Air Force Research Laboratory

711th Human Performance Wing

Wright-Patterson Air Force Base, Dayton, OH
Fort Sam Houston, San Antonio, TX

Office of the Chief Scientist

As the Chief Scientist for all of the U.S. Air Force's human-centered research at the Air Force Research Laboratory, I invite you submit an application to participate in our Dr. Daniel Repperger Research Intern Program . This program posthumously honors Dr. Repperger, who mentored many young people during his 35 year research career with our organization, by providing research opportunities for students to work in one of our facilities under the mentorship of an Air Force scientist. Each of these scientists has been hand-selected to mentor because of their technical knowledge, experience and willingness to help science and engineering students enhance their learning experience through participation in an actual Air Force research project.

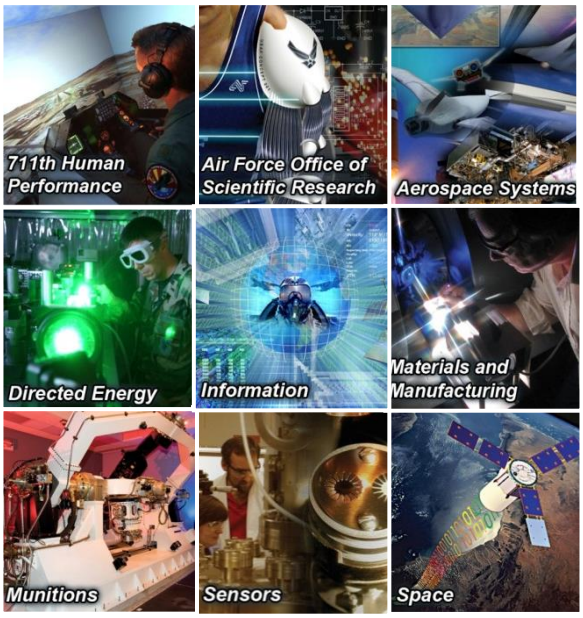
Please review the information and application instructions on page 4 of this brochure to determine your eligibility and then review the research projects on pages 5-31 to see if any match your research interest. If selected for one of the projects, you will have temporary summer employment through our contract with the Oak Ridge Institute for Science and Education (ORISE) to participate in this 10-week research internship at one of our two research locations; Dayton, Ohio or San Antonio, Texas. Along with gaining first-hand research experience, you'll learn the inner workings of an operational laboratory and develop contacts and friendships that will last a lifetime. Again, please review the information in this brochure carefully to understand the specifics of the program before you apply. I look forward to reviewing your application and wish you the best of luck in the selection process.

JAMES L. OVERHOLT, PhD, ST
Acting Chief Scientist
711th Human Performance Wing

WHO WE ARE

Air Force Research Laboratory

AFRL leads the discovery, development and integration of affordable warfighting technologies for America's air, space and cyberspace forces. We are a full-spectrum laboratory, responsible for planning and executing the Air Force's science and technology program. AFRL leads a worldwide government, industry and academic partnership in the discovery, development and delivery of a wide range of revolutionary technologies. The laboratory provides leading edge warfighting capabilities keeping our air, space and cyberspace forces the world's best. Operating from over 40 sites worldwide, AFRL focuses on technologies for air vehicles, human performance, materials and manufacturing, sensors, propulsion, space vehicles, directed energy, information and weapons. The lab employs approximately 5,800 government people (1,400 military and 4,400 civilian personnel). It is responsible for the Air Force's science and technology program of $2.1 billion including basic research, applied research, advanced technology development, and an additional $2.3 billion in externally funded research and development." **AFRL Research Areas**



711th Human Performance Wing

The 711th Human Performance Wing advances human performance in air, space, and cyberspace through research, education, and consultation, accomplished through the synergies created by the wing's three distinct but complementary entities:

The **U. S. Air Force School of Aerospace Medicine (USAFSAM)** is an internationally renowned center for aerospace medical learning, consultation, aerospace medical investigations and aircrew health assessments. The school trains approximately 5,000 students each year. It also performs research on technologies for the rapid detection of chemical, biological and radiological events, hyperbaric medical research and light, durable intensive care capabilities. USAFSAM also has the Nation's only Radiological Assessment Teams available for 24/7 deployment.

The **Human Performance Integration Directorate (711 HPW/HP)** focuses on human performance optimization and sustainment through human systems integration (HSI)**.** The directorate is the bridge among the acquisition communities and lead integration agent for the promotion, guidance, consultation, and implementation of human systems integration. It also provides HSI consulting services and technical advisory support to capability requirements developers, program managers, and engineers throughout the Air Force.

The **Human Effectiveness Directorate (711 HPW/RH)** leads the U.S. Air Force's human-centered research, discovering biological and cognitive technologies to optimize and protect the Airman's capabilities to fly, fight, and win in air, space, and cyberspace. The Directorate provides a strong in-house research program and extensive research partnerships with industry and academia. Its research team is composed of the most diverse range of technical disciplines in the Air Force to explore the human from the bio-molecular level to the societal behavior level. The Directorate focuses its research in four Core Technical Competencies: Training, Decision Making, Bioeffects and Human-centered Intelligence, Surveillance and Reconnaissance.

AIR FORCE RESEARCH LABORATORY
711TH HUMAN PERFORMANCE WING

REPPERGER RESEARCH INTERN PROGRAM

Dr. Daniel W. Repperger
1942-2010

The Repperger Research Intern Program honors the life and works of Dr. Daniel W. Repperger (1942-2010) a scientist and mentor to many young engineers and scientists. As a researcher in the Air Force Research Laboratory's Human Effectiveness Directorate for 35 years, Dr. Repperger's mathematical and scientific innovations have revolutionized image and network complexity analysis. He received international recognition in haptic controllers, human-machine interface performance enhancement, and mathematical methods development. While Dr. Repperger's significant research accomplishments helped advanced the performance of Air Force airmen and the field of human-centered research, his most significant accomplishment may well be the impact he had as a kind and caring mentor of many young Air Force scientists and science and engineering students.

Dr. Repperger received a BS and MS in Electrical Engineering from Rensselaer Polytechnic Institute and a PhD in Electrical Engineering from Purdue University. He was a David Ross Research Fellow at Purdue from 1971-1973 and a National Research Council Post-Doctoral Fellow at Wright-Patterson AFB from 1973-1975. A member of Eta Kappa Nu, Tau Beta Pi and Sigma Xi, Dr. Repperger was a Registered Professional Engineer in Ohio and on the Board of Trustees of the Ohio Academy of Sciences. He was a Fellow of the IEEE, Air Force Research Laboratory, American Institute of Medical and Biological Engineering, the Ohio Academy of Science and the Aerospace Medical Association. Dr. Repperger authored over 400 technical journal articles, reports and conference publications, was selected as Associate Editor of five international journals and obtained 14 U.S. patents and 28 Air Force invention registrations. His honors and awards include the Harry G. Armstrong Scientific Excellence Award, Human Effectiveness Directorate Mentor of the Year, IEEE Third Millennium Medal Winner and the IEEE Dayton Fritz Russ Award. Dr. Repperger is listed in the Who's Who in Science and Engineering and the American Men and Women of Science.

