Radiological /Nuclear Medical Preparedness: Operationalizing a Decade of Development

The RITN is a cooperative effort of the National Marrow Donor Program® (NMDP)/Be The Match and the American Society for Blood and Marrow Transplantation (ASBMT).

Jointly Provided by:

National Marrow Donor Program® / Be The Match®

Medical College of Wisconsin CME program

Supported by:

Office of Naval Research Science & Technology

RITN Key Partners:

ASBMT – American Society for Blood and Marrow Transplantation

ASPR – Assistant Secretary for Preparedness and Response

astho

HRSA – U.S. Department of Health and Human Services, Health Resources and Services Administration

NACCHO – National Association of County & City Health Officials

National Alliance for Radiation Readiness

RadCCORE – Radiation Countermeasures Center of Research Excellence @ Duke School of Medicine

World Health Organization

reac/ts

EBMT – European Society for Blood and Marrow Transplantation

REMM – U.S. Department of Health & Human Services, Radiation Emergency Medical Management

WBMT

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Workshop Overview

Title: Radiation/Nuclear Medical Preparedness: Operationalizing a Decade of Development

Workshop Description:

The workshop will highlight the most recent research and developments in the field of radiological/nuclear emergencies, including the Federal Concept of Operations, patient movement, the Public Health Emergency Medical Countermeasure Enterprise (PHEMCE), operational best practices, and biodosimetry.

Target Audience:

Physicians, and other clinicians, support staff, emergency managers, research scientists, and appropriate federal agency staff involved in radiation response and treatment of patients with bone marrow toxicity.

Learning Objectives:

At the completion of this workshop, attendees will be able to:

1. Discuss progress in research on radiological countermeasures and biodosimetry.
2. Explain best practices from RITN hospitals.
3. Evaluate medical and societal effects from a pertinent recent incident.
4. Describe current gaps identified in federal planning efforts to prepare for a radiological disaster.

National Marrow Donor Program (NMDP):

The NMDP facilitates unrelated marrow, PBSC and cord blood transplants. The NMDP also provides research, medical education and patient advocacy to extend and improve lives through innovations in transplantation.

Non-Endorsement of Products:

The opinions expressed in this workshop are those of the participating faculty. Approval of this workshop does not imply endorsement by the workshop providers or ACCME and ANCC of any commercial products discussed.

Verification of Participation and Continuing Education:

To receive continuing education credit for this workshop, attendees must attend the workshop sessions and complete the **Activity Evaluation and Verification of Participation online by August 25, 2017.** Credits will not be granted retroactively. Certificates will be sent to participants following completion of the evaluation.

Continuing education credit is available for:

MEDICAL COLLEGE OF WISCONSIN

CME program

- **Physicians**: This activity has been planned and implemented in accordance with the Essential Areas and policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship of the Medical College of Wisconsin and American Society for Blood & Marrow Transplantation. The Medical College of Wisconsin is accredited by the ACCME to provide continuing medical education for physicians.

  <u>Hours of Participation for Allied Health Professionals</u>

  The Medical College of Wisconsin designates this activity for up to 8.75 hours of participation for continuing education for allied health professionals.

  Nurses: The National Marrow Donor Program is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation (COA). Up to 8.75 contact hours may be claimed for this educational activity.

- All other health care professionals requesting continuing education credit for this activity will be issued a certificate of attendance.

Speaker/Planner Disclosures

It is the policy of the providers of this program to ensure balance, independence, objectivity, scientific rigor and content that is free of commercial bias and outside the control of persons or organizations with an economic interest in influencing the content in all of its sponsored educational activities. Therefore, all planning committee members and speakers are required to disclose their relevant financial relationships and any or apparent conflicts of interest to the content of their presentations have been identified and resolved. The audience shall be informed of all relevant financial relationships, including the source of any commercial support for this forum.

Speakers/Planners:

These individuals have disclosed the following pertinent financial relationships:

Cullen Case	3M (Spouse/Employment)
Anita D' Souza, MD	Celgene, Merck (Research Funding)
Thomas MacVittie	Innovation Pathways, Inc; Pluristem Therapeutics Inc (Advisor/Consultant fees)

These relationships were reviewed via the MCW conflict of interest resolution process and resolved. All other planners and speakers had no relevant disclosures.

