The R&T Connection Newsletter

A Publication of the Research and Technology Directorate

Spring 2012

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R&T Connection

Have an item for the **R&T Connection**? Whether it's a technical accomplishment, an upcoming speech, an employee award or any other news story, please share it with R&T Communications Officer Mia Scharper at mia.d.scharper.ctr@mail.mil or 410.436.2262.

Tragedy Spotlights DTRA Technology Development Supported By ECBC

A catastrophic event in March last year put the spotlight on a technology being developed by the Defense Threat Reduction Agency (DTRA), the U.S. Army Edgewood Chemical Biological Center (ECBC) and others that garnered a 2011 DTRA Director's Annual Team Award – Large Team in recognition of its noteworthy contribution to the agency.

The Weapons of Mass Destruction (WMD) Aerial Collection System (WACS) is comprised of two sensor and tracker pods placed under the wings of a shadow Unmanned Aerial Vehicle. The pods can detect, track and collect WMD threats.

The event was the meltdown at Fukushima Daiichi nuclear power plant in Japan. The technology is the Weapons of Mass Destruction Aerial Collection System (WACS).

On March 11, 2011, tragedy struck Japan when a massive earthquake-driven tsunami flowed over the Fukushima Daiichi nuclear power plant, causing power outages and dangerous radiation contamination. DTRA received a request for forces from U.S. Pacific Command to conduct airborne radiation detection and monitoring of Fukushima.

WACS was one of several U.S. capabilities identified and requested by name by the Government of Japan and the Japan Joint Staff to rapidly and effectively stabilize the situation at the Fukushima Nuclear Power Plant. The system was ready to deploy in only six days.

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ECBC Receives FLC Award for TAC-BIO

This article first appeared in the April 5, 2012 edition of APG News.

Receiving an award for Excellence in Technology Transfer for their work with the TAC-BIO at the FLC national meeting in May are ECBC staff, from left, Rick Sickenberger (Teledyne Brown/CollaborX), Jerry Cabalo, Ph.D., Aime Goad, Lester Strauch, Fiona Narayanan, David Sickenberger and Rich Kreis.

The U.S. Army Edgewood Chemical Biological Center (ECBC) received an Award for Excellence in Technology Transfer from the Federal Laboratory Consortium (FLC) for its work on the Tactical-Biological Detector (TAC-BIO). The TAC-BIO program resulted in five patents addressing state-of-the-art optics and optical interrogation techniques. In addition, it also provides a biological agent detector that costs nearly 10 percent less, is 50 percent smaller, weighs 80 percent less and uses only four percent of the energy.

The TAC-BIO is a biological agent sensor developed at ECBC that is low-cost, low-power and compact in size. It is designed to rapidly detect the presence of an airborne biological threat and to provide an early warning to minimize exposure and casualties to our Armed Forces. The device exploits the scientific principle that biological aerosols will fluoresce and scatter light when exposed to ultraviolet (UV) light. These signals can be used to detect the existence of a threat.

Prior to the TAC-BIO, most biological agent detectors used large and costly UV lasers to extract optical signals from threat aerosols. However, a shift toward a low-cost detector began in 2002 when John Carrano, Ph.D., led an effort within the Defense Advanced Research Projects Agency (DARPA) to develop Semiconductor Ultraviolet Optical Sources (SUVOS), a type of light-emitting diode that could replace the larger and more costly UV lasers.

TAC-BIO began with funding from DARPA to explore the potential of designing a biological agent detector based on SUVOS technology. Funding from the Defense Threat Reduction Agency allowed ECBC scientists and engineers to advance the design toward a mature, Technology Readiness Level 6 product.

The effort was supported by the Center's Chemical Biological Systems Integration Branch within its Research and Technology Directorate and the Advanced Design Manufacturing team within its Engineering Directorate. The team was led by Division Chief David Sickenberger and included six other ECBC employees.

"I'm very proud of the work our team has done on the TAC-BIO and the paradigm shift it has driven to low-cost biological agent detectors," said Sickenberger.

ECBC transitioned the TAC-BIO into industry, specifically General Dynamics and Research International, Inc., in 2009 and 2010 respectively. Collaboration among the organizations was made possible through three technology transfer mechanisms that helped industry access the Center's expertise and facilities: a patent licensing agreement, cooperative research and development agreement, and partnership intermediary agreements.

The ECBC Technology Transfer team played an integral role in these transitions by managing the licensing process. The team engaged a Department of Defense partnership intermediary, TechLink, for resources on publicizing the availability of such a system to interested industry organizations.

"Commercialization of the TAC-BIO by our partners is the culmination of many years of effort by the inventors, and their cooperation with the Technology Transfer Team to enable an expedited path to commercial success," said Technology Transfer Team Lead Dhirajlal Parekh.

Efforts to improve the product are ongoing. Work continues to make the product simpler, more durable in all weather conditions and more capable. Other potential licensees continue to be interested which will allow for further modification of the TAC-BIO system prior to wide distribution and fielding.

ECBC has been recognized as a critical national asset in the chemical biological defense community, and its innovative workforce evolves CBRNE defense technologies and capabilities worldwide.

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Lt. Col. Alan Samuels, Ph.D., is honored by the White House as a Champion of Change. (Photo credit: U.S. Army RDECOM)

White House Honors 'Champion of Change' for Afghanistan Energy-Saving Technology

By C. Todd Lopez

WASHINGTON (Army News Service, April 20, 2012) -- An Army Reserve officer who researched the effectiveness of energy-saving "micro-grid" technology in Afghanistan was among nine Americans honored as "Champions of Change" by the White House, April 19.