REPPERGER RESEARCH INTERN PROGRAM
INFORMATION AND APPLICATION INSTRUCTIONS

Program Dates:	June 1 – August 7, 2015 (arrive May 31 – depart August 8)
Program Hours:	40 hours per week Monday-Friday (actual hours set by mentor)
Stipend:	$12,000 for 10-week period
Lodging:	Student's expense - Click on items below for lodging options: • **Wright State University Summer Housing** • **Apartment Finder** • **Local Hotel Search**
Research Locations:	Wright-Patterson AFB, Dayton, OH or Ft Sam Houston, San Antonio, TX
Number Positions:	Up to 10 students will be selected for participation
Requirement:	• Graduate students and undergraduate juniors and seniors. • Must be a U.S. citizen
Final Report:	PowerPoint presentation or poster at end of internship
Application Deadline:	February 27, 2015 at 5:00 p.m. EST
Application:	1. Application form 2. Curriculum Vitae 3. Copy of Transcript (unofficial is okay) 4. Copy of proof of U.S. citizenship 5. Letter of recommendation from current faculty adviser
Proof of U.S Citizenship (submit 1 of the items shown on list with application)	• **Copy** of U.S. Passport • **Copy** of Certified birth certificate issued by the city, county or state of birth • **Copy of** Consular Report of Birth (of U.S. citizen) Abroad or Certification of Birth • **Copy** of Naturalization Certificate • **Copy** of Certificate of Citizenship
Application Submission Instructions	Send: (1) application form (save as your last name), (2) Curriculum Vitae, (3) copy of transcript, (4) copy of proof of U.S. citizenship, and (5) signed letter of recommendation from adviser by email to: 711th HPW Chief Scientist's Office at **711.hpw.chiefscientist@us.af.mil**. NOTE: Be sure to indicate on the application the project for which you are applying. If more than one, please indicate your priority by entering the research project number in the appropriate choice box.
Computer Access	Students selected will be required to undergo a National Agency Check prior to being granted access to government computer systems.
Notification:	Students selected for the program will receive a fellowship with the Oak Ridge Institute for Science and Education (ORISE) to perform intern duties in the 711th Human Performance Wing.
For More Info:	Mike Reynolds, 937-255-7629, **mike.reynolds.ctr@us.af.mil**

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Repperger Research Intern Program

RESEARCH PROJECT #: 15-01

COMPUTATIONAL MODELS OF HUMAN INFORMATION PROCESSING

PROJECT SYNOPSIS: This research focuses on basic cognitive science research to improve our understanding of human information processing, behavior, and performance. The long-term goal is to develop psychologically valid models of human cognition that can be used in a variety of ways to improve the effectiveness and efficiency of training (e.g., as synthetic teammates or instructors to support training, or as training analysis tools). We are pursuing this long-term objective through the use of computational cognitive modeling, focused on changes in cognitive performance resulting from sleep loss and extended time on task. We utilize a variety of research methodologies, including empirical research studies with human participants, cognitive model development using multiple modeling formalisms, validation of model performance through careful comparison to empirical human data, and development of quantitative theoretical mechanisms to account for important psychological phenomena. We seek interns who can contribute to the development of formal, quantitative accounts of human performance in the context of fatigue and/or other areas of research within the Cognitive Models and Agents Branch. Some relevant publications can be found at:
http://palm.mindmodeling.org/~glennng/ for research on fatigue;
http://palm.mindmodeling.org/palmListings/ for a complete listing of research being pursued by the Cognitive Models and Agents Branch at AFRL.

STUDENT LEVEL/DISCIPLINE NEEDED:
PhD or Master's/ Cognitive Science, Mathematics or Computer Science

RESEARCH LOCATION: Cognitive Models and Agents Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Glenn F. Gunzelmann, PhD

DEGREE: Cognitive Psychology, Carnegie Mellon University, 2003

Dr. Gunzelmann is a Senior Research Psychologist and the Science and Technology Advisor for the Air Force Research Laboratory's Cognitive Models and Agents Branch. The branch pursues basic and applied research to (1) understand the foundational information processing mechanisms of human cognition, and (2) develop technologies and formalisms that allow those mechanisms to be leveraged in understanding human cognition and performance in complex, dynamic tasks. Dr. Gunzelmann currently leads research efforts focused on developing a computational theory to account for the effects of sleep loss and time on task on cognitive functioning.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-02

ASSESSMENT OF LEARNING THROUGH ENGAGEMENT AND COLLABORATION FOR PEDOGOGICAL EFFECTIVENESS AND READINESS ENHANCEMENT

PROJECT SYNOPSIS: As the military moves to more distributed collaborative day-to-day operations, the current generation of collaboration tools to support learning design, delivery and assessment has not kept pace. Moreover, there has been limited leveraging of advances in commercial-off-the-shelf technology and tools to support this distributed migration. This research topic focuses on examining, evaluating, and recommending alternative tools and technologies to support collaborative learning and assessment in team-based environments such as close air support missions for the warfighter. There are three major objectives for this research topic. The emphasis on one or another of these objectives is negotiable. First, identify and elaborate current and potential future conditions and drivers such as task engagement, workload, or feedback, for distributed collaboration and learning, and the mission areas and decision processes most directly impacted. This also includes identifying and measuring the most relevant learning outcomes. Second, evaluate most recently developed government-off-the-shelf and commercial-off-the-shelf tools and technologies that are currently available to the lab and can be integrated with learning and assessment processes that have been identified. Third, design evaluation studies to be conducted both at the Wright-Patterson AFB team research testbeds and potentially in our Gaming Research Integration for Learning Laboratory at Tec^Edge to create baselines and enhance processes and outcomes that result from the integration of new technologies and methods. Experimentally evaluated recommendations would then be provided to relevant communities of interest.

STUDENT LEVEL / DISCIPLINE NEEDED:
PhD or Master's/Psychology, Computer Science or Operations Research

RESEARCH LOCATION: Continuous Learning Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Winston "Wink" Bennett, Jr., PhD

DEGREE: Industrial Organizational Psychology, Texas A&M University, 1995

Dr. Winston "Wink" Bennett, Jr. is a Principal Research Psychologist and Technical Advisor for the Warfighter Readiness Research Division. He is a Fellow of the Air Force Research Laboratory and is also a Fellow of the American Psychological Association. His team is actively involved in research related to performance evaluation, personnel assessment, training requirements identification, and quantifying the impact of organizational interventions - such as interactive, high fidelity immersive simulation environments and job redesign/restructuring and training systems impacts on individual, team, and organizational learning and effectiveness. He has published over 90 research articles, textbooks, chapters, and technical reports.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-03

DEVELOPMENT OF REAL-TIME, PERFORMANCE-DRIVEN ADAPTIVE TRAINING

PROJECT SYNOPSIS: This research topic will focus on developing mathematical models to enable real-time adaptive training based on real-time performance and physiological measurement for individuals and teams performing intelligence analysis tasks for Air Force mission areas. This includes researching existing approaches, identifying shortfalls, and recommending new methodologies for integration of performance and physiological measures to understand the current level of competency, engagement, and workload to adapt training for individual analysts and analyst teams. A three phase effort is envisioned. First, perform a survey of current methods for integration of performance and physiological measurement to build smarter adaptive training. This will be accomplished by reviewing the foundational literature, as well as recent applied research (e.g., the recent Mission Essential Competency studies with analyst teams). Second, develop potential concepts based on lessons learned from the survey of current methods and best practices. Third, design assessments to be conducted at the Wright-Patterson AFB team research testbeds in Dayton, Ohio, to identify measures to assess training outcomes and readiness to determine which factors should be adjusted within the scenario to automatically adapt the scenario in real-time. Experimentally evaluated recommendations would then be provided to relevant communities of interest.