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Radiological/Nuclear Medical Preparedness: Operationalizing a Decade of Development

July 25-26, 2017 | Hilton, Rockville, MD

Day 1		
11:00-1:00	**Registration Opens - Lunch on own**	
The Situation	**Session Chair: Cullen Case**	
1:00-1:45	ASPR and RITN: Past as Prologue for National IND Preparedness	Korch, ASPR
1:45-2:15	NTI's Role in Reducing the Radiological Dirty Bomb Threat	Nalabandian, NTI
2:15-3:00	Orlando Health Response to the Pulse Nightclub Tragedy (Medical Surge Case—Orlando)	Alberts, Orlando Health
3:00-3:15	**Break**	
Progress	**Session Chair: Julie Wilhauk**	
3:15-3:45	Responding to a Medical Mass Casualty After Years of Preparation (Medical Surge Case – Seattle)	Lien, NWHRN
3:45-4:30	PHEMCE and ASPR Successes and Future Directions	Homer, BARDA Coleman, ASPR Hrdina, ASPR
4:30-5:00	FDA Changes that Expedite MCM Development	Marzella, FDA
5:00	**Conclusion of Day 1**	
5:00-7:00	**Networking Reception** - Cash Bar and Hors d'oeuvres (*Hilton Atrium*)	

Day 2		
9:00-12:00	**Track 1: Research Updates**	**Track 2: Operations**
Biodosimetery **Session Chair: Nelson Chao**		**Operational Response Considerations** **Session Chair: Cullen Case**
9:00-9:15	Establishing Gene Expression as an Early and High-Throughput Tool for Prediction of the Hematological Acute Radiation Syndrome (Abend)	2015 RITN Fullscale Exercise in the Rockies (Conroy)
9:15-9:30	Evolutionarily Conserved Serum MicroRNAs Predict Radiation-Induced Fatality in Non-Human Primates (Chowdhury)	Integrating RITN Center Response with Local, State and Regional Preparedness Partners (Reissman)
9:30-9:45	Cutaneous Radiation Injuries in the Aftermath of an Improvised Nuclear Detonation (Clay)	The Intersection of Public Health, Radiation Control, and Healthcare Priorities for Radiation Emergency Preparedness (Puerini)
9:45-10:00	Biomarkers and Biodosimetry (Jacob)	Preparing for Radiation Casualties: When to Administer Radiation Mitigators? (Greenberger)
10:00-10:15	Rapid Prediction of Hematological Acute Radiation Syndrome in Radiation Injury Patients Using Peripheral Blood Cell Counts (Abend)	The Value of Conducting a Multi-Disciplinary Real-Time Functional Exercise (Johnson)
10:15-10:30	Q&A	NDMS Patient Movement (Hopper)
10:30-10:45	**Break**	
Day 2 Continues on next page...		

*indicates sessions where continuing education credit is not available

Radiological/Nuclear Medical Preparedness: Operationalizing a Decade of Development