As a civilian, Alan Samuels, Ph.D., works as a research chemist at Edgewood Chemical Biological Center at Aberdeen Proving Ground, Md., where he studies remote-sensing technology for the Army. As a lieutenant colonel in the Army Reserve, he recently returned from deployment to Afghanistan, where he supported the efforts of the Army's Research, Development and Engineering Command to evaluate better ways to more efficiently use energy in a combat environment.

"It's a very humbling thing for me as a research chemist without any real expertise in power and energy," Samuels said of being honored as a Champion of Change. "I am glad I was able to make a contribution to help out."

Samuels deployed to Afghanistan in April 2011 to stand up a science and technology integration and collaboration center at Bagram Airfield. He and his team collaborated and shared information with other Army and Department of Defense agencies in theater to address operational energy challenges there.

One of the efforts Samuels was involved in was to assess, in an operational environment, the efficiency of traditional power-distribution systems using generators, and how that changes with the addition of "micro-grid" technology. Traditional power-distribution networks on a forward operating base, or FOB, in a combat environment, Samuels said, are using fuel inefficiently.

"We had 60kw generators putting out anywhere from 5-15kw around the FOB," he explained. "That is kind of bad news for the generator systems. They are using a lot of fuel they don't have to. Second, there are maintenance issues. Since the generator is not running at its load, then it's not reaching the temperature it needs to efficiently burn that fuel and put out the power, based on the demand."

Micro-grid technology, Samuels said, makes the whole system more efficient and so they use less fuel.

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'Champion of Change' Honored

"So what these computer technologies do as components of the micro-grid systems is sense that load and only turn on those generators that are needed," he said. "And their maintenance, as well as their fuel consumption, goes way down."

Samuels said in Afghanistan, in an operational environment, he was able to observe a 17-percent reduction in the amount of fuel used, relative to the baseline, just using micro-grid technology.

Samuels said assessments for how fuel usage numbers change, how efficiency changes with demand-side reductions in energy use, are still underway. The "demand side" of the energy equation is the user, and how much electricity he pulls from the grid.

Ways to reduce efficiency on the user side can involve things like improving the efficiency of environmental control units that cool and heat tents, placing shades over the tops of tents to reduce solar loads, and using thermal quilts to insulate tents, "so you are not trying to cool the tent when you really only have the thickness of canvas as insulation," Samuels said.

Those kinds of improvements to demand-side efficiency could also significantly reduce the amount of fuel used on a FOB or a combat outpost, or COP, Samuels said. But those assessments are still underway, because they will be conducted through multiple seasons in theater to get the best numbers.

Reducing the amount of fuel used in theater is not just an environmental concern, or even a cost concern, it's a concern for the lives of Soldiers.

"The Army's mission is very dependent on power and energy, and upon our ability to adapt, change and innovate to the circumstances in which our forces find ourselves," said Katherine Hammack, the assistant secretary of the Army for Installations, Environment and Technology.

Technology, like micro-grids, can reduce fuel usage, and the great costs associated with providing it. "It means that we can have fewer fuel convoys on the road," Hammack said. "One in every 46 convoys suffers a casualty, which means if we have fewer convoys over the road, we are saving lives."

View more photos at the U.S. Army article link and in the RDECOM photo gallery.

Under Construction! Proteomics Core Facility

Watch this space for updates on the construction of the ECBC-U.S. Army Medical Research Institute for Chemical Defense (MRICD) Proteomics Core Facility. This facility will allow ECBC to provide a Department of Defense-wide inter-institutional capability in large-scale proteomics. Large-scale proteomics will help elucidate the host-toxicant and host-pathogen responses for a wide variety of CBRNE threats. Work in this area will help to identify biomolecules that may serve as biomarkers of exposure and effect, and against which countermeasures can be designed.

Jennifer Sekowski, Ph.D., poses with boxed equipment that will be used in the Proteomics Core Facility.

Spring 2012 Status: The upgraded power supply for both rooms of the Core, which runs entirely through an uninterrupted power supply (UPS) system, has been completed. Instrumentation is scheduled for installation beginning May 15 through mid-June.

Sekowski, lead for the ECBC-MRICD Proteomics Core Facility, tests the power in the facility.

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ECBC Staff Say "Yes" to Winning Proposals on Valentine's Day

Nearly 60 administrative professionals, scientists, engineers and leaders at the U.S. Army Edgewood Chemical Biological Center's (ECBC) Research and Technology (R&T) Directorate attended a proposal writing workshop on Valentine's Day to learn best practices for writing winning proposals. The workshop was offered by the R&T Directorate as part of the Center's strategic goal of workforce development to continue to meet evolving CBRNE defense needs.

The four-part, one-day course covered the essential components for developing a competitive research proposal, from hypothesis and technical approach development through the peer review process. The workshop, held Feb. 14, came just in time for the In-house Laboratory Independent Research (ILIR) call for proposals. It was designed to help R&T staff improve their skills for developing winning proposals for more funding, publications and more successful projects.

"I'm very pleased with both the turnout for the workshop and the content," said Augustus W. Fountain III, Ph.D., acting director of Research and Technology. "Those who attended are better equipped now to write more effective proposals that will win our customers' confidence and support."

Part one of the workshop focused on formulating a proposal hypothesis in terms of why the work is important; why it should be funded; how it is different; and what new knowledge will be developed. Appropriately enough, the method recommended for formulating a hypothesis comes not from the business community but the science community.

"The Scientific Method of asking a question, doing research, forming a hypothesis, testing it, conducting analysis and drawing a conclusion works really well in proposal writing," said Mark Brickhouse, Ph.D., the Booz Allen Hamilton workshop facilitator. "It enables us to organize and clarify our thoughts, encourages conceptual thinking, and opens routes to new knowledge." The goal of this part of the proposal writing process is to develop a strong statement that conveys the proposed problem and the intended approach to solving it.

