our STEM workforce are civilians? Whether it's working in advanced manufacturing, civil engineering, medical research and other diverse fields, the Army and our Nation's defense and prosperity depend on people like you to pursue STEM careers.

So, where to get started? Well, right here! Learn more about the exciting challenges and opportunities these individuals take part in every day as part of their careers. Go to www.usaeop.com if you'd like to learn more about the many educational opportunities - STEM apprenticeships, summer activities and competitions - the Army Educational Outreach Program has waiting for you!

Your STEM future is vital to America's future, so what are you waiting for? **It starts here!**

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Sound is pretty much a constant in our everyday lives – we're so completely surrounded by noises that we can usually tune out most of it. For a researcher like Asha Hall, sound waves are a useful tool that can be shaped and focused to do some pretty amazing things.

Hall is a materials researcher at an U.S. Army Research Laboratory who conducts research to improve the structure and function of vehicles that soldiers use day in and day out. This includes something that scientists and engineers call acoustic signature control – making vehicles and other equipment as quiet as possible.

According to Hall, the goal can be to reduce sounds the vehicle makes on the outside and to make it quieter inside, keeping the occupants from becoming distracted and fatigued by noise. Hall and her colleagues also use sound in ways you might not have even imagined – making coatings stick to aircraft to improve their efficiency in the air.

"We can use sound energy to attach a thin film to helicopter blades and airplane wings," Hall explains. "This makes these surfaces smoother, which means they use less fuel and provide a better, safer ride to our Soldiers."

Hall and her team have all sorts of interesting uses for sound, including using it to find cracks in aircraft wings and other testing for equipment. This diversity of research topics is something Hall enjoys most about her job. "I have the freedom of having my own research topics and then finding a way to research and test what I come up with," she says. "Having an idea and being able to set up an experiment and working on the research and development of a new technology or application is probably the most exciting part of my work," she adds. "I love getting my hands dirty and being in the lab – that's the fun part of my day."

That hands-on approach to learning and exploring STEM goes back a long time for Hall. When she was a young girl, she loved to take apart things around the house, from simple kitchen appliances to the family VCR. Rather than getting upset for her deconstructive habits, her parents encouraged her to keep

exploring her curiosity about how things work.

Despite her curiosity and fascination with technology, Hall says she wasn't set on a career in STEM until she went with her father, who served in the Army, to the post where he was serving. A senior officer asked her what she wanted to do with her life, "and when I replied 'I don't know,' he yelled 'what do you mean you don't know? We need more women in science!'" Hall says that moment sealed the deal for her, and after college, she was delighted to find a position at an Army research lab, where she can help improve the equipment and conditions of our Soldiers.

I love getting my hands dirty and being in the lab – that's the fun part of my day."

passionate about our work," she says. "Getting to work with the team day in and day out is probably the most exciting part of my job." Hall describes a recent day when her colleagues created a speaker from a thin carbon nanotube just 50 nanometers wide – much more narrow than a human hair. Hall says she hooked up her iPhone to this tiny thread and it played music like a normal speaker. In addition to being a cool project, Hall says the project showed that the thermal acoustic properties of carbon nanotubes have a lot of exciting possible applications.

Hall says young people interested in pursuing careers in engineers should try and get involved in as many programs as possible, such as the AEOP's internships and competitions. "You can get interested in a lot of different topics that will help you understand what you're learning in school, and what the possibilities are" for further study, she says. She also recommends getting involved in engineering societies and seeing what programs they have for students. Above all, Hall says its crucial to mix formal learning with hands-on STEM experiences. "Get your hands dirty," she says. "Do the fun stuff as well as class." ★

While many people imagine scientists and engineers working alone in a lab, Hall says the opposite is true. "I work closely with a team of great people who are also



VIRTUALLY AMAZING

Can you make a computer figure out when somebody is lying? To read a person's 'tells' as well as any poker player and know when somebody is trying to mislead or is hiding an important piece of information? Could a suite of code you've developed know when you're sad or feeling upset and know what to do to help?

Jonathan Gratch, a researcher at the University of Southern California's Institute for Creative Technologies, has devoted his career to learning how to do just that. He can now program computer-based virtual humans to read, interpret and interact with real humans' emotions.

The virtual humans Gratch and his colleagues have created are computer-generated characters that couple cameras, microphones and other sensors with sophisticated algorithms and other computational tools to interpret what you're saying and what it is you might be really trying to say.