July 25-26, 2017 | Hilton, Rockville, MD

Day 2 (continued)		
Medical Countermeasure New Research, Novel Devices or Therapies for Radiation Damage Diagnosis and Treatment Session Chair: Nelson Chao		**New developments in response planning Session Chair: Sam Shartar**
10:45-11:00	Reversal of Radiation Damage to Marrow Stem Cells by Mesenchymal Stem Cell Derived Vesicles (Quesenberry)	Recommendations for the Operation of Contaminated Medical Infrastructure after an Improvised Nuclear Device (IND) Detonation (White)
11:00-11:15	CDX-301 - A Novel Radiation Countermeasure (Kumar)	Enhancing National Preparedness through Biodosimetry (Wathen)
11:15-11:30	Thioredoxin Enhances Hematopoietic Stem Cell Recovery and Protects Mice from Radiation-Induced Death (Sundaramoorthy)	Important Issues to Consider in the Implementation of a Biodosimetery Program (Salame-Alfie)
11:30-11:45	The Toll-Like Receptor 2 Antagonist, FSL-1 Lipopeptide, Therapeutically Mitigates Acute Radiation Syndrome (Guo)	Overview of the Medicare and Medicaid Programs; Emergency Preparedness Requirements for Medicare and Medicaid Participating Providers and Suppliers; Final Rule* (Blondiaux)
11:45-12:00	CaMKK2 Regulates the Hematopoietic Stem Cell Response to Radiation (Racioppi)	ASPR TRACIE: Your Healthcare Emergency Preparedness Information Gateway (Mazurek)
12:00-1:00 - Lunch – Buffet in Hallway		
Rejoin as One Group		
Industry Update	**Session Chair: Ann Jakubowski**	
1:00-1:10	Development of Sargramostim (rhu GM-CSF; Leukine®) as a Medical Countermeasure for the Treatment of Hematopoietic Acute Radiation Syndrome Under the "Animal Rule"* (Nicholas Clayton – Sanofi)	
1:10-1:20	Placenta-Derived PLX-R18 Stromal Cells as Mitigators of H-ARS - Pre Clinical Findings and MoA*(Racheli Ofir – Pluristem)	
1:20-1:30	Radiation Biodosimetry Test Systems* (Bob Terbrueggen – DxTerity Diagnostics)	
1:30-1:40	Status of the Development of Lyophilized Human Platelets for Treatment of Radiation Injury* (Todd Getz – Cellphire)	
1:40-1:50	Lessons Learned from the Advanced Development of AEOL 10150 as a Medical Countermeasure Against Radiological and Chemical Threats* (John McManus – Aeolus)	
1:50-2:00	Development of Human Ghrelin as Mitigator for Acute Radiation Injury* (Weng-Lang Yang – TheraSource)	
2:00-2:15	**Break**	
Putting It All Together	**Session Chair: Nelson Chao**	
2:15-3:15	Panel: Neupogen and Neulasta: Short-Term Gain, Long-Term Benefit or Consequences (MacVittie, Booth, and Cohen)	
3:15-4:00	Emerging Scientific Advances and Their Implications for Security (Casagrande)	
4:00-4:30	**Recap Summary and Conclusion**	

**indicates sessions where continuing education credit is not available*

ASPR and RITN: Past as Prologue for National IND Preparedness

George W. Korch, Ph.D.

This plenary session reflects upon 10+years of partnership and effort between ASPR, RITN, and others in preparing the United States for the medical consequences of a nuclear detonation. Additionally, potential future objectives and endpoints are suggested. The goal is to provide background and to introduce subjects that will receive more detail throughout the workshop.

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The United States Government (USG) and partners have made significant progress in preparing the Nation for response to an improvised nuclear detonation (IND) and charted a course for future development and improvement. Since 2005, the Radiation Injury Treatment Network (RITN) has been an important partner with ASPR solving complex problems associated with IND and has been integrated into the National response (Ross JR, et al., Radiation Injury Treatment Network (RITN): Healthcare Professionals Preparing for a Mass Casualty Radiological or Nuclear Incident. Int J Radiat Biol. 2011 Aug; 87(8): 748–753).

In 2015, the overall evolution and trajectory of these efforts was described as the Nuclear Incident Medical Enterprise (NIME) (Coleman CN, et al., Public Health and Medical Preparedness for a Nuclear Detonation: The Nuclear Incident Medical Enterprise. Health Phys. 2015 Oct; 108(2):149–160.). The NIME paradigm integrates contributors, levels, approaches, outcomes, and future requirements. It begins with science basis and works through coordination, scenarios, preparedness and response requirements, planning, policy and response guidance and continues through developing capabilities. Existing and evolving response capabilities across decision making, communication, organization, triage, medical management and care are components of the phased matrix.

The National Planning Guidance for Response to a Nuclear Detonation (White House National Security Staff, 2nd Edition, June 2010), summarizes the determination of National experts that capacity to assess and treat IND casualties will be exceeded. This session describes progress to resolve that issue, discusses implementation efforts, and suggests foci for additional efforts. The goal is to highlight where the RITN network, facilities, and experts collaborated with ASPR to inform efforts that maximize lives saved in the resource constrained environment anticipated following an IND and to suggest areas for continued collaboration.

RITN's work with ASPR at the strategic policy level provides critical knowledge and thinking in development of medical countermeasures through the Public Health Emergency Medical Countermeasures Enterprise (PHEMCE), the Biomedical Advanced Research and Development Authority (BARDA), and the National Preparedness and Response Science Board (NPRSB) (2016 PHEMCE Strategy and Implementation Plan - https://phe.gov/Preparedness/mcm/phemce/Pages/strategy.aspx). These collaborations have focused on triage challenges, biodosimetry and diagnostics, patient transport, and patient care and management guidance for use across the Nation (Radiation Emergency Medical Management. REMM – https://www.remm.nlm.gov/).