STUDENT LEVEL / DISCIPLINE NEEDED:
PhD/ Computer Science, Mathematics or Cognitive Science

RESEARCH LOCATION: Continuous Learning Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Lisa Marie Tripp, PhD

DEGREE: Experimental Psychology, Washington State University, 2011

Lisa Tripp is a Research Psychologist at the Air Force Research Laboratory's Warfighter Readiness Research Division where she performs training and readiness research to improve human effectiveness for Air Force Members assigned to work in the Intelligence, Surveillance, and Reconnaissance (ISR) domain.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-04

TEV&V TECHNIQUES FOR AUTONOMOUS AGENTS

PROJECT SYNOPSIS: In recent years, the Air Force has emphasized the need for increased use of autonomous systems. Numerous obstacles remain before such systems can be deployed. Autonomous systems are fundamentally complex, with large and non-deterministic decision spaces that are difficult to correctly design and implement. This also makes them difficult to analyze and test for factors such as safety, resulting in significant barriers to system certification. To address these problems in a cognitive modeling scope, this effort will seek to expand and apply TEV&V techniques to human-inspired autonomous agents being developed by AFRL. The intern will research and develop a model-to-model translation capability that will convert agents expressed in formal behavior models into temporal logic or colored petri nets. Behavior models translated into temporal logic will be analyzable using the Temporal Logic of Actions (TLA+) Toolbox. Behavior models translated into colored petri nets will be analyzable using CPNTools. The model-to-model translation capability will be developed in the Generic Modeling Environment GME) meta-modeling framework. Participation in this project will allow intern to: (1) acquire meta-modeling experience; and (2) contribute to the early development of new methods for test, evaluation, verification, and validation (TEV&V) of cognitive models and agents.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelors/Psychology
PhD/Cognitive Psychology

RESEARCH LOCATION: Cognitive Models and Agents Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Scott A. Douglass, PhD

DEGREE: Cognitive Psychology, Carnegie Mellon University, 2007

Dr. Scott A. Douglass is Senior Cognitive Scientist with the 711/HPW Cognitive Models and Agents Branch (RHAC), US Air Force Research Lab, Wright-Patterson Air Force Base, Ohio. He holds a Ph.D. (2007) in cognitive psychology from Carnegie Mellon University. Working with John R. Anderson at CMU, he acquired expertise in cognitive architectures and the modeling and simulation of complex situated cognitive processes. His research interests include large-scale cognitive modeling, artificial intelligence, knowledge engineering, multi-formalism modeling, and complex event processing. He is a member of the Society for Modeling and Simulation International (SCS).

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Repperger Research Intern Program

RESEARCH PROJECT: 15-05

MODELING WORKLOAD CAPACITY

PROJECT SYNOPSIS: Workload capacity is the information processing characteristic that captures the cognitive system's ability to respond to changes in stimulus or task demands. That is, if you are given more tasks to do or more stimulus features to look at, does your processing slow down, stay the same, or even speed up? The goal of the present research is to extend response time hazard function analysis and response time random walk models (LBA, diffusion, etc.) to complex, multi-task environments comprised of complex visual tasks and changing workload demands. Additional modeling efforts seek to integrate these mathematical characterizations with computational (ACT-R, EPIC) cognitive models, to work toward real-time monitoring. These tasks may also include rare event and vigilance characteristics. Research interns are expected to engage a range of activities, such as running experiments, reviewing literature on multiple measures of workload, applying existing capacity models to response time and accuracy, and examining relationships between the model-based assessments of capacity to alternative measures of workload (e.g. questionnaires). Experience in human subjects research and in mathematical or statistical cognitive modeling, as well as programming skills in R/Matlab/Python, will be helpful.

STUDENT LEVEL / DISCIPLINE NEEDED:
Master's/ Cognitive Science, Mathematics, or Experimental Psychology
PhD/ Cognitive Science or Psychology

RESEARCH LOCATION: Battlespace Visualization Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Leslie M. Blaha, PhD

DEGREE: Psychology – Cognitive Science, Indiana University, 2011

Mathematical psychologist Dr. Leslie Blaha joined the U.S. Air Force Research Laboratory in 2010 to pursue in-house basic research in the Battlespace Visualization Branch. Her doctoral research was completed in the Mathematical Psychology Lab of Dr. James Townsend, where she developed a non-linear dynamic systems model of perceptual learning and visual perceptual expertise. Her research interests include statistical modeling of high dimensional and asymmetric data for visualization, and models of human visual decision making efficiency and expertise. Current efforts are focused on integrating mathematical and computational cognitive modeling tools for more effective modeling of workload efficiency in dynamic multitasking visualization environments.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-06

MINDMODELING: HIERARCHICAL DISTRIBUTED SEARCH ALGORITHM

PROJECT SYNOPSIS: The MindModeling@Home project (http://MindModeling.org) strives to provide a simple, efficient and reliable resource for evaluating models of cognition. By uniting heterogeneous computational resources ranging from high performance computing systems to local grids to workstations of volunteers around the globe, the MindModeling@Home system avails large-scale computational power that enables exploration of models at a deeper level and across a larger number of contexts than is typically possible using a single research workstation. Over the past four years, the MindModeling@Home system has facilitated billions of cognitive model runs, using thousands of computers located in dozens of countries. The system has contributed to a broad spectrum of research, ranging from robust decision making to understanding the underlying cognitive mechanisms of fatigue. The Repperger researcher will be working to extend the work done in the MindModeling effort in the area of parallelize search. The research will work to integrate both a local search component running in parallel on multiple heterogeneous machines with a centralized simulation scheduler found in the MindModeling system in order to produce a global search space for parameter optimization with minimal communication between distributed components.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's, Master's or PhD/Computer Science

RESEARCH LOCATION: Cognitive Models and Agents Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Jack Harris, PhD

DEGREE: Computer and Cognitive Sciences, Indiana University, 2011

Dr. Jack Harris has worked for the United States Air Force for over 12 years on various projects both on active duty and as a government civilian. As an active duty Communications officer at MacDill AFB, he garnished experience in the information technology world by working as the OIC of network security and later as the Information Systems flight commander in charge of over 100 officers and enlisted personnel. Dr. Harris later transitioned to civil service and now works as a research scientist at Wright Patterson, AFB. Dr. Harris leads large-scale computing efforts including the use of super computers and volunteer computing grids to support the better evaluation of cognitive models.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-07

ADAPTIVE COGNITIVE MODELS THAT LEARN FROM INSTRUCTION

PROJECT SYNOPSIS: Humans are often capable of strategically adapting to dynamic, non-stationary environments. In environments where we want rapid adaptation, we instruct humans how to perform the task at hand. A current limitation in computational cognitive process models is their ability to receive instruction and operate on the basis of that instruction while also adapting strategies derived from the instructions to nuanced environments. We are working toward developing models capable of learning from experience as well as operating from instruction. The goal is a model capable of doing both, simultaneously.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's, Master's or PhD/ Cognitive Science, Computer Science or Mathematics

RESEARCH LOCATION: Cognitive Models and Agents Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Christopher Myers, PhD

DEGREE: Cognitive Science, Rensselaer Polytechnic Institute, 2007

Chris Myers is a Cognitive Scientist interested in computational and mathematical models of cognitive processes to improve our understanding of human performance and learning in order to build work systems that maximize individuals' performance. My research emphasizes perceptual-motor systems, learning and forgetting, adaptive systems and strategy acquisition.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-08

