

AFRL FIGHT'S ON!

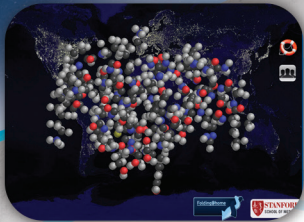
THE AIR FORCE RESEARCH LABORATORY

VOLUME 39
SUMMER 2020

FOLDING@HOME

Supercomputer is Helping Combat Disease

Participating users from
around the world



Washington University
St. Louis School of Medicine



NITE Enterprise
stateless super compute cluster

Graphic by Mr. Will Graver

In an effort to help scientists combat the Coronavirus Disease-19 (COVID-19) and other diseases, Dr. Leah Rowe, Program Manager, and members of her Extramural Operational Research & Development Team are participating in a distributed computing project called Folding@home (F@h). The F@h project is using donated computing power to solve complex problems by breaking them down for multiple computers to work in parallel to process extremely large amounts of data. The combined computing power of volunteers who run simulations on their computers is helping scientists better understand how the human body's proteins fold and how that process is related to diseases.

The proteins in the human body are long-chain molecules of amino acids that are responsible for the structure, function and regulation of the body's tissues and organs. They perform a wide array of functions, such as enzymes and antibodies. In order to perform these functions, the protein molecules must conform to a "native 3-dimensional structure" or a shape called a "fold." Scientists theorize that diseases such as Cystic Fibrosis, Alzheimer's disease and cancers result when proteins fold incorrectly. Scientists are also investigating how virus protein functions (i.e., viral reproduction and human immune system suppression) affect human diseases like COVID-19.

James "JT" Taylor, LVC (live-virtual-constructive) Team Lead, is spearheading the Extramural team's participation in F@h. After receiving the endorsements of the Airman Systems Directorate Director, the 711th Human Performance Chief Scientist, the

National Institute of Health and the Department of Defense, the team initially reconfigured 46 of their computers to contribute to the supercomputer. Currently, the team has approximately 100 computers and servers configured to participate in the project. Collectively, the 100 high-performance systems supply 1,157.4 (1 trillion) floating point operations per second (TFLOPS) of computing power to the F@h project. Processing power of this magnitude places the combined computing power of the team in the top 500 supercomputers in the world. At present, the team has the 118th fastest super computer in the nation.

When the team assembled the computer cluster, JT ran LINPACK software to identify where the team ranked on the top 500 supercomputers list. As of the writing of this article, the team has the 485th fastest supercomputer in the world. The team's contribution to the F@h project is also substantial. The team is currently ranked 191 of 25,000+ teams, with more than 2 billion credits and 39,000+ work units completed. Based on their average contribution, the team is currently the 70th most productive team across the entire project, including teams from big data industry leaders like Intel®, IBM and Google.

For those who would like to contribute to the effort by using their home computer, go to: foldingathome.org/start-folding/ and join team 259877, or contact JT at: james.taylor.100.ctr@us.af.mil. ★

Mr. James Taylor, LVC Team Lead

Ms. Suzette Westhoff, Senior Technical Writer-Editor

SUMMER SCIENTISTS

This summer, scientists from the Warfighter Interactions and Readiness Division are mentoring interns from three different internship programs. In addition, summer faculty and staff are collaborating with students and educators. Together, they are delving into research and working on solving actual problems that focus on improving warfighter readiness and performance. Due to the ongoing COVID-19 pandemic, the internships are virtual. The articles featured here provide an overview of these programs.

Articles by: Dr. Leslie Blaha, Dr. Kevin Gluck, Dr. Megan Morris, Dr. Christopher Stevens, The GRILL Team and Ms. Suzette Westhoff

REPPERGER RESEARCH INTERNS

Starting 1 June through 7 August, undergraduate and graduate students pursuing degrees in science, technology, engineering or mathematics (STEM) are gaining real-world experience by virtually participating in the Repperger Research Intern Program. This program commemorates Dr. Daniel W. Repperger, who was an exceptionally active student mentor during his 35 years at the Air Force Research Laboratory.

The 10-week educational internship experience provides students the opportunity to work on an Air Force research project under the mentorship of Air Force scientists. These scientists are specifically selected for their subject matter expertise, experience and willingness to enhance the students' learning. The Oak Ridge Institute for Science and Education administers the research appointments.