For IND medical response, evidence and science-based concepts developed over the last decade are now incorporated into National policies and plans (FEMA Nuclear/Radiological Incident Annex to the Response and Recovery: Federal Interagency Operational Plan - https://www.remm.nlm.gov/NRIA_FINAL_110216.pdf). These have transitioned into exercises, implementation, and early development of a National Concept of Operations. Novel medical countermeasures, assays, and diagnostics have emerged and are in the process of production and stockpiling, and utilization constructs being developed (https://www.medicalcountermeasures.gov/barda.aspx). As this integrated system matures, the understanding of specific metrics to define operational capability determinants grows (Ajao, A; Nystrom, SV, et al. Assessing the Capacity of the US Health Care System to Use Additional Mechanical Ventilators During a Large-Scale Public Health Emergency, Disaster Med Public Health Preparedness. 2015; 0:1-8) and RITN is collaborating on future efforts to this end. This presentation summarizes past and existing collaboration, progress, and the future of ASPR, RITN, and other partner efforts to prepare the Nation for the medical consequences of an IND.

NTI's Role in Reducing the Radiological Dirty Bomb Threat
Michelle Nalabandian, M.S.

NTl's Role in Reducing the Radiological Dirty Bomb Threat

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The risk of a radiological "dirty bomb" attack remains dangerously high globally. Governments and the private sector must work together to raise awareness about the threat, develop a more secure system for protecting radiological sources, and replace dangerous isotopes with alternate technologies, where feasible, for permanent threat reduction. World leaders at the 2014 and 2016 Nuclear Security Summits put a spotlight on the radiological threat, and several countries have begun the important step of eliminating the most dangerous isotopes, such as cesium-137, which is used in medical equipment. Although these are important steps, a more urgent global effort is needed to reduce this significant risk. This presentation will highlight the threat posed by radiological sources globally as well as the Nuclear Threat Initiative's (NTl) role in mitigating risks posed by these sources.

Orlando Health Response to the Pulse Nightclub Tragedy (Medical Surge Case—Orlando)
Eric Alberts, B.S., CEM, CHS-V, FPEM, FPEM-HC, CDP-1, CHPP, CHEP, SEM, CFRP, FABCHS

Violence and Mass Casualty Incident Response: Lessons Learned from the Pulse Nightclub Shooting in Orlando, FL on June 12, 2016

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This presentation will explore how healthcare providers can prepare for and respond to incidents involving violence. Lessons learned will be explored on "no notice" incidents such as the Pulse Nightclub shooting in Orlando Florida.

Discuss major lessons learned during the response to this incident to identify any gaps in preparedness efforts which will enable participants to be better prepared for a major incident in their community.

- Explain the impact of the incident on hospital operations.
- Provide a timeline of events to demonstrate the fast pace nature of the incident and the importance of communications.
- List the primary challenges identified by hospital staff during and immediately following the incident.
- List the hospital programs or policies maintained or strengthened based on their successful contribution to the response.
- Provide takeaways for the audience.

Responding to a Medical Mass Casualty After Years of Preparation (Medical Surge Case – Seattle)
Onora Lien, B.A., M.A.

This session will review lessons learned from 2015 response to a large mass casualty incident in Seattle. It will describe the systems that have been built to manage a large healthcare response, how they were leveraged to respond to an emergent situation and lessons learned including patient tracking and reunification.

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This session will review lessons learned from 2015 response to a large mass casualty incident in Seattle. On September 24, 2015, a charter bus and a Ride the Duck amphibious vehicle (tourist activity) collided on a Seattle area bridge, resulting in 5 deaths and nearly 70 injured who were transported to 7 area hospitals. Adding to the complexity of this incident, most patients were foreign nationals from one of 14 countries. Based on the work of the Northwest Healthcare Response Network, a large emergency management healthcare coalition based in Seattle, WA, and its members, this session will describe the systems that have been built to manage a large healthcare response, how they were leveraged to respond to an emergent situation and lessons learned including patient tracking, family reunification and coordination of a health emergency with community and local, state and federal partners.

PHEMCE and ASPR Successes and Future Directions
Mary Homer, Ph.D.
C. Norm Coleman, M.D.
Chad Hrdina, M.S.

This session will include a review of PHEMCE and ASPR past accomplishments and future directions.