ENHANCED COMMUNICATION IN AUTOMATION-RICH ENVIROMENTS

PROJECT SYNOPSIS: Tomorrow's AF will require operators to interact with many sources of automation from assistive agents like intelligent route planners and cyber security bots to fully autonomous systems like UAVs and surveillance satellites. With this increased level of automation comes an increased need for effective communication between operators and their machine teammates. The current project will focus on designing speech-based agent interfaces that take advantage of natural human-human communication strategies to facilitate increased situation awareness in automation-rich environments. Aspects of the project might include improving spoken dialog systems for multiple (semi)-autonomous agents to convey information about an agent's identity and state both explicitly through speech and implicitly through emblematic voice characteristics (i.e. identity, sex, accent, urgency, confidence, etc.). Secondly the project could focus on developing techniques to integrate agent-based communications, whether through voice or chat, into traditional, potentially crowded, communication channels based on natural channel-sharing etiquette and turn-taking behavior.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's, Master's or PhD/ Computer Science, Electrical Engineering or Human Factors Psychology
Other/ Linguistics, Language Technology or Machine Learning

RESEARCH LOCATION: Battlespace Visualization Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Griffin D. Romigh

DEGREE: Electrical and Computer Engineering, Carnegie Mellon University, 2012

Dr. Griffin Romigh is a Research Engineer and Program Manager for the Enhanced Tactical Communication Group within the Battlespace Acoustics Branch. Dr. Romigh's research interests include the application of signal processing and machine learning techniques to solve problems in the areas of auditory situation awareness and communication. Dr. Romigh has authored or co-authored several peer-reviewed manuscripts, conference proceedings, and a book chapter within the topics of spatial hearing, head-related transfer functions, and speech communication, and was selected as an AFOSR STAR Team member and awarded the Dept. of Defense SMART Scholarship in 2009.

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Repperger Research Intern Program

RESEARCH PROJECT: 15-09

CHARACTERISTICS OF CRITICAL CARE AIR TRANSPORT (CCAT) TRAINING SUCCESS

PROJECT SYNOPSIS: Critical care air transport teams (CCAT) are comprised of a critical care physician, critical care nurse, and a respiratory therapist. These teams provide medical care to critically ill and injured patients in the en route care system. This project is a retrospective document review aiming to describe the characteristics and factors associated with student successful/unsuccessful completion of the CCAT Advanced Course. The intern will be instrumental in study database creation, data collection and management, including developing and maintaining a study code book. He/she will assist with study statistical modeling, testing, and analysis. The intern will create and present associated technical reports. Specific CCAT knowledge is not required. The study will provide invaluable experience to the intern pertaining to research methodology, data collection, management, and analysis, in addition to scientific report writing and presentation.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's or Master's/Operations Research, Information Sciences or Computer Science

RESEARCH LOCATION: Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Darcy Mortimer

DEGREE: Nursing Science, University of Arizona- PhD In progress

Darcy Mortimer is a Research Nurse with 25 years of experience spanning direct patient care, academia, hospital administration, and research. She is certified as an adult critical care nurse (CCRN). She specializes in CCAT and flight nursing. During her USAF active duty career, Ms. Mortimer's operational nursing experience was extensive including performing as a Critical Care Clinical Nurse Specialist, Critical Care Air Transport Team Nurse, Flight Nurse, and Trauma Nurse Coordinator with the Joint Theater Trauma System.

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Repperger Research Intern Program

RESEARCH PROJECT: 15-10

GENERAL EFFECTIVENESS OF COMPUTER-BASED GAMES TO TEACH CRITICAL THINKING SKILLS

PROJECT SYNOPSIS: Intelligence analysts follow extensive paths of investigation and interpretation leading to conclusions and recommendations that often impact military operations and human lives. History reveals a number of cases and situations in which the analytical process has detoured down flawed logic tracks leading to invalid actions or unintended outcomes. Learning to examine one's own, and one's peers, thinking for potentially unsound decision-making has traditionally been a social skill achievable only through extensive experience and failures. Recent research at several institutions has investigated various methods to employ computer-based video games to teach recognition, discrimination, and mitigation of common thought patterns known as cognitive biases. Published results are just emerging that show a wide variety of hypotheses, approaches, analytical techniques, and outcomes. In this project, the intern will prepare an overarching analysis of the literature, theory, approaches and comparative results of recent efforts to improve these critical thinking skills, possibly including the analysis of AFRL unique data on physiological intervention effect on such methods. Participation in this project will allow the intern to become widely familiar with this state of the art, and potentially very lucrative, technology.

STUDENT LEVEL / DISCIPLINE NEEDED:
Master's/Psychology or Cognitive Science
PhD/Social Psychology

RESEARCH LOCATION: Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Tamara Chelette, PhD

DEGREE: Biomedical Sciences, Wright State University, 1994

Dr. Chelette is a Principal Research Biomedical Engineer and Extramural Program Manager for the Warfighter Readiness Research Division. Her current research programs encompass both human and machine learning for autonomous system implementation, human-machine trust, and improved decision making. She is a Fellow of the Aerospace Medical Association and the Aerospace Human Factors Association.

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Repperger Research Intern Program

RESEARCH PROJECT: 15-11

BIOLOGICAL EFFECTS ASSOCIATED WITH TERAHERTZ RADIATION

PROJECT SYNOPSIS: The primary goal of this work is to validate conclusions drawn from previous terahertz (THz) bioeffects studies using additional cell lines and primary cells varying exposure times and doses of THz radiation along with a wide range of THz frequencies. Our previous results demonstrated that 2.52 THz may exert distinct effects compared to those observed in the conventional bulk heating (BH). We clearly saw that this THz frequency triggered specific mRNAs, miRNAs and intracellular metabolic and signaling pathways that were not affected by BH. Moreover, since we provided evidence that THz radiation did not alter the expression of major heat shock chaperoning and proteolysis proteins that were affected in BH, our result implies that 2.25 THz did not appear to be directly damaging intracellular proteins. These studies also revealed valuable new insights that give a much clearer picture of intracellular canonical pathways that are specifically triggered in human cells exposed to 2.52 THz. Given the many innovative THz-based technologies now used in medical, military, and security applications, it is crucial that we understand the fundamental effects of exposure not only to support the development of exposure standards, but also to identify areas ripe for exploitation.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's, Master's or PhD/ Electrical Engineering or Biomedical Engineering
PhD/Computer Science
Master's/ Physics

RESEARCH LOCATION: Fort Sam Houston, Texas

RESEARCH ADVISER: Ibtissam Echchgadda, PhD

DEGREE: Cellular and Structural Biology, University of Texas HSC San Antonio, 2003

Dr. Echchgadda is currently a Research Biological Scientist with the Air Force Research Laboratory (AFRL). Her involvement with the AFRL research began in 2011, when she joined the team as a National Academy of Sciences Senior Associate. She then continued as a Senior Scientist with General Dynamics Information Technology. Prior to that, Dr. Echchgadda worked at UTHSCSA where she led studies related to multiple NIH-funded projects. During her appointments at the AFRL, she served as a lead investigator in several projects investigating the interaction of the electromagnetic fields with biological systems. Dr. Echchgadda received multiple honorable awards and her work has been published in high impact journals and has been presented at local, national and international conferences.

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Repperger Research Intern Program

RESEARCH PROJECT: 15-12

INTERFACE FACTORS THAT INFLUENCE WORKLOAD AND SITUATION AWARENESS IN DEFENSIVE CYBER OPERATIONS

PROJECT SYNOPSIS: Air Force cyberspace strategic guidance (e.g., Cyber Vision 2025) indicates a need to develop human-machine interfaces that aid comprehension of cyber events and increase situation awareness, consequently improving analyst performance. Potential solutions to this problem may be found in emerging interactive visual analytic techniques, such as coordinated views, brushing and linking, etc. These techniques may help users perceive complex and dynamic relationships in the underlying data, facilitating comprehension and pattern recognition. Currently, several of these approaches have been proposed for use in cyber operations; however, their evaluation in empirical human experiments has been limited, focusing mostly on issues of usability. Consequently, the goal of this research project will be to examine the performance effectiveness of operators performing cyber defense monitoring using interfaces that employ one or more of these interactive visual analytic techniques. In addition, this research will assess operator cognitive workload and situation awareness using self-report and physiological metrics to further explicate the effects of those interfaces on analysts.