When you interact with a virtual human, you see a very realistic looking, computer-generated image of a person that can communicate not just by speaking, but also by using its face and body to convey the subtle non-verbal signs we real human beings use to communicate. The virtual human can notice your eyebrows knitted in pain and see that your shoulders are hunched while you sit with your body slightly turned away from the screen. After analyzing what you're saying and your tone of voice while you say it, the virtual human can deduce if you're upset

and ask you, in a concerned way, if everything is alright or if something is bothering you.

In addition to being a cool sim project, the ICT virtual human project has some very important real-world applications. The Army has funded Gratch and ICT team to create realistic training and education environments for soldiers about to deploy to foreign cultures. It is also testing virtual humans to work with soldiers and other veterans returning from stressful deployments to check up on their mental and emotional well-being. Gratch, taking a break from his work to talk to IT STARTS HERE, says that research has shown many people actually feel more comfortable opening up to virtual human about the problems and stresses they face in life.

As a teenager, Gratch did not always know he wanted to create virtual humans, but he did know what he did not want for a career. "My dad was a developmental psychologist," he says. "I knew I didn't want to do that."

So like a lot of STEM-inclined students, Gratch headed off to college with every intention of becoming a medical

doctor—until he took a computer science course. That, he says, is when he understood the potential of computing to create things not possible in real life. Shunning medical school, he pursued graduate studies in computer science with a focus on artificial intelligence. He decided to take some psychology courses to better understand how people think, and realized the power of human emotion in our behavior and everyday lives. Soon he began to focus his research in getting computers to be able to interpret and understand human emotion and to train a computer program to present emotions in a realistic and believable way to real human beings. It became clear to him, he says, that working to build virtual humans can further social science research about real people.

Gratch says he finds his work to be a fun challenge. "A lot of what I do," he says, "is solve puzzles." He encourages young people to explore what puzzles them about the world, whatever field or area of STEM it takes them to. "Don't narrow your horizons," he says. "You won't know how they everything fits together now, but they might be relevant tomorrow." ★



“Don't narrow your horizons... you won't know how everything fits together now, but they might be relevant tomorrow.”

QUICK TAKES

ELLIE COVINGTON

U.S. Army Corps of Engineers
Savannah District

Education:
B.S. in Marine Science

What Do You Do? I work as a field biologist for Savannah District of U.S. Army Corps of Engineers. The Corps dredges Savannah harbor so ships can pass through it safely, and then uses the rocks and dirt that get dredged up to create shore islands. These shore islands are off-limits to people and are designed to provide habitat for shore birds. I study how these shore birds, especially ones that are threatened or endangered, adapt to these new islands we've made.

What Inspired You to Do This?

As a child, I was always in love with animals and nature. And I always knew I wanted to do something with the ocean, so I studied biology in college.

What Do You Love About Your Work?

A few times a year, we get to go out to these islands where humans otherwise aren't allowed. When you see all the birds nesting and being there, you can just hear all their energy and see all the birds. It's energizing and unique – there's nothing else like it.

What's the Coolest Thing You've Seen This Year?

My trip to a bird island we created called 12A. It's 8 acres, much bigger than usual. I really didn't know how well it would work as nesting habitat, if the birds would take to it and survive there. We found over 300 nesting pairs of black skin rows, 400 of their fledglings, 200 pairs of leaf terns. It was clear that 'if you build it, they will come,' but we didn't know that until we saw it. We also discovered that feral pigs and coyotes swim out to the islands. That's a danger to the birds, but then the alligators who are also making a home there are 'discouraging' those invaders from making the trip.

“Get out there in the community and see what interests you.”

Any advice? I'm a big believer in volunteer work as a way to get experience and see what interests you. I joke that I'm a professional volunteer – I get to do work I'd be willing to volunteer for.

CAITLIN RIVERS

Epidemiology
U.S. Army Medical Command
U.S. Army Public Health Center

Education:
Ph.D. student in
Computational Epidemiology
**DOD SMART Scholarship
Recipient**

What Do You Do? I am a graduate student studying and researching computational epidemiology. I am working on a lot of different projects involving the Ebola outbreak. I work with part of a team modeling the outbreak to help the Department of Defense plan their response. I also use data about the people who are sick to learn more about how to stop the disease from transmitting.

What Inspired You to Do This? I can't remember how or exactly when I decided to be an epidemiologist, but when I was a sophomore in college I read Mountains Beyond Mountains, which is about public health and epidemiology. That really cemented it for me.

What Do You Love About Your Work?

Because I work in outbreak response, the work I do is always exciting. Outbreaks are emergencies, so I think of my job a bit like firemen responding to a fire. Except my emergencies are much longer [they last months!], and I respond mostly doing math at a computer. Okay maybe it's not like being a fireman at all...but it's still saving lives and a complex and fun challenge.