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The Public Health Emergency Medical Countermeasure Enterprise (PHEMCE), led by the Assistant Secretary for Preparedness and Response, has had significant advances over the past 10 years. Advancements in policy, operations, emergency medical management, SNS management, medical countermeasure development, licensure, and procurement as well the evolution of a new concept area of CBRNE Science are all key accomplishments. Iterative collaboration among all PHEMCE partners has been critical and instrumental in pushing initiatives forward. A retrospective review of these accomplishments and description of collaborative efforts will be discussed. Future directions for all aspects of USG HHS Radiological/Nuclear preparedness will be presented.

FDA-Changes that Expedite MCM Development

Libero Marzella

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Over the past decade, the FDA has worked to streamline medical countermeasure approval and development process to assist with response planning and improving the US's capabilities. The animal rule has been instrumental in part of this improvement as well as other steps taken. The need for change, changes implemented and the results realized will be discussed.

Establishing Gene Expression as an Early and High-Throughput Tool for Prediction of the Hematological Acute Radiation Syndrome
Michael Abend, Prof. Dr. MSc.

We identified a radiation-induced gene signature measured in the peripheral blood to predict the later occurring hematological acute radiation syndrome (HARS). Next step is a forward-deployable device.

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We aimed to predict the later occurring hematological acute radiation syndrome (HARS) and its severity based on early detected changes in gene expression. Using peripheral blood from baboons irradiated with 2.5 or 5 Gy (whole body equivalent dose) we examined changes in gene expression occurring 1 and 2 days after exposure in relation to unexposed blood samples (pre-exposure samples). Utilizing whole genome microarrays and validating candidate genes with qRT-PCR finally allowed us to identify a set of 29 baboon genes forwarded for cross-species validation using human samples. Within this presentation we will provide first results on this cross-species validation and share preliminary results on our envisioned 1,000 sample exercise to examine the feature of high-throughput diagnostic of the HARS using gene expression.

Evolutionarily Conserved Serum MicroRNAs Predict Radiation-Induced Fatality in Non-Human Primates
Dipanjan Chowdhury, Ph.D.

Evolutionarily conserved serum microRNAs predict radiation-induced fatality in non-human primates.

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Effective planning for the medical response to a radiologic or nuclear accident is complex. Due to limited resources for medical countermeasures, the key would be to accurately triage and identify victims most likely to benefit from treatment. We had used a mouse model system to provide evidence that serum microRNAs (miRNAs) may effectively predict the impact of radiation on long-term viability of animals. Here we use non-human primates (NHPs) to demonstrate that this concept is conserved and serum miRNA signatures have the potential to serve as prediction biomarkers for radiation-induced fatality in a human population. We identified a signature of seven miRNAs that are altered by irradiation in both mice and NHPs. Genomic analysis of these conserved miRNAs revealed that there is a combination of seven transcription factors that are predicted to regulate these miRNAs in human, mice, and NHPs. Moreover, a combination of three miRNAs (miR-133b, miR-215, and miR-375) can identify, with nearly complete accuracy, NHPs exposed to radiation versus unexposed NHPs. Consistent with historical data, female macaques appeared to be more sensitive to radiation, but the difference was not significant. Sex- based stratification allowed us to identify an interaction between gender and miR-16-2 expression, which affected the outcome of radiation exposure. Moreover, we developed a classifier based on two miRNAs (miR-30a and miR-126) that can reproducibly predict radiation-induced mortality. Altogether, we have obtained a 5-miRNA composite signature that can identify irradiated macaques and predict their probability of survival.

Cutaneous Radiation Injuries in the Aftermath of an Improvised Nuclear Detonation
Matthew Clay, Ph.D.

In the wake of an improvised nuclear device (IND) detonating in a U.S. city, fallout is one of many concerns to those evacuating. We examine the risk of beta-radiation-induced cutaneous radiation injury (CRI) resulting from people walking through fallout-covered areas.

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In the wake of an improvised nuclear device (IND) detonating in a U.S. city, fallout is one of many concerns to those evacuating. We combine existing modeling of the effects of nuclear detonations, layering in prompt injuries, evacuation, and the exposures that accumulate during evacuation. We examine the risk of beta-radiation-induced cutaneous radiation injury (CRI) resulting from both direct skin and clothing contamination by fallout as well as beta groundshine from people walking through fallout-covered areas. We calculate how many people may present at hospitals or other locations with acute radiation syndrome (ARS) and CRI in the wake of a detonation.