Laura Borland, Ph.D., and Mark Brickhouse, Ph.D., facilitated the proposal workshop in February.

Once the hypothesis is developed, the next step is to identify which specific tasks make up the approach to solving the problem. Part two of the workshop focused on defining research tasks in terms of testing the hypothesis, setting milestones and navigating roadblocks, and putting a timeframe around the research.

"Saying that you have a novel approach to the problem isn't enough to secure support and funding for your project," said Laura Borland, Ph.D., also of Booz Allen Hamilton and co-facilitator of the workshop. "To get the support you need, you have to identify expected results and data analysis methods to show that your project is focused and purposeful."

Part three of the workshop focused on budget development.

"How much is your project going to cost?" asked Dan Davis, director of the R&T Business Management Office. "Our customers pay for services rendered. This means we must develop accurate budgets. Accurate budgets increase our ability to manage resources, increase the accuracy of our financial systems, allow our customers to see true value, and justify our expenses if and when we are audited."

Part four of the workshop focused on the peer review process, which is essential for ensuring proposals sent to government agencies for review and acceptance make it through the process successfully. Fortunately, there's a key to this and anyone can use it – it's called the "Heilmeyer Catechism."

"George Heilmeyer was a director at the Defense Advanced Research Projects Agency (DARPA) who developed a set of questions every research proposal needs to answer," said Brickhouse. "If you plan up front to answer these, you will be well on your way to writing a complete, compliant and competitive proposal."

Nearly 75 percent of the participants completed a workshop survey at the end of the day, and most respondents said they found the workshop to be helpful. Some expressed a hope that the workshop, or something like it, would be held again in the future.

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ECBC Modifies Homemade Explosives Kit Detector for Fall 2012 Operational Assessment

This article first appeared in the April 2012 issue of the ECBC Engineering Edge.

In less than two months, the U.S. Army Edgewood Chemical Biological Center's (ECBC) Innovative Development Engineering Acquisitions (IDEA) Team and the Advanced Design and Manufacturing Division's (ADM) Engineering Design and Manufacturing Team were able to create a new model of a homemade explosives kit detector, now known as the Colorimetric Reconnaissance Explosive Squad Screening (CRESS) detector. The new detector will be ready to be issued to an operational unit to conduct an operational assessment in fall 2012. The first prototypes will be used by the Fort Benning Infantry School in Georgia. ADM coordinated a low-rate production line to begin the creation of these prototypes.

"We're in the process of fabricating 4,000 units to be sent to the Warfighter late fall," said Jim Genovese, IDEA Branch Chief. "This type of technology is useful right now, so we need to get it out fast."

The CRESS Kit development, formerly known as the Squad Homemade Explosives Kit, was initially funded by the Army Technology Objective R.FP.2010.01 "Detection of Unknown Bulk Explosives." It is a pocket-sized detector that uses colorimetric technology to detect unsophisticated, homemade substances such as ammonium nitrate, commonly used in improvised explosives overseas.

The CRESS has two plastic halves that fold together and click into place. One side of the half is a sticky paper that is used for collecting the unknown substance, and the other side contains ampoules filled with the colorimetric substance. The two halves are folded together and reagent ampoules crushed. After about 30 seconds, the colorimetric technology will identify the substance, whether or not it is part of a harmful mixture.

A U.S. Army Soldier tests soil samples for evidence of homemade explosives near a suspected HME factory using the old style kit.

The Squad Homemade Explosives Kit is a pocket-sized tool that helps Soldiers detect improvised explosives made from household chemicals. In the past five months, the groups working on this project have made significant strides to prepare the kit for late fall 2012 operational assessment.

After the first Military User Assessment (MUA) in June 2011, the IDEA and Engineering Design and Manufacturing teams implemented several slight modifications to CRESS in order to improve efficiencies and usability. One of the changes included creating a new way to activate the ampoules. In the previous method, color results often varied due to inconsistencies in the ampoules successful activation. The new model includes an easy-to-use cover that effectively breaks each of the ampoules, ensuring the quality and consistency of results.

This new model presented at the February 2012 MUA at Fort Leonard Wood, Mo., performed well and the Soldiers performing the assessment could easily use the detector. The success of the MUA spurred requests for prototypes by the summer.

In addition to adjusting how ampoules are activated, the new detector model improves the device's usability and intuitive design. Additionally, the teams are working to implement edits to the device's user manual. Rather than reading dense lines of directions in fine print, easy-to-follow pictorial directions will be used that can be absorbed by the end-user within minutes.

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R&T Heads 'OnSite' to Advance High-Priority Research Areas

The U.S. Army Edgewood Chemical Biological Center's (ECBC) Research and Technology (R&T) Directorate was well represented at a leading technology conference in Baltimore in January.

The 20th International Conference for OnSite Analysis for Homeland Security, Forensics and Environmental Remediation is the premier conference promoting communication and collaboration across industry, government and academia for emerging field analytical technology.

Harry Salem, Ph.D., R&T's chief scientist for life sciences, and Russell Dorsey, Ph.D., a biologist in R&T's BioSciences Branch, chaired the Pharmacology and Toxicology session. Rabih Jabbour, Ph.D., and Peter Snyder, Ph.D., both of the Chemical and Biological Detection Division, chaired the Chemical and Biological Agent Detection session. The Chemical Security Analysis Center also participated in the event.

Harry Salem, Ph.D., left, and Peter Snyder, Ph.D., chaired sessions at the OnSite Conference.