This summer, four of the division's scientists—Dr. Leslie Blaha, Dr. Kevin Gluck, Dr. Megan Morris and Dr. Christopher Stevens—are mentoring students. The table below highlights their projects and the students who are participating in the program. ★

REPPERGER HIGHLIGHTS

Projects and Students in the Program

Scientist	Intern	Academic Institution	Project Name	Research Goal
Dr. Leslie Blaha	Ms. Kathleen "Angie" Willoughby	Colorado State University	Science of Understanding	"...to explore the definitions of understanding ... and to develop the critical tests and metrics for assessing that we have achieved capabilities for mutual understanding." ¹
Dr. Kevin Gluck	Mr. Tyler Whitlock	Wright State University	Interactive Task Learning	"...to make progress on a vision of the future in which humans, robots and agents are able to rapidly learn and teach each other entirely new tasks through natural interaction." ¹
Dr. Megan Morris	Ms. Elizabeth Pettit	Miami University	Individualizing Cognitive Models	"...to incorporate individual differences into models of vigilance, fatigue, or workload." ¹
Dr. Christopher Stevens	Mr. Jackson Pelzner	University of Nevada, Las Vegas	Cognitive Metrics Profiling	"...to better understand the causes and consequences of cognitive load in complex task environments." ¹

¹Excerpts from each of the Repperger Research Intern Program project synopsis.

SUMMER AT THE GRILL 2020

The Gaming Research Integration for Learning Laboratory® (GRILL®) started its summer STEM (science, technology, engineering, mathematics) program on 15 June 2020. Due to the COVID-19 pandemic, the program is being reduced to 6 weeks and includes safely distanced face-to-face and virtual teams. The GRILL is hosting 13 Wright Scholars, four Legacy students, 10 teachers and the following faculty researchers: Dr. Denny Yu (Purdue University), Dr. Mike Coovert and Dr. Kelsey Merlo (University of South Florida), Dr. Chang-Geun (Kent State University) and Dr. Summer Rebensky (Florida Institute of Technology). An Education intern, a STEM outreach coordinator and several mentors support the program. Together, these participants are working on community-driven challenge problems.

This summer's challenge problems include: (1) an augmented reality maintenance trainer, (2) a virtual environment to explore laser effects on human eyes, (3) a virtual home orientation trainer for veterans with dementia, (4) an assessment with sonography in a medical trauma trainer and (5) a gaming engine to model 3D avatars. Upon completion of these projects, the students will present their work to community stakeholders. They and the teachers will also publish their work the GRILL website (www.gamingresearchintegrationforlearninglab.com). This hands-on program provides its participants opportunities to experience real-world research and gain invaluable career skills. ★