What's the Coolest Thing You've Seen This Year?

The diseases I work with are called emerging infectious diseases, which means they are fairly rare in humans. So almost everything I see in my work is previously unknown, and it all blows my mind! A recent example is the forecasts we generate to predict the number of new Ebola cases that are coming. We do a good job with those forecasts, so it's really interesting, but also very sad, to see our predictions come true.

Any Advice? I hated taking math and statistics classes, even though it's absolutely crucial to my job. My advice to people who want to pursue something similar is to not let that deter you. Just because you don't like calculus class doesn't mean you aren't cut out for epidemiology. Just hang in there, because it's so worth it when you get to the good stuff.

ANDRES BUJANDA

Materials Engineering
U.S. Army Research Development
and Engineering Command
U.S. Army Research Laboratory

Education: Ph.D. in Chemistry

What Do You Do? I am an engineer and the head of the plasma group at an Army research lab. Plasma is a way to alter surfaces, and we research and test ways to use plasma to improve the things our soldiers depend on, including body armor.

What Inspired You to Do This?

Both my parents were math and science teachers, and they helped me appreciate the problem-solving aspects of science and math. You realize it's not just about finding the answers to a problem, but designing systems to solve it. I think that's the difference between being a scientist and being an engineer – engineers find real-world answers.

What Do You Love About Your Work? I get to do things and run experiments that no one has gotten to do before. No one else is looking at the same problems we are. We get to blaze new trails, and do true research, where you don't know what's going to happen. No day is like the one before and I like that. I like problem solving, and the best part of my day is when I'm confused, and I have to go find the answers and the solutions.

“You realize it's not just about finding the answers to a problem, but designing systems to solve it.”

What's the Coolest Thing You've Seen This Year?

Non-combustable tracer technology. When our soldiers are in combat, many times they use tracer rounds to see where their other rounds are going. But existing rounds are flares, and they can cause fires and their path is usually different from other rounds because they burn up. This new technology is a new application of different materials, and it brings up all kinds of challenges.

Any Advice? Take advantage of any opportunity that presents itself, like internships and other possibilities. Get involved in things outside of school, during the summer, even during the year.

LISA SKANDALIS

Forensic Biology
U.S. Army Criminal Investigation Command
U.S. Army Criminal Investigation Laboratory
at the Defense Forensic Science Center

Education:
M.S. in Forensic Genetics
AEOP Experience: CQL
**DOD SMART Scholarship
Recipient**

What Do You Do? I just started training as a forensic biologist/DNA analyst for the US Army Criminal Investigation Laboratory. I will screen evidence that comes to the lab for the presence of biological material, and conduct DNA testing on items of evidence when an investigation requires that information.

What Inspired You to Do This? Starting in elementary school I knew I loved science. When I was in middle school I began to about forensic science and it piqued my interest enough to choose that topic for an end of the year project in one of my classes. I soon realized that this field am amazing way to put my love of science to a necessary and practical use, and that goal is what helped drive me all throughout my education.

“I knew I needed to go for the right education program for me, and that's what I did.”

What Do You Love About Your Work?

This job will allow me to use something I love to help others, and there is no greater feeling in the world than that.

What's the Coolest Thing You've Ever Seen?

As I'm still a rookie in the field I know that I have many years of interesting stories ahead of me. But for right now that title would have to go to a research project I conducted during my summer internship back in 2012. I was able to detect full DNA profiles off of mock explosive devices that were merely handled and detonated underwater.

Any Advice? The most important thing I've learned is that there are sometimes when you truly have to put yourself first. Once I graduated undergrad I had 3 options for grad schools I could attend, and the easiest choice would have been to go to the school closer to where my fiancé is in med school, but that wasn't the best choice for me. I knew I needed to go for the right education program for me, and that's what I did.

LTC KATE HINKLE

Infectious Disease Medicine
U.S. Army Medical Research
and Materiel Command
Walter Reed Army Institute
of Research

Education: M.D.

What Do You Do? I am an infectious diseases [ID] physician in the U.S. Army. I have cared for U.S. service members and their families stationed overseas, including many trauma patients injured in the wars in Iraq and Afghanistan. I am now stationed at the Walter Reed Army Institute of Research in Silver Spring, MD, where I am the deputy director for the Multidrug resistant organism Repository and Surveillance Network, a group of doctors, scientists and database developers who are collecting and studying samples of bacteria from all over the world that are resistant to multiple antibiotics.