Other focus areas of the three-day conference included field forensics and trace volatile organic compounds, biosensors and bio-detection, and sampling/detection CBRNE.

"This was a successful and most rewarding conference," said OnSite-2012 Chair Jayne Morrow.

"The opportunity to collaborate with colleagues in high-priority research areas made the conference very worthwhile," said Salem, who was selected to chair OnSite-2013.

"The OnSite Conference proved an excellent opportunity to interact with scientists in varying yet related fields," said Dorsey. "ECBC provided several representatives, and we hope to increase participation in 2013."

"The conference was a great venue to get updates on the applications of recently developed technologies in important areas such as homeland security, criminal Investigations, health and military tasks," said Jabbour. "Our session featured high-quality presentations, cutting-edge topics and expert speakers."

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ECBC Modifies Homemade Explosives Kit Detector

"The old directions were 20 lines long and in small print," Genovese said. "When a Warfighter is in an emergency and needs to learn how to use something, there may not always be time to stand and read through every little thing. These new picture directions will enable the Warfighter to easily glance down at the manual, learn how to use the device and proceed with testing the substance. Results need to happen fast in theater, so we want to make it as easy as possible."

To ease the use of the product, Genovese teamed up with ECBC Engineering's Pyrotechnics and Explosives Branch to work on a trainer kit that will complement the CRESS. The kit allows Warfighters to practice using the detector with commonly found chemicals in theater.

The training kit will include transportable forms of the chemicals that are easy to store. "The Warfighter can practice using the CRESS on a training kit, before he actually needs it. Thanks to Pyrotechnics and Explosives Branch Chief Joe Domanico and the folks in his branch, we were able to give the Warfighter forms of actual chemicals to practice with that did not have the level of hazard," Genovese said.

With a Technology Readiness Level that increased from six to nearly eight in less than two months, Genovese attributes the forward momentum and success of the CRESS project to a solid team effort across ECBC. Additionally, Genovese noted that the support from the project's sponsor, Augustus W. Fountain, III, Ph.D., acting director of the ECBC Research and Technology Directorate, and a good relationship with the Army Training and Doctrine Command Maneuver Support Center for Excellence have also attributed to the recent strides in the device's development.

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Employees Honored for Exceptional Support to Visits by the National Academy of Sciences and the Army Science Board

From left, Augustus W. Fountain, III, Ph.D., Matt Shue, and Brent Mantooth, Ph.D. ◄

▼ *Aime Goad*

▲ *Mary Wade, Ph.D., Todd Sickler, and Warren Gardner, Ph.D.*

Members of the Research & Technology Directorate's BioSciences, Chemical and Biological (CB) Detection, CB Protection and Physics and Computational Sciences Divisions were honored with a U.S. Army Edgewood Chemical Biological Center (ECBC) coin from Augustus W. Fountain, III, Ph.D., acting director of Research and Technology. Fountain recognized these individuals for their exceptional support to the recent visits by the National Academy of Sciences and the Army Science Board. Both visits presented significant opportunities for ECBC to demonstrate its unique value to National Defense.

Receiving coins were Warren Gardner, Ph.D., Henry S. Gibbons, Ph.D., Amber Prugh, Todd Sickler and Mary Wade, Ph.D., of BioSciences Division; Rich Vanderbeek of CB Detection Division; Brent Mantooth, Ph.D., and Matt Shue of CB Protection Division; and Aime Goad, Nirmala Pinto and Mike Kierzewski of Physics and Computational Sciences Division.

R&T Welcomes New XO, Adam Baker

ECBC's Research and Technology (R&T) Directorate welcomes Adam Baker as our newest executive officer, or XO. Baker received his bachelor of science degree in chemical engineering from the University of Maryland, College Park in 2004. He has worked at ECBC since February 2005, primarily with Explosive Destruction Technologies for the disposal of chemical warfare material and conventional munitions. Prior to joining R&T, Baker worked in the Program Management Branch of the Chemical Biological Operations Division in the Directorate of Program Integration (DPI).

"I'm looking forward to learning about the activities ECBC is involved in outside of DPI, and about ECBC's role in the larger RDECOM mission," Baker said.

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R&T Researchers Present Work at Defense and Security Conference in Baltimore

Four U.S. Army Edgewood Chemical Biological Center Research and Technology Directorate (R&T) researchers – Dorothea Paterno, Rabih Jabbour, Ph.D., Jason Guicheteau, Ph.D., and Steve Harden, Ph.D. – presented their latest work at the 2012 SPIE Defense, Security, and Sensing Conference, held Apr. 23-27 at the Baltimore Convention Center. The conference brought together expert scientists from military, industry and academia to share the latest technological innovations for defense, security, sensing, robotics and environmental applications.

Jason Guicheteau, Ph.D.

From left, Rabih Jabbour, Ph.D., Dorothea Paterno and C. Steve Harden, Ph.D.

Presenting in the Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE) Sensing Conference, chaired by R&T Acting Director Augustus W. Fountain, III, Ph.D., the scientists shared their knowledge of biological detection strategies and novel schemes for explosives detection and identification.

Paterno addressed the issue of background interference from environmental biological particulates, such as native microbes, pollen and fungi, on the testing and evaluation of bioaerosol detectors. She found that there is a significant contribution from normal flora that must be accounted for and included as a variable when testing and assessing bioaerosol detectors. Paterno created a representative background aerosol sample, which contained specific quantities of bacteria, pollen and mold, to better represent normal air. Paterno believes that this new background air sample more accurately mimics real life air sampling situations, which should allow researchers to better calibrate bioaerosol detectors in the laboratory, for a reduction in false alarms and more stringent testing before the detectors are subjected to field use.