PATHWAYS INTERNSHIP PROGRAM

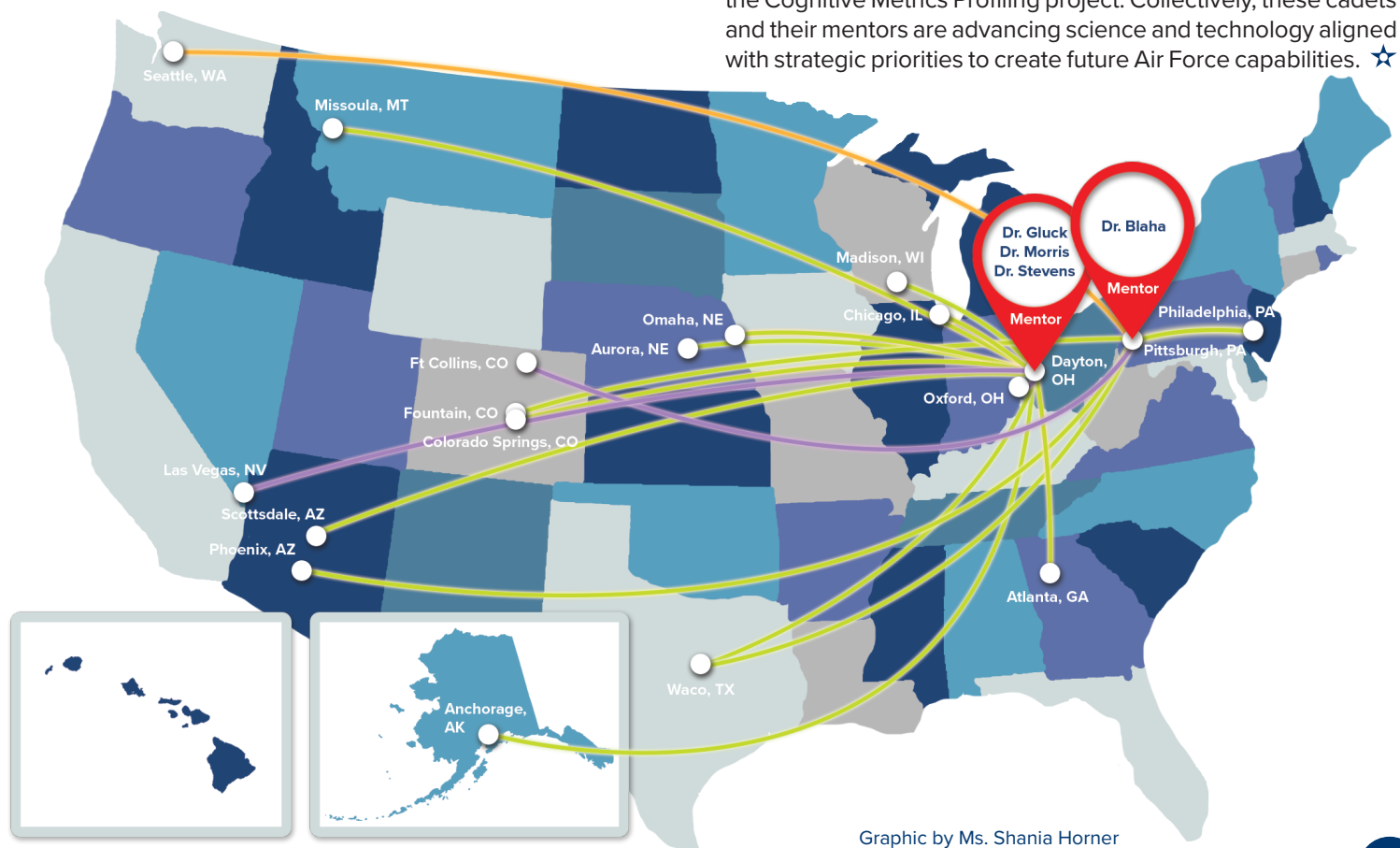
In 2010, the President signed the Recruiting and Hiring Students and Recent Graduates Executive Order, which led to the establishment of the federal Pathways Program. The Pathways Program actually encompasses a series of programs, including internships that offer talented students and recent graduates an opportunity to explore federal careers.

Thanks to the Pathways Internship Program, this summer, Dr. Leslie Blaha, Senior Research Psychologist embedded at Carnegie Mellon University, is working virtually with Ms. Zaynah Arif, a rising senior undergraduate student at the University of Washington majoring in Computer Science with a minor in Architecture. Ms. Arif is working with Dr. Blaha on the Robust and Secure Machine Learning Commander's Research and Development Fund project. She will apply her skills to developing software for computing and visualizing metrics for robust performance of image classifiers. ★

SUMMER SCIENTISTS MAP

KEY

- Interns' Locations
- Air Force Academy Cadet Summer Research Program
- Pathways Internship Program
- Repperger Research Intern Program

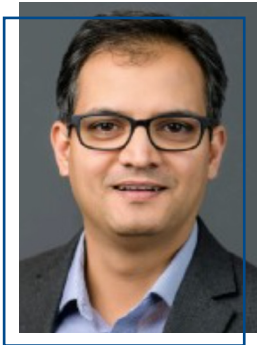


Graphic by Ms. Shania Horner

AIR FORCE ACADEMY CADET SUMMER RESEARCH PROGRAM

The Air Force Research Laboratory in collaboration with the United States Air Force Academy is providing Air Force cadets the opportunity to gain real-world experience through summer internships. The 711th Human Performance Wing facilitated the collaborative effort by enabling researchers at the Warfighter Interactions and Readiness Division to submit their project summaries to the Academy with the understanding they would serve as mentors to interested cadets.