What Inspired You to Do This? Since I was in middle school, I have been interested in how the human body becomes infected with various organisms, how our bodies handle these infections, and what treatments are available to fight these infections. I always thought that I would like to help other people, but it was only after I entered medical school and began interacting with sick patients that I realized how much I really enjoyed that type of interaction, and knew that this job was what I was meant to do.

What Do You Love About Your Work?

My patients. I have met some of the most amazing and interesting people sitting in my office. Not only have I learned much about medicine through their illnesses, but I have learned so much about human nature and the endurance of the human spirit. I also love being a teacher, both to the medical students and residents and to my patients. Patients become energized and more involved in their own care after someone has taken the time to teach and empower them about their condition.

What's the Coolest Thing You've Ever Seen?

It's probably what you expect me to say, but seeing patients critically ill or injured in the hospital, fighting infections, and then care for them for weeks to months afterwards while they heal never gets old to me. It always helps me keep things in perspective. When things get stressful in my own life, inevitably my problems seem trivial compared to what some of my patients have gone through.

Any Advice? If you are passionate about something, keep pursuing that dream no matter what. But also keep your mind open to the possibility that the path to that dream may not be a straight one and that diversions along the way may actually be better for you in the long run. I ended up working in basic science research for about 3 years after college before getting accepted to medical school. Looking back now, that was the best thing for me because I was so much more mature, prepared and focused on my goals in life than I had been when I left college.

RASHA HAMMAMIEH

Molecular Biology
U.S. Army Medical Research and Materiel Command
U.S. Army Center for Environmental Health Research

Education: Ph.D. in Chemistry
AEOP Experience: CQL

What Do You Do? I'm the Director of the Integrative Systems Biology Program at the US Army Medical Research and Materiel Command. We apply integrative biology approaches to understand the causes of military-relevant health issues including PTSD, coagulopathy, infectious diseases and pain. These approaches can combine animal and human studies, computational simulations, and other methods. We use state-of-the-art approaches to ultimately enable the diagnosis, prediction, therapeutic interventions of illnesses of high relevance to the military.

“I am blessed to be able to get involved in these efforts that could one day help patients.”

What Inspired You to Do This?

I am very fascinated by the human body and living cells, especially the brain. I always try to understand the biology of living cells and understand how we respond to stressors, such as infection, trauma, psychological stress and microgravity.

What Do You Love About Your Work?

I love the excitement when we characterize a mechanism of a disease and identify diagnostic biomarkers and therapeutic intervention strategies. I am blessed to be able to get involved in these efforts that could one day help patients.

What's the Coolest Thing You've Ever Seen?

The launch of Space Shuttle Atlantis [STS-135]. We had an experiment onboard and I had a chance to watch the shuttle take off.

Any Advice? Never stop dreaming and aiming very high, beyond your limits. Always ask and be curious. There is no limit to what you can do.

Are you ready to

START HERE?

A great place to start pursuing your STEM career is through the portfolio of free programs that the Army Educational Outreach Program (AEOP) offers students and teachers from Kindergarten through College.

AEOP's STEM opportunities are designed to effectively engage future workforce generations in meaningful, real-world STEM experiences, competitions and paid apprenticeships and to provide exposure to Army and Department of Defense (DoD) STEM careers.

Did you know that the U.S. Army, DoD and our Nation have a large demand for talented STEM professionals like yourself? Did you know that Soldiers and Civilians across the U.S. Army and DoD work alongside each other in a wide array of different STEM professions to protect our Nation and those who serve our Nation so proudly?

Here are some resources that can help you get started in learning more about STEM programs and careers with the U.S. Army and DoD!

Learn more about AEOP's STEM opportunities: www.usaeop.com



Check out additional DoD, U.S. Navy and Air Force STEM programs:

The Science, Mathematics And Research for Transformation (SMART) Scholarship:
www.smart.asee.org/

The Air Force Civilian Service:
www.afciviliancareers.com/

Naval STEM:
www.navalstem.navylive.dodlive.mil/

Explore the careers and work that U.S. Army commands offer talented STEM professionals:

The U.S. Army Research, Development and Engineering Command:
www.army.mil/info/organization/unitsandcommands/commandstructure/rdecom/

The U.S. Army Medical Research and Materiel Command:
www.mrmc.amedd.army.mil/

The U.S. Army Corps of Engineers:
<http://www.usace.army.mil/>

Find more information about Army and DoD STEM opportunities:

Army STEM: Careers & Jobs:
www.goarmy.com/careers-and-jobs/about-army-stem.html

Army Technology Magazines:
www.issuu.com/rdecom

United States Military Academy West Point:
www.usma.edu/cldstem/SitePages/Home.aspx