STUDENT LEVEL / DISCIPLINE NEEDED:
Master's or PhD/ Human Factors Psychology, Human Factors or Cognitive Science

RESEARCH LOCATION: Applied Neuroscience Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Gregory Funke, PhD

DEGREE: Experimental Psychology (Human Factors), University of Cincinnati, 2007

Dr. Funke is an Engineering Research Psychologist in the Air Force Research Laboratory's Applied Neuroscience Branch. His current research foci are cyber operations and understanding team processes that contribute to team successes or failures.

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Repperger Research Intern Program

RESEARCH PROJECT: 15-13

Breath Detection of Hypoxia and Fatigue for Pilot Physiology and Cognitive Performance

PROJECT SYNOPSIS: High performance fighter aircraft subsystems are acutely monitored enabling a high degree of "forensic" analysis of any inflight "incident." Pilot monitoring is also a critical element in any flight. This effort seeks to address perceived knowledge gaps in understanding breath volatile organic compound (VOC) profiles. This goal will be addressed through both the establishment and characterization of physiological states of concern in the operational environment such as hypoxia, stress, and fatigue and the subsequent development of selective real-time VOC sensors for their detection in real-time.

STUDENT LEVEL / DISCIPLINE NEEDED:
PhD or Master's/Chemistry, Biomedical Engineering or Electrical Engineering

RESEARCH LOCATION: Applied Neuroscience Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Claude (Curt) Grigsby, PhD

DEGREE: Biomedical Science, Wright State University, 2013

Dr. Grigsby is an analytical chemist and board certified medical technologist with over 20 years of experience in mass spectrometry based proteomics, metabolomics, volatile analysis, and clinical diagnostics utilizing a variety of analytical chemistry and bioinformatics techniques. He is currently serving as a research chemist at the Air Force Research Laboratory in the Human Biosignatures Branch, where, for the past several years, he has applied his mass spectral expertise in support of the air quality investigation of high performance aircraft conducted by the 711th Human Performance Wing and is co-PI in leading numerous USAF efforts focused on cockpit environmental exposures and breath based biomarker discovery.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-14

COMPUTATIONAL MODELS OF ATTENTION FOR DATABASE SEARCH

PROJECT SYNOPSIS: The intelligence, surveillance, and reconnaissance enterprise of the Air Force seeks to provide support to the warfighter by reducing the massive amounts of sensed data into information products relevant to the mission at hand. Attempting to process all of the available data is impractical. As such, intelligence analysts must develop some strategy for processing only limited samples of data. These strategies are myriad, each with their own pros and cons, and overall success is dependent on the analyst's ability to adjust to the data and use multiple methods in the search process. The speed of this process is limited by the rate at which data can be examined and understood. This project seeks a more rapid workflow that would allow the operator to manage analysis while offloading time consuming search to the computer. Doing this requires shaping data into networks akin to how operators mentally organize it and creating algorithms that can navigate over it using methodologies provided by the operator. By overcoming some of these barriers we can begin to perform some human tasks at computer speeds. This project will build on established models of human attention for both continuous and discrete information spaces. There are positions available for major programming support, interface design, and usability studies. Interns will have the opportunity to substantially contribute to the overall direction of the project.

STUDENT LEVEL / DISCIPLINE NEEDED:
PhD or Master's/ Computer Science or Cognitive Science
Master's/ Experimental Psychology

RESEARCH LOCATION: Wright-Patterson AFB, Dayton OH

RESEARCH ADVISER: Daniel Roberts

DEGREE: Cognitive Systems Engineering, The Ohio State University, 2013

Daniel Roberts is a Cognitive System's Engineer in the Air Force Research Laboratory's Human Centered ISR Division. He conducts research focusing on ways to improve the search for information via sensor networks.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-15

INVESTIGATION OF BIOLOGICAL RESPONSE TO ELECTROMAGNETIC EXPOSURE

PROJECT SYNOPSIS: Understanding the mechanism(s) underlying the interaction of electromagnetic (laser, thermal, short-pulse electric) energies with biological systems is integral for development of novel technologies provided by interfacing these energies with biology. This project focuses on understanding the subtle impacts of electromagnetic energy on cells, with a particular focus on the plasma membrane. Depending on the interests of the researcher, advanced optical imaging techniques such as coherent Raman scattering, high-speed imaging, stimulated emission depletion (STED), or confocal or multi-photon microscopy may be used to observe the effects on cells from neuron stimulation by electromagnetic sources. Additionally, wave propagation in neurons may be explored with laser trapping and fluorescence correlation. Candidates with expertise in neuroscience seeking to expand their techniques repertoire by combining optical approaches with single cell events, such as patch clamp for investigation of their observed cell response phenomenon, are particularly desired, as well as those individuals with demonstrated experience with novel optical sensing and imaging applications.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's; Master's or PhD/ Biomedical Engineering, Neural Science or Biochemistry

RESEARCH LOCATION: Optical Radiation Bioeffects Branch, Fort Sam Houston, San Antonio, TX

RESEARCH ADVISER: Hope Beier, PhD

DEGREE: Biomedical Engineering, Texas A&M University, 2009

Hope Beier is a principle investigator for efforts in applying optical techniques to explore the effects of directed energy on biology. She is PI on two three-year Air Force Office of Scientific Research LRIR grants: one to study the biomechanisms underlying infrared stimulation of neural tissue and a second to examine the thermodynamic propagation of soliton waves in neuronal axons during action potentials. She also leads efforts exploring the biomechanisms of infrared stimulation and use of stimulated emission depletion (STED) nanoscopy to study membrane dynamics. Dr. Beier joined the Air Force Research Laboratory in 2010 as a National Research Council Postdoctoral Research Associate and is currently working as a Research Biomedical Engineer.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-16

IMPACT OF SHORT PULSE ELECTROMAGNETIC FIELDS ON MAMMALIAN CELLS

PROJECT SYNOPSIS: Our laboratory's goal is to understand the biological effects of high peak power microwaves. Utilizing directly applied nanosecond pulsed electric fields (nsPEF) as a microwave surrogate; we study changes in cell plasma membrane structure, morphology and physiological, and genetic and proteomic expression. To study such changes, we use electrophysiological and optical microscope systems to record changes in membrane conductance in real time allowing for the determination of thresholds for effect of various nsPEF exposure parameters. In addition, we study the impact of such pulses on neurological cells to investigate the impact of electrical pulses on the conduction of action potentials. Genetic and proteomic techniques are used in conjunction with an exposure system capable of exposing a population of cells to elucidate stressful and lethal exposure endpoints. Lastly, we pursue the development of theoretical models that describe and predict the impact and response of cells exposed to nsPEF. We aim to generate models that compliment empirical results to predict observed cellular effects and lethality. The overarching aim of this research effort is to generate a comprehensive model that can predict the field distribution and biological impact of high peak power microwave exposures to ensure soldier safety in the battlefield.