Jabbour presented a new method for identifying and differentiating deadly bacterial strains. Using mass spectrometry-based proteomics (MS) to detect and identify the outer membrane proteins of different pathogenic bacteria, results showed the ability to detect unique proteins across bacterial genus, species and strain levels, which could be fed into a database to identify and differentiate bacteria from unknown samples. Jabbour compared his new method to "catching all the fish with a net, rather than specific ones with a bait," as he could detect multiple proteins and use specially designed algorithms, ABOid, to sort the fish (i.e., bacteria). This method is faster than targeting single proteins or bacteria, which are typically more difficult to detect in unknown samples. This MS technique is effective and comparable to more traditional genomic techniques.

Research presented by Guicheteau revealed that Raman spectroscopy could be used to detect temporal changes in bacterial spores (three different Bacillus species) in deionized water. Guicheteau found that he could create Raman spectral fingerprints of spores periodically over seven days of soaking in deionized water and correctly distinguish between the different spore species. He also discovered that the supposed dormant, yet viable spores exhibited significant changes in spectra during the resting time in non-nutrient rich medium (deionized water). Guicheteau suspects that the spores may have been testing the water for proper growth conditions, a hypothesis he plans to test in follow-on experiments.

Harden presented his recent work to modify the Joint Chemical Agent Detector (JCAD) M4A1 model for detection of explosives vapor. The JCAD is currently used by U.S. Soldiers for the detection of chemical warfare agents (G, V and H series). The JCAD uses ion mobility spectrometry to detect these agents – Harden is working to optimize the detection parameters, making maximum use of detector software and algorithms and minimum modifications to detector hardware, to sensitively and selectively detect explosives, as well as the chemical agents. Thus far, the JCAD has been observed with a limit of detection of less than 10 parts per billion for volatile explosives, like TNT and taggants in plastic explosives, with excellent precision, fast response and fast clearing times, suggesting that it could be used in the field for explosives detection in the near future.

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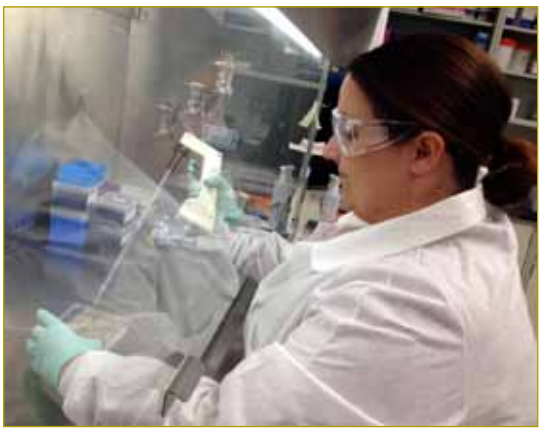
Kristen Willis: Portrait of an ECBC Postdoctoral Associate

In the second of a series of articles on U.S. Army Edgewood Chemical Biological Center (ECBC) postdoctoral associates, the *R&T Connection* sat down with Kristen Willis, Ph.D., an associate in the National Research Council's (NRC) Postdoctoral Resident Research Associateship Program (RAP). From her work with stem cells to her love of music to her three dogs, Willis has multi-faceted interests.

After receiving her B.S. in microbiology from Cornell University, Willis went on to the University of Illinois, where she earned her M.S. and Ph.D. also in microbiology. "Biology was always my favorite subject," she said.



Kristen Willis, Ph.D., feeds stem cells by adding growth media. Feeding has to be performed daily to maintain healthy, human stem cells.

During her doctoral studies, she worked in a virology lab. "This was my dream come true. I'd always wanted to do virus work," Willis said. "When the opportunity presented itself to work with stem cells here at ECBC, it was another fascinating area of science for me to experience. Both my virology work and stem cell work require the ability to culture cells, so I had the necessary skills."

Willis said that the NRC postdoctoral program was a perfect fit for her after she completed her Ph.D. "The NRC program provided me with the unique opportunity to work as a postdoc in a government lab, specifically in a defense research lab," she said. "And ECBC was a perfect fit for my husband (a chemical engineer in the R&T Directorate) and me as it provided career opportunities for both of us despite the fact that we work in different disciplines."

She hopes to stay at ECBC after her postdoctoral residency, possibly to return to virus research merging her new stem cell experience.

Willis started with the program in October 2010 but spent her first year onsite at Johns Hopkins University. She transitioned to ECBC full time the following year. Willis is working with a stem cell team under the direction of Harry Salem, Ph.D., ECBC chief scientist for the life sciences. The project is funded by the Defense Threat Reduction Agency.

"I'm always so impressed with our talented postdoctoral associates," said Salem. "They arrive at ECBC with plenty of energy as well as expertise with the latest technology. It's enjoyable to work with them."

"We're all working on stem cell related projects," said Willis. "My focus is toxicity of the nervous system. I'm differentiating human stem cells to create neurons, which can be used to develop an in vitro system for screening neurotoxic chemicals or chemicals of interest to the Army. Ultimately, we hope to have a system that will yield human toxicity information for both known chemicals and unknown chemicals in order to predict how these unknown chemicals will affect humans."

Willis explained that the ECBC team works exclusively with induced pluripotent stem cells (IPSCs), which are derived from adult tissue. "One of the great advances in the stem cell field was the development of human induced pluripotent stem cells in 2007. This discovery allowed for the use of skin samples or other adult tissues as a source of cells, which are then reprogrammed to act like embryonic stem cells."

ECBC obtains its cells from the Wisconsin International Stem Cell Bank (or WISC Bank), which serves researchers engaged in non-commercial research at academic or not-for-profit institutions.