Dr. Leslie Blaha, Dr. Kevin Gluck, Dr. Megan Morris and Dr. Christopher Stevens agreed to serve as mentors for fifteen cadets. Dr. Blaha is working with Cadets Lauren Neilsen, Minjung "MJ" Park and Armani Resto on the Science of Understanding project. Dr. Blaha and Dr. Gluck are co-mentoring Cadet Brayden Mathis, who is doubling up on literature reviews focused on interactive human-machine learning (Blaha) and on the historical evolution of the military concept of readiness (Gluck). Dr. Gluck and Cadets Jack Zocher and Tyler Whitlock are working on hardware and software requirements for the Vision, Inference and Action line of effort. In addition, Dr. Gluck has Cadets Jazmyne Garza, Helen Hitt, Maria Mettler and Braden Parks conducting literature reviews related to developing model or system comparison and competition best practices guidance for the Applied Proficiency Technologies and the Interactive Task Learning lines of effort. Dr. Morris is working with Cadets Thomas Corpuz, Madison Edwards, Lisa Oswald and Connor Settle on literature reviews that support the Individualizing Cognitive Models project. Dr. Stevens has Cadet Alec Young involved in the Cognitive Metrics Profiling project. Collectively, these cadets and their mentors are advancing science and technology aligned with strategic priorities to create future Air Force capabilities. ★



711TH HUMAN PERFORMANCE DIRECTORATE RECEIVES NEW SENIOR TECHNICAL LEADER

Dr. Gaurav Sharma became the 711th Human Performance Directorate's new Senior Technical Leader for Cognitive Neuroscience in April. In this role, Dr. Sharma serves as the primary scientific

authority for the Air Force Research Laboratory's cognitive neuroscience research. His responsibilities include advancing the Laboratory's cognitive science technologies and developing collaborative strategies that focus on identifying and fulfilling Air Force mid- and far-term autonomous systems capabilities. ★

CONGRESSMAN LEARNS ABOUT DIVISION'S INNOVATIONS IN READINESS

On 16 June 2020, the Warfighter Readiness Research Division (the Warfighter Interactions and Readiness Division as of 21 June) hosted Congressman Douglas L. Lamborn, Representative of Colorado's 5th Congressional District. The Congressman visited the facility's NITE (Networked Integrated Tactical Environment) testbed to hear about innovations in readiness. ★



AIR FORCE-NAVY COLLABORATE TO REVOLUTIONIZE RESILIENCE TRAINING FOR WARFIGHTERS

The Air Force Research Laboratory and the Navy's 21st Century Sailor Project are capitalizing on complementary research efforts to transition away from the "one-size-fits-all" approach to training and overhaul existing behavioral health (e.g., resiliency) training. This collaborative work leverages proficiency-based performance metrics developed by the Warfighter Readiness Research Division and the office of AF/A1Z and feeds these data into the Predictive Performance Optimization (PPO) cognitive technology (a patented, peer-reviewed cognitive model). This technology tracks learning dynamics over time and personalizes training schedules around individuals' learning needs. Because the Navy invested in developing the Personal Assistant for Lifelong Learning (PAL3—a virtual training platform), Air Force and Navy researchers seek to combine forces to augment PAL3 with PPO modeling capabilities to advance the personalization and enhancement of readiness and resiliency training. ★

RECOGNITIONS

2020 SECOND QUARTER AWARDS

RHA

Company Grade Officer:
Lt Chao Pan

Field Grade Officer:
Maj Miguel Valle

Civilian Category II:
Ms. Kaylee Eakins

Civilian Category III:
Dr. Christopher Myers



Published quarterly since 2001, Fight's ON! continues to serve as the Division publication for our partners and features innovative science and technology that is accelerating and revolutionizing readiness.

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711TH HPW/RHW

The first day of our new integrated Warfighter Interactions and Readiness Division (RHW) is 21 June 2020. Welcome to Dr. Louise Carter, Division Chief, and all new colleagues from the former Warfighter Interface Division!

Hails

LtCol Tamera Borchardt • Mr. Patrick Dull • Dr. Jayde King
Dr. Colin Kupitz • Maj Thomas Payne • Ms. Kiersten Rowland
LtCol Jesse Somann • Mr. Brett Wiseman

Farewells

LtCol James Bowers • Ms. Cayley Dymond • Mr. John Foster
Mr. Garrett Goodin • Dr. Katherine Gulpin • Mr. Tim O'Neil
Col Danny Slifer • Ms. Suzette Westhoff • Mr. Josh Ziegler

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• Collaborative Interfaces and Teaming (RHWC)
• Continuous Learning (RHWL)
• Cognitive Models (RHWM)
• Sensory Systems (RHWS)