STUDENT LEVEL / DISCIPLINE NEEDED:
PhD/ Electrical Engineering, Biomedical Engineering or Biology
Bachelor's or Master's/ Biomedical Engineering, Electrical Engineering or Biology

RESEARCH LOCATION: Radio Frequency Bioeffects Branch, Fort Sam Houston, San Antonio, TX

RESEARCH ADVISER: Bennett Ibey, PhD

DEGREE: Biomedical Engineering, Texas A&M University, 2006

Dr. Ibey began working for the Air Force Research Laboratory in 2007 as the principal Investigator of high peak power microwaves (HPPM) bioeffects. His research includes the construction of HPPM microwave systems, the use of patch clamp to study cellular bio-electric effects, the development of theoretical models, cellular microscopy, and the measurement of genetic or proteomic effects of HPPM exposure. Dr. Ibey has published 1 book chapter, 2 patents, and 34 peer-reviewed publications. He is a board member of bioelectromagnetics society, active member of SPIE, and the Direct Energy Professional Society. He was named the AF Junior Civilian Scientist of the Year 2010 and received an honorable mention for the McLucas Basic Science Award in 2012

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Repperger Research Intern Program

RESEARCH PROJECT: 15-17

COMPUTATIONAL LASER BIOPHYSICS

PROJECT SYNOPSIS: This project will address one of a number of standing research problems relevant to describing and directing (through predictions in on-going experimental programs) research within our laboratory. Depending upon the applicant's interest and background, the research will be guided to focus on one of the following problems: (1) acceleration of multi-physics simulations through the use of graphical processing units and other high-performance computing algorithm improvements, (2) the molecular-level interaction of lasers with protein-ligand systems to examine photo-induced electron transfer and resultant protein conformational changes, or (3) improving solution coupling in multi-physics simulations relating material response from pulsed lasers to unify propagation, acoustic, thermal diffusion, photo-ablative, and other responses.

STUDENT LEVEL / DISCIPLINE NEEDED:
Master's or PhD/ Physics or Computer Science
PhD/ Biomedical Engineering
Bachelor's/ Physics, Computer Science or Electrical Engineering

RESEARCH LOCATION: Optical Radiation Bioeffects Branch, Fort Sam Houston, San Antonio, TX

RESEARCH ADVISER: Robert Thomas, PhD

DEGREE: PhD, Physics, University of Missouri, 1994

Robert Thomas is a Physicist with the Air Force Research Laboratory where he has served for the past 20 years. He currently leads a wide variety of modeling and simulation activities from study of laser-tissue interactions at the molecular level, to multi-physics simulations in bio-photonics, to engagement-level simulation studies relevant to the applications of lasers in USAF technologies. With a wide-range of interests, his current research focus is the improvement of algorithms for simulating laser interaction within biological structures and enabling high-fidelity multi-physics models.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-18

USING GENETIC ALGORITHM METHODOLOGY TO PREDICT GOAL CHANGES DURING A DIRECTED ENERGY EVENT

PROJECT SYNOPSIS: Genetic Algorithms have been developed to enable better operational planning during air-to-air combat missions, and a wide range of modeling and simulation of logistical requirements as an adaptive system to understand potential chaotic and random changes in the environment. We are proposing to adapt this cutting edge methodology as a potential predictor of how individual's goals change during a directed energy event, specifically before, during and after. Algorithm and code development in this area would be suited for a recent bachelor's or master's graduate in Mathematics or Computer Science.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's/ Computer Science, Electrical Engineering or Mathematics
Master's/ Computer Science, Mathematics or Electrical Engineering

RESEARCH LOCATION: Optical Radiation Bioeffects Branch, Fort Sam Houston, San Antonio, TX

RESEARCH ADVISER: Robert Thomas, PhD

DEGREE: PhD, Physics, University of Missouri, 1994

Robert Thomas is a Physicist with the Air Force Research Laboratory where he has served for the past 18 years. He currently leads a wide variety of modeling and simulation activities from study of laser-tissue interactions as the molecular level, to multi-physics simulations in bio-photonics, to scenario-based studies relevant to the applications of lasers in USAF technologies. With a wide-range of interests, his current focus is the improvement of algorithms for simulating laser beam propagation within biological structures and making a number of long-standing, non-linear response simulations tractable. In addition, his work has the goal of coupling with these propagation algorithms the material and molecular-level response of the system with the laser or its effects.

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REPPERGER RESEARCH INTERN PROGRAM

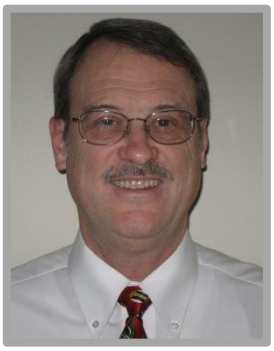
RESEARCH PROJECT: 15-19

BIOPHYSICS / BIOCHEMISTRY / MOLECULAR BIOLOGY OF PHOTOBIOMODULATION

PROJECT SYNOPSIS: Photobiomodulation (PBM) is the term now used, in place of low level laser therapy (LLLT), to refer to a general invigoration of cells following exposure to low doses of red or near infrared (NIR) electromagnetic radiation ("light"). Because the first observation of this effect was therapy-like, the vast majority of research on PBM has been therapy oriented. However, PBM has also been shown to protect mouse retina cells in vivo from methanol toxicity and from injurious levels of white light. In our hands PBM also protects human retinal pigmented epithelium (hTERT-RPE) cells growing in vitro against the lethal effects of a pulse of 2 µm laser radiation, modulates expression genes associated with growth control and apoptosis, stimulates synthesis of nitric oxide in the cells and stimulates oxygen consumption by mitochondria. The goal of this research is to discover the physical, chemical, molecular, biological, and cellular mechanisms of PBM in order to exploit this phenomenon to the benefit of the warfighter. The absorption of light (600-1000 nm), the influence of light exposures on reduction/oxidation potentials in cells, gene expression (DNA methylation, DNA transcription, RNA translation, protein levels), protein phosphorylation, cell cycle perturbations, cell membrane effects, reactive oxygen species (ROS), and the competing roles of apoptosis and necrosis are all of interest.

STUDENT LEVEL / DISCIPLINE NEEDED:
PhD, Masters or Bachelor's/ Biochemistry, Biology or Chemistry

RESEARCH LOCATION: Optical Radiation Bioeffects Branch, Fort Sam Houston, San Antonio, TX



RESEARCH ADVISER: Jeffrey Wigle, PhD

DEGREE: Radiation Biophysics, University of Rochester, 1982

Dr. Wigle is a Research Biological Scientist in the Optical Radiation Branch of the Bioeffects Division. After completing his Ph.D., Dr. Wigle did a Postdoctoral Fellowship in Genetic Toxicology, and then joined the USAF, where he served primarily in research management positions. After leaving the USAF in 1999 he worked as an in-house contractor for the Laser Eye Protection Advanced Development Program, and then was hired as a civilian scientist. His overarching research interest is molecular mechanisms of bioeffects from light-tissue interactions. His current research effort is aimed at understanding the biochemistry of red-light induced photobiomodulation in order to determine how one might exploit those pathways towards enhancing performance and protection of the warfighter.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-20

NUMERICAL SOLVER FOR FRACTIONAL ORDER WAVE EQUATION

PROJECT SYNOPSIS: The purpose of this project is to develop an alternative to solving a newly-derived wave equation that incorporates fractional order derivatives currently being used to describe the dispersion and absorption of electromagnetic radiation in a dielectric material. Though analytical solutions exist for this particular wave equation, they are not numerous since it requires the initial conditions to be zero. It is important to develop the capability to solve this wave equation in the event that the input waveform of incident electromagnetic waves does not fall into this category. The fractional order wave equation in question, unlike most other fractional order differential equations, which are found in the literature, has the unique advantage of being causal. That is, the fractional order terms are not arbitrarily inserted into the traditional wave equation but rather stem from experimentally observed behavior. This allows for an unprecedented level of fidelity to the actual physical mechanisms being modeled, antiquating many traditional models that are now considered to be industry standards. Methods will include an introduction to the fractional calculus; a powerful branch of mathematics dealing with differentiation and integration of arbitrary order, and the development of a numerical solver based upon findings from a literature survey. Secondary objectives will include an analysis of the accuracy and precision of the developed numerical solver and the optimization of the developed algorithm for its execution on both serial and parallel processing architectures.