What constitutes a typical day for a postdoctoral associate? Willis said that she spends about half her day working in the lab, with the rest of the day focused on reading, writing papers, participating in meetings and updating lab notebooks.

While her academic career has been focused on biology, Willis noted that, in high school, she briefly considered becoming a musician and she played the oboe and clarinet through college. Although she does not have the time to play now, she would like to pick it up again as a hobby in the future. "I see connections between music and science," she said. "They both require a lot of dedication and practice. I'm a type A personality who enjoys structure."

Willis also enjoys spending time with her three dogs, including a one-year-old spirited Bassett hound.

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ECBC's BioTechnology Branch Recognized by DoD for Standardization Efforts

Each fiscal year, the Defense Standardization Program Office (DSPO) honors individuals and organizations of the Defense Agencies who achieve significant improvements in interoperability, cost reduction, quality, reliability and readiness through standardization. Four individuals from the U.S. Army Edgewood Chemical Biological Center's (ECBC) BioTechnology Branch – Roy Thompson, Darrel Menking, Heather Welsh and Melody Zacharko – were recognized by Stephen Welby, the Deputy Assistant Secretary of Defense for Systems Engineering, during an awards ceremony March 14, 2012, in the Pentagon's Hall of Heroes.

Warfighters depend on accurate detection and identification systems to protect them from the threat of biological agent attack. Antibodies that recognize and bind specific biological entities (e.g., bacteria, viruses or toxins) play a key role in fielding detection/diagnostic devices for the Department of Defense (DoD).

Antibodies can be produced in many forms and exhibit different properties depending on temperature, buffer, concentration and pH. The effectiveness of an antibody in a given detection platform critically depends on whether its biophysical properties are within a fixed parametric range that will accurately predict how it functions in a given scenario: structure=function.

Now, Army scientists have established a standard for characterizing the biophysical properties of antibody production lots. The BioTechnology Branch, in support of the DoD Joint Program Executive Office for Chemical and Biological Defense, Critical Reagents Program (CRP), has developed and validated an ISO 17025:2005-certified antibody quality management system that generates data significant enough to enable early decision-making in accepting or rejecting antibody production lots. But first they had to go against the flow of traditional laboratory practice.

"The biggest challenge we faced in implementing our antibody quality management system," said Roy Thompson, BioTechnology Branch chief and quality program champion, "was training the mind-set of laboratory scientists to focus on the exacting day-to-day requirements for documentation and accurate record-keeping an ISO-certified Quality Management System requires." Once they learned to make a dividing line between our quality system requirements and their other R&D activities, he said, they became much more accepting and eager to participate in the new system.

With the Antibody Quality Management System in place, the previous frustration of wondering why a given antibody performed poorly in an assay platform was significantly mitigated, along with the sole available conclusion that the antibody production lot was bad and had to be replaced at significant time and cost.

Only five team members could be listed in the award nomination, but the honor could not have been achieved without the support of the ECBC BioTechnology Branch team. From left to right: Patricia Buckley, Melody Zacharko, Heather Welsh, Candice Warner, Darrel Menking and Roy Thompson.

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Fifth National Bio-Threat Conference Focuses on Solving Real-World Problems

The Fifth National Bio-Threat Conference, a collaborative interagency effort held March 27-29, provided a forum for dialogue between government, industry, academia and first responders to address critical issues in environmental sampling, bio-detection, clinical diagnostics and biosurveillance.

"What makes this conference stand out from others is its focus to solve real-world problems of service members and emergency responders," said Peter Emanuel, Ph.D., one of the organizers of the Fifth National Bio-Threat Conference and BioSciences Division Chief at the U.S. Army Edgewood Chemical Biological Center (ECBC). "Each organization showcased research and technologies that ensure our service members, first responders and laboratory technicians are prepared and well-equipped against emerging biological threats."

"For example, the American Society for Testing Materials, or ASTM, sampling standard was established as a direct result of collaborative efforts and community consensus sparked by the Bio-Threat Conference series," he continued. "This standard conventionalized the process of sampling suspicious powders within the emergency responder and military community."

According to Emanuel, this year much of the discussion revolved around biosurveillance, a collection of programs and capabilities that allow experts to recognize a pandemic before it becomes a pandemic.

"For a topic as complex as biosurveillance, it is key to use a multi-disciplinary approach, share information and collaborate," he stated. "There is no better place than the Bio-Threat Conference to harness the brightest ideas, because we always have world-class experts from many different disciplines and organizations contribute to leading-edge biological defense solutions."

"Global biosurveillance at its essence is a collaborative endeavor," Emanuel added. "A disease that begins on a farm in Mumbai can quickly make its way to Miami."

He concludes that conversations at this conference are vital to identify and react to biological threats proactively as the world becomes a smaller place each day.

"ECBC has a long tradition of solving problems for emergency responders," he said. "We've always been a key player in developing smart solutions to counter emerging biological threats."

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ECBC Branch Recognized for Standardization Efforts

At $100 per milligram replacement cost, remanufacturing just one gram of antibody due to quality issues costs the DoD Critical Reagents Program $100K. This is money saved if the CRP can reject the production lot on delivery. With inventory volumes commonly exceeding 5 grams (5000 milligrams) per antibody and up, and the CRP selling antibodies for $6-700 per milligram, the potential market value of the CRP inventory easily exceeds hundreds of millions of dollars.

"I couldn't be happier with the success we are realizing with this effort," said Bruce Goodwin, deputy director of the JPEO-CBD Critical Reagents Program. "Not only did we accomplish our initial goal of developing and implementing a quality system that received ISO 17025:2005 accreditation for three test methods, it also established a web-based CRP antibody database." The Joint Acquisition CBRN Knowledge System (J.A.C.K.S.) database is accessible worldwide for authorized users to obtain up-to-date information on test reports, repository inventory levels, and status on current lots.