STUDENT LEVEL / DISCIPLINE NEEDED:
Master's or PhD/ Mathematics, Physics or Mechanical Engineering
Bachelor's/ Mathematics, Physics or Biomedical Engineering

RESEARCH LOCATION: Optical Radiation Bioeffects Branch, Fort Sam Houston, San Antonio, TX

RESEARCH ADVISER: Andrew Wharmby, PhD

DEGREE: Biomedical Engineering, University of Texas San Antonio, 2013

Andrew Wharmby is a Research Biomedical Engineer in the Optical Radiation Bioeffects Branch at the Air Force Research Laboratory Human Effectiveness Directorate. He joined the Air Force Research Laboratory in 2006 as an Associate Research Biomedical Engineer where he focused on the development and application of digital image and video processing algorithms, automated instrumentation control, and data analysis for the Vision Science team. He then moved to the Modeling and Simulation team where he developed finite element analysis code for simulating real-time dynamic thermal lensing events in the human eye. Upon completing his Ph.D., he returned to RHDO where he now focuses on the application of fractional calculus to solve problems involving directed energy effects on materials, biological or otherwise.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-21

BIOLOGICAL INTERACTION OF ENGINEERED NANOMATERIALS

PROJECT SYNOPSIS: Engineered nanomaterials (NM), within dimensions ranging between 1-100 nm in size, possess novel physical and chemical properties that can be applied to create uniquely engineered devices. NM quantum characteristics can confer unique electrical, optical and magnetic at a nanosystem level with attributes not found in the corresponding prepare bulk chemical materials. Nano-scale prepared materials are useful for military applications with engineering aspects important for portable battlefield systems such as remote monitoring devices. This project will seek to understand the fundamental mechanism of interaction of engineered nanomaterials based on their unique physiochemcial characteristics including, dimensional size, structure, shape and surface chemistries that can interact with cultured cell components that initiate novel molecular events such as membrane receptor modulation, enhanced endocytosis dynamics and subcellular signal activation. The work supports the understanding of the interaction between biological systems and novel human synthetically engineered nanomaterials to aid in the development of novel material-based biosensors for military applications.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's or Master's/ Bionanotechnology, Chemistry or Biomedical Engineering

RESEARCH LOCATION: Molecular Bioeffects Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Saber Hussain, PhD

DEGREE: Biology, Indian Institute of Chemical Technology, 1991

Saber Hussain is Senior Scientist and Nanotoxicology Group Lead, Molecular Bioeffects Branch. He began his scientific career in 1987 as a toxicology research fellow at the Indian Institute of Chemical Technology (IICT) and received his doctorate degree in 1991. Here, his novel exploration of heavy metal biotransfer between different proteins in complex biological environment led to a series of prestigious research fellowships in Italy, Switzerland, and the U.S. Dr. Hussain joined the Air Force Research Laboratory at Wright-Patterson AFB in 1999, where his research interests transitioned into evaluating potential toxicity arising from the physicochemical properties of nanoscale structures. His research interests include 1) the understanding of how engineered nanoparticles with different geometries interact with cells, 2) molecular and cellular events–membrane receptor binding, endocytosis and subsequent signaling activation caused by nanoparticles, and 3) assessment of toxicity arising from unique physicochemical properties associated with nanoscale structures and their surface chemistries. His research addressing nanomaterial toxicity and biomolecular interaction of nanomaterials has resulted in author/co-authorship of 100 peer-reviewed publications, 9 book chapters, and 200 technical abstracts. He is currently an Associate Editor of Toxicological Sciences and serves as an editorial member of several other toxicology journals. He is a Fellow of the Academy of Toxicological Sciences.

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Repperger Research Intern Program

RESEARCH PROJECT: 15-22

TRUST CALIBRATION FOR HUMAN-MACHINE INTERACTION

PROJECT SYNOPSIS: The current research will involve laboratory or field studies to identify factors that influence the process of trust calibration between humans and machines. Example projects may include, but are not limited to: understanding the role of social dialogue and social intent within a human-robot interaction, experiments that manipulate aspects of transparency between humans and machines to gauge their impact on trust and performance, studies that empirically evaluate the impact of individual differences such as personality, expectations, and bias on the development and maintenance of trust in initial and pervasive human-machine interactions, and field studies which examine the antecedents of trust among operators of novel autonomous or automated systems.

STUDENT LEVEL / DISCIPLINE NEEDED:
PhD/ Human Factors Psychology, Experimental Psychology or Industrial Engineering
Master's/ Human Factors Psychology, Industrial Engineering or Industrial/Organizational Psychology
Bachelor's/ Industrial Engineering, Human Factors Psychology, or Experimental Psychology

RESEARCH LOCATION: Patterns of Life Branch, Wright-Patterson AFB, Dayton OH

RESEARCH ADVISOR: Joseph Lyons, PhD

DEGREE: Industrial/Organizational Psychology, Wright State University, 2005
Dr. Lyons is the Technical Advisor of the Human Trust and Interaction Branch within the Human-Centered ISR Division, Human Effectiveness Directorate. Dr. Lyons has technical interests in the area of human-machine trust in domains such human-automation interaction, human-robot interaction, and human-machine teaming. More specifically, Dr. Lyons is interested in understanding what dispositional factors, transparency factors, and contextual factors shape the trust calibration process between humans and machines.

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Repperger Research Intern Program

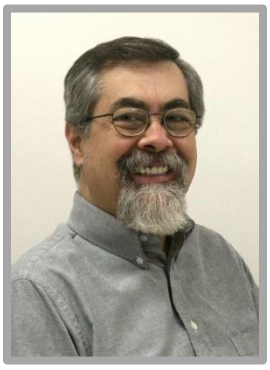
RESEARCH PROJECT: 15-23

COGNITIVE AND HUMAN FACTORS OF ANOMALY DETECTION

PROJECT SYNOPSIS: Many jobs require a person to detect anomalies in routine data input streams. Tasks range from those of Air Traffic Controllers and rush-hour traffic reporters who view video-feeds under real-time pressure; whereas medical researchers and stock market analysts follow large volumes of text data over days to spot new breakouts and trends. Unfortunately, key signals often go undetected and planes crash or markets plummet. We need answers to three questions: How prevalent are failures to detect both "obvious" and subtle items? Why do detection failures occur? How do we improve and aid human monitors? Perceptual and cognitive research shows that people, even when actively looking for anomalies that they have been forewarned about, often miss glaring oddities in dynamic events when they are engaged in information gathering tasks. In additional to psychological research on "change blindness" and "inattention blindness," personality and thinking styles may affect anomaly detection, but the research is still in its infancy. Research projects should focus on the reasons for detection failures and improvement, but also be aware of false alarms and performance quantification. Students can research various factors which contribute to anomaly detection and inattention blindness such as (1) Display factors (e.g., number, position, motion, pattern, & complexity of elements, (2) Task factors (e.g., number of tasks, communications, and distractions), (3) Human factors (e.g. training, workload, personality, culture, teamwork). Student will be involved at all phases of research including hypothesis generation, experimental design, data analysis, and documentation. Original ideas encouraged.