The value of the BioTechnology Branch's Antibody Quality Management System and standardization of testing has also been recognized by others for its added value. The Defense Advanced Research Projects Agency (DARPA) selected the BioTechnology Branch as its independent test laboratory to evaluate methods for improving antibody stability and affinity in its Antibody Technology Program, and the Defense Threat Reduction Agency (DTRA) Joint Science and Technology Office has provided additional funding for developing new methods for biophysically characterizing antibodies and other proteins.

"I think the Defense Standardization Program achievement highlights ECBC's commitment to formalized quality management systems and the positive impact they have on supporting our mission," said Peter Emanuel, Ph.D., chief of the ECBC BioSciences Division.

But Thompson and his team, including Patricia Buckley, Candice Warner, Alena Calm, Jacqueline Harris, Heather Welsh and Darrel Menking, won't be resting on their laurels following the ceremony. In FY12, they plan to add two additional antibody test methods to their ISO 178025:2005 Scope of Accreditation and continue their efforts to provide the JPEO-CBD CRP with the best quality materials for saving warfighter lives.

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Fifth National Bio-Threat Conference

One of ECBC's closest partners, the Joint Program Executive Office for Chemical and Biological Defense (JPEO-CBD), co-hosted this conference and led multiple discussions that addressed next-generation biosurveillance techniques and improvements.

"This conference was very valuable to what we are trying to accomplish within the Department of Defense," said Lt. Col. Jennifer Nicholson, JPEO-CBD director for Biosurveillance Strategic Initiatives. "The biosurveillance mission is very diverse, and therefore it is beneficial to have a wide range of organizations here that look at problems from various angles."

Henry S. Gibbons, Ph.D., discusses his work at a poster session.

ECBC Research Biologist Brady Redmond, Ph.D., who is currently matrixed to JPEO-CBD described this conference as "a reunion of long-time colleagues that share a comfort level, which is conducive to a considerable amount of business."

"ECBC plays a huge role in biosurveillance," he said. "The Center is also known as a test bed for biosurveillance systems and methods."

Sponsors and major contributors to this conference included the Department of Homeland Security, the Environmental Protection Agency as well as the Department of Defense's JPEO-CBD, Joint Project Manager Biological Defense, and Joint Project Manager Guardian.

Please find more photos of a poster session at the Fifth National Bio-Threat Conference at the ECBC Flickr gallery.

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Take Our Word for It!

Congratulations to the many R&T staff who are spreading the good word through technical reports and publications. Here is a sampling of recent work:

TECH REPORTS

- VX Studies in Support of the Contact Hazard DTO and Recommendations for Human Toxicity Estimates, S. Reutter-Christy et al.
- Discrimination of Pathogenic vs. Non-pathogenic Francisella tularensis and Burkholderia pseudomallei Using Proteomics Mass Spectrometry, M. Wade et al.
- Physical Properties and Spectral Characterization of EA 6032 (U), A. Butrow et al.
- Novel Cell-Based Assays for Detecting Low Levels of Active Ricin Following Decontamination, L. Wallace et al.
- Respiratory Protection Technology Assessment of the Future Chemical Biological Ground Soldier System Technology Demonstration Project, D. Barker et al.

PUBLICATIONS

- Ben-David, A. & Davidson, C. Probability theory for 3-layer remote sensing radiative transfer model: univariate case. Optics Express, Vol. 20, Issue 9, pp. 10004-10033 (2012) link
- Ben-David, A. & Davidson, C. On the use of covariance and correlation matrices in hyperspectral detection. Applied Imagery Pattern Recognition Workshop (AIPR), Oct. 11-13, 2011. IEEE link
- Jabbour, R., Wade, M., Deshpande, S., Stanford, M., Zulich, A. and Snyder, P. Comparative proteomics of tandem mass spectrometry analyses for bacterial strains identification and differentiation. Chapter in Tandem Mass Spectrometry - Applications and Principles. InTech, February, 2012.
- Miklos, A., Buckley, P., Calm, A., Welsh, H. et al. Structure-based design of supercharged, highly thermoresistant antibodies. Chemistry & Biology, Volume 19, Issue 4, 449-455, 20 April 2012. link
- Peterson, G. et al. Sulfur dioxide and nitrogen dioxide adsorption on zinc oxide and zirconium hydroxide nanoparticles and the effect on photoluminescence. Applied Surface Science. Volume 258, Issue 15, 15 May 2012, Pages 5778–5785. link
- Wick, C. The use of mass-spectrometry-based proteomics for reliable detection and identification of pathogens as illustrated by the study of bee colony collapse disorder. Spectroscopy. March 1, 2012. link

R&T Directorate Staff Recognized With Patents

- Patent # 8,124,936 - Stand-Off Chemical Detector, William Lagna
- Patent # 8,129,149 - Rapid and Sensitive Method to Measure Endonuclease Activity, Robert Dorsey, Russell Dorsey, Ph.D.
- Patent # 8,146,446 - Concentrator Device and Method of Concentrating a Liquid Sample, Charles Wick, Ph.D. (Retired)
- Patent # 8,164,742 - Photopolarimetric Lidar Dual-Beam Switching Device and Mueller Matrix Standoff Detection System and Method, Arthur Carrieri, Erik Roese, Jerold Bottiger (Retired)
- Patent # 8,151,630 - Quantitative Fit Test System and Method for Assessing Respirator Biological Fit Factors, Paul Gardner

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Mark Your Calendar!

Research and Technology Directorate staff are invited to attend the Computational Chemistry Workshop, scheduled for May 17, 2012, at 10:30 a.m. in E3330, room 134. For more information, please contact Dr. Jerry Cabalo.

HR Tip

Did you know you can enroll or make changes any time to the Thrift Savings Plan (TSP)? Follow the link at www.tsp.gov or call the plan administrator, ABC-C, at 1-877-276-9287.

Financial Tip

Start of Work: Keep in mind that work cannot be performed, services cannot be provided and items cannot be purchased prior to receiving funding without proper approvals and/or if costs exceed available funding. The purchase of items or services without approval or available funding is an unauthorized commitment of government funds, and the employees responsible can be held liable for payment. *(DoD FMR Vol 14, Ch 2)*

Upcoming S&T Conferences

- 2012 CBRN JIIM-IA Conference & Exhibition, June 26-27, 2012, Ft. Leonard Wood, MO link
- 2nd World Congress on Proteomics and Bioinformatics, July 2-4, 2012, Las Vegas, NV link
- 6th Annual Chemical Sector Security Summit & Expo, July 30 – August 1, 2012, Baltimore, MD 21201 link
- 2nd World Congress on Virology, August 20-22, 2012, Las Vegas, NV link
- 3rd World Congress on Biotechnology, September 13-15, 2012, India link
- World Toxicology Summit and Expo, September 17-19, 2012, San Antonio, TX link
- Federation of Analytical Chemistry and Spectroscopy Societies 39th Annual Meeting, September 30 – October 4, 2012, Kansas City, KS link
- World Congress on Forensic Research and Technology, October 15-17, 2012, Chicago, IL link
- International Conference on Biothreats & Biodefense, October 16-17, 2012, San Francisco, CA link
- 3rd World Congress on Analytical and Bioanalytical Techniques, November 22-24, 2012, India link

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Tragedy Spotlights DTRA Technology Development Supported By ECBC

A technology that initially was developed as a counter-proliferation system to interrogate chemical, biological, radiological and nuclear (CBRN) clouds generated in an attack, and conduct battle damage assessments, was wanted for an additional purpose: civil defense.

"WACS is the first all-in-one chemical, biological, radiological and nuclear unmanned aircraft system for locating, intercepting and collecting CBRN materials," said Britt Kelley, Unmanned Aircraft Systems (UAS) integration manager and WACS program manager (PM). "We weren't thinking of using WACS to interrogate natural or man-made disasters like Fukushima when we began development, but of course it's perfect for that."

The WACS team was just completing the first fully integrated flight tests when the call came in to go to Japan. Although the system was not fielded and was still in the research prototype phase, the system was ready to perform when needed. This was due to years of development and testing starting with chemical collection and real-time chemical detection/identification reporting to ground forces, and biological collection.

ECBC was in on the project from the beginning. The original chemical collection with real-time chemical detection/identification work was conceived and developed by the Research and Technology (R&T) Directorate's Chemical-Biological Point Detection Branch in collaboration with Science Applications International Corporation and Smiths Detection-Watford, with assistance from members in the Engineering Directorate under the Associate Director, Joint & Interagency Division. The ECBC team also engineered parts of the system that make these capabilities effective. Their "Rapid Prototyping" accelerated engineering and manufacturing ability enabled the team to machine the shell and wing pods that contain the system components in only a few days in response to the Fukushima disaster.

"The Research and Technology Directorate, with the support of other ECBC components, has the ability to develop solutions over the course of their lifecycle, from research to fielding," said Augustus W. Fountain, III, Ph.D., R&T acting director.

The flexibility and rapid response of the WACS team to the Fukushima disaster demonstrated the program's and DTRA's commitment to U.S. Pacific Command and the Government of Japan to assist in civilian humanitarian relief operations. Though the WACS team was fully prepared to deploy in under a week, the Japanese government ultimately decided against employing WACS. The Japanese Minister of Defense personally thanked DTRA during a visit in 2011 for its willingness to provide support in a time of crisis.

The WACS team faced many challenges and accomplished a full spectrum of tasks ranging from completing system testing, conducting a capstone technology demonstration, and integrating the capability with the Soldier in 2011. Major milestones were accomplished using combined testing and aviation teams with personnel from eight cross-divisional and multi-agency teams including U.S. Forces Korea, U.S. Army Program Manager Unmanned Aircraft Systems, U.S. Army Aviation and Missile Research Development and Engineering Center, ECBC, U.S. Navy THIRD Fleet, Naval Research Laboratory, West Desert Test Center-Special Programs Division and Johns Hopkins University Applied Physics Lab.

The outstanding performance of the WACS system provided the basis for Kelley to initiate a technology transition agreement and proceed with a plan to transition WACS to the Army. U.S. Forces Korea has already signed a WACS Concept of Operations to implement the system into its operations.

The DTRA director conferred his Annual Team Award – Large Team honors on the PM Unmanned Aircraft Systems in March. Members of the ECBC cross-directorate collaborative team who played a role in the accomplishment received the good news shortly thereafter. The team includes members from the CB Point Detection Branch (CBPD, CB Detection Division, R&T Directorate) and the Engineering Design & Analysis (EDA) and Rapid Technologies and Inspection (RTI) Branches (Engineering Directorate, Advanced Design and Manufacturing Division). Team members are: Vince McHugh (CBPD, WACS team leader), C. Steve Harden (SAIC supporting CBPD), Rob Schafer (SAIC supporting CBPD), Lester Strauch (EDA), Brad Ruprecht (RTI), Gretchen Blethen (CBPD), and Brian Ince (CBPD).

From left to right: Vince McHugh, C. Steve Harden, Rob Schafer, Lester Strauch, Brad Ruprecht.