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's, Master's or PhD/ Psychology, Social Psychology or Mathematics

RESEARCH LOCATION: Human Analyst Augmentation Branch, Wright-Patterson AFB, Dayton OH



RESEARCH ADVISOR: Rik Warren, PhD

DEGREE: Experimental Psychology, Cornell University, 1975

Dr. Warren is a National Research Council Post-Doctoral Advisor and has mentored numerous NRC post-docs and graduate students. He is a perceptual psychologist and currently is interested in failures of perception to detect critical items in rich natural environments, for example, inattention and change blindness. He is also developing statistical methods for finding anomalies in large and small datasets. The role of cultural factors in perception and mis-perception is also central. He serves on three journal editorial boards and is on the program committees of several social dynamics and complex systems conferences.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-24

REAL-TIME DISPLAY FOR USE WITH A PHYSIOLOGICAL MONITORING DEVICE APPLICABLE TO A HIGH PERFORMANCE AIRCRAFT

PROJECT SYNOPSIS: The goal of this project is to develop a Graphical User Interface (GUI) that processes and displays physiological data obtained from a sensor suite. Currently, 711th HPW is conducting several efforts to explore causes and contributors to physiological incidents involving high performance aircraft. These efforts focus on the characterization of work of breathing during flight, hypoxia on performance, impact of atelectasis, and fatigue secondary to combat maneuver stress. The Repperger Intern will perform background research into human factors design for displays and research to determine the necessary display elements. The intern will support the design of a GUI model in LabView that will take physiological data from the monitoring device, calculate the pertinent medical signals for the display, and output those data.

STUDENT LEVEL / DISCIPLINE NEEDED:
PhD, Master's or Bachelor's/ Biomedical Engineering, Human Factors or Systems Engineering

RESEARCH LOCATION: U.S. Air Force School of Aerospace Medicine
Wright-Patterson AFB, Dayton OH

RESEARCH ADVISER: Jennifer Serres, PhD

DEGREE: Engineering, Wright State University, 2008

Dr. Jennifer Serres is a Biomedical Engineer in the Department of Aeromedical Research at the USAF School of Aerospace Medicine in the 711th Human Performance Wing at Wright Patterson AFB, OH. She earned her Ph.D. in Engineering from Wright State University in 2008. In addition to conducting aeromedical research focusing on the optimization of Airmen performance in adverse environments, she is also the Aeromedical Evacuation / Critical Care Air Transport Core Research Competency Lead.

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Repperger Research Intern Program

RESEARCH PROJECT: 15-25

SOUND CANCELLATION MODIFICATION FOR THE ELECTROMECHNICAL PORTION OF A NOISE-IMMUNE STETHOSCOPE DEVICE

PROJECT SYNOPSIS: There are many challenges related to patient care in the in-flight environment. Aircraft noise has long been known to be a barrier to optimal patient care primarily because it renders auscultation of physiologic sounds as a critical assessment technique practically useless. Conventional stethoscopes are appropriate for use in clinical environments with minimal ambient noise (clinic room), but they are not efficacious in high noise environments, such as is typical in the en route care environment. Therefore, the goal of this effort is to support the assessment of stethoscope technology for use in an Aeromedical Evacuation flight environment. The intern will assist in preparing Institutional Review Board (IRB) protocols, project coordination, data collection, data analysis and the development of relevant technical publications.

STUDENT LEVEL / DISCIPLINE NEEDED:
PhD, Master's or Bachelor's/ Biomedical Engineering, Electrical Engineering or Hearing Science

RESEARCH LOCATION: U.S. Air Force School of Aerospace Medicine
Wright-Patterson AFB, Dayton OH

RESEARCH ADVISER: Jennifer Serres, PhD

DEGREE: Engineering, Wright State University, 2008

Dr. Jennifer Serres is a Biomedical Engineer in the Department of Aeromedical Research at the USAF School of Aerospace Medicine in the 711th Human Performance Wing at Wright Patterson AFB, OH. She earned her Ph.D. in Engineering from Wright State University in 2008. In addition to conducting aeromedical research focusing on the optimization of Airmen performance in adverse environments, she is also the Aeromedical Evacuation / Critical Care Air Transport Core Research Competency Lead.

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REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT: 15-26

EPIDEMIOLOGICAL ASSESSMENT OF INCIDENT POST-DEPLOYMENT MENTAL HEALTH PROBLEMS IN AIR FORCE MILITARY MEDICAL PERSONNEL

PROJECT SYNOPSIS: The purpose of this project is to conduct a correlational study to determine the association between post-deployment incident mental health conditions in Air Force healthcare providers and the following: a) healthcare utilization, b) pharmacotherapy use, and c) performance-related outcomes. The intern will investigate the relationship between post-deployment mental health conditions and a variety of variables including demographic characteristics, deployment environmental and occupational exposures, and health-related data to determine risk and/or protective factors.

STUDENT LEVEL / DISCIPLINE NEEDED:
Master's/ Operations Research, Experimental Psychology, Biostatistics or Statistics

RESEARCH LOCATION: U.S. Air Force School of Aerospace Medicine
Wright-Patterson AFB, Dayton OH

RESEARCH ADVISER: Gen Maupin, MS

DEGREE: Public Health, University of Rochester, 2008

Ms. Gen Maupin, MPH, is a quantitative research epidemiologist with over ten years of research experience in immunology, respiratory diseases, en route care, and occupational and aerospace medicine. Her methodological interests are in descriptive epidemiology, secondary data analysis, and predictive analytics.

NOTE TO APPLICANTS: If selected for participation in this program, you will be offered temporary summer employment through a contract to perform work for AFRL's Human Effectiveness Directorate. This is not a U.S Government position. If selected, you will be required to undergo a National Agency Check before being granted access to government computer systems.

Repperger Research Intern Program

RESEARCH PROJECT: 15-27

PHYSICAL TRAINING AND NUTRITIONAL SUPPLEMENTATION

PROJECT SYNOPSIS: Battlefield Airmen are elite combat warriors that must have the ability to meet the taxing physical and cognitive demands of their missions. In operational mission settings, Airmen often encounter uncertain conditions leading to unexpected demands. Combat athletes must travel to a mission site, often on foot, commonly carrying 100 pounds of equipment while overcoming unexpected obstacles along the way. This can be physically draining which in turn can negatively affect aspects of cognitive performance such as information processing, problem solving, memory and decision making. Battlefield Airmen are constantly faced with critical decisions, therefore optimal cognitive performance under physical exertion is crucial for mission success. This proposal will evaluate the synergistic effects of two interventions for optimized performance: nutritional supplementation and specialized physical training. This project is an extension of a previous Repperger research opportunity, "Adaptive Training for Elite Athlete/Combat Warrior".

STUDENT LEVEL / DISCIPLINE NEEDED:
Bachelor's or Master's/ Cognitive Science, Experimental Psychology or Human Factors Psychology

RESEARCH LOCATION: Applied Neuroscience Branch, Wright-Patterson AFB, Dayton, OH

RESEARCH ADVISER: Edward Eveland, PhD

DEGREE: Biomedical Sciences, Wright State University, 2002

Dr. Eveland is currently engaged in human performance research that embraces both physical and cognitive components. He is interested in traditional and non-traditional physical training methods. He has obtained certification as an ISSA fitness trainer (CFT) and is personally active in physical training pursuits.

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