While best practice calls for individuals to shelter in place in the aftermath of a detonation, many people are likely to attempt to self-evacuate and become contaminated. We present results on the delayed injuries (first manifesting days to weeks after exposure) that will result from CRI due to individuals not being fully compliant with shelter in place guidance. These injuries will likely present in a range of patients, both those who seem uninjured as well as those who have more obvious mechanical, burn, or radiation injuries. These two modalities present new and perhaps unanticipated complications for treatment: seemingly well people (without ARS or mechanical trauma) who unexpectedly manifest CRI after being triaged as uninjured as well as hospitalized patients presenting new injuries, complicating treatment. These results may assist in planning for the range and timing of injuries and healthcare needs after an IND detonation.

Biomarkers and Biodosimetry
Naduparambil K. Jacob, Ph.D.

Non-Coding RNAs as Radiation Biodosimeters and Early Predictors of Late Toxicities

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Exposure to ionization radiation from a nuclear reactor accident or an unfortunate terrorist attack could have major consequences. Depending on the absorbed dose and the geography of exposure, the intensity and onset of Acute Radiation Syndromes (ARS) and Delayed Effects of Acute Radiation Exposure (DEARE) will vary. Rapid triage and early detection of late effects is critical for timely administration of countermeasures and proper allocation of the resources. Over the last several years, significant progress has been made in radiation biodosimetry using clinical parameters such as time of emesis, lymphocyte depletion kinetics and dicentric chromosome assay. However, these are not sufficient to identify individuals who might be at risk of developing ARS or DEARE in partial body exposure scenario, expected in real-life accidents. Comparative analysis of dose and time dependent changes in over 80 serum/plasma detected microRNAs in multiple animal models of partial as well as whole body irradiation has identified several evolutionarily and functionally conserved biomarkers with potential to develop as biodosimeters. Decrease in serum/plasma miR-150 was detected in rodent models of whole body irradiation (Jacob et al., 2013), in non-human primates (Menon et al., 2016), and in human leukemia patients (unpublished data), in the dose-range relevant to triage in radiological events. The response correlated with percentage of marrow exposed in partial body irradiation models, confirming that the depletion of circulating miR-150 levels indicate bone morrow damage. Evaluation of reconstitution kinetics weekly for up to 100 days in patients who received bone marrow transplantation after myeloablative total body irradiation, shows utility of miR-150 for assessing recovery and the effect of countermeasures. Specificity in the signature of circulating microRNAs in whole thorax lung irradiation models indicate their potential to provide organ specific readouts and for early prediction of late effects. Ongoing studies include validation of several of the candidates identified in animal models using specimens from human patients who developed delayed toxicities such as pneumonitis and fibrosis. The utility of circulating miRNA biomarkers for triaging victims of radiation accidents, early prediction of late effects and therapy guiding in patients who receive therapeutic radiation will be discussed. This work was partly supported by The Ohio State University Comprehensive Cancer Center, NIH/NIAID Grant Nos. 1R43AI108019-01A1, U19AI067798-09 (Pilot Project) and The Office of the Assistant Secretary of Defense for Health Affairs through the Peer Reviewed Medical Research Program Award No. W81XWH-15-2-0054.

Rapid Prediction of Hematological Acute Radiation Syndrome in Radiation Injury Patients Using Peripheral Blood Cell Counts

Michael Abend, Prof. Dr. MSc.

Using peripheral blood cell counts available during the first 3 days after radiation exposure we developed a tool (H-module) to predict the clinical outcome (hematological acute radiation syndrome severity) in radiation injury patients.

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Rapid clinical triage of radiation injury patients is essential to determine appropriate diagnostic and therapeutic interventions. We examined the utility of blood cell counts (BCC) in the first three days after irradiation to predict clinical outcome, specifically hematological acute radiation syndrome (HARS). Material and Methods: For the test sample we analyzed BCC from radiation accident victims (N = 135) along with their clinical outcome HARS severity scores H1-4 using the database SEARCH (System for Evaluation and Archiving of Radiation Accidents based on Case Histories). Data from unirradiated individuals (H0, N=132) were collected from an out-patient facility. We created binary categories of (1) H0 versus H1-4, (2) H0-1 versus H2-4 and (3) H0-2 versus H3-4 severity scores to assess the discrimination ability of BCC using unconditional logistic regression analysis. The test sample contained 454 BCC from 267 individuals. We validated the discrimination ability on a second independent group comprising 275 BCC from 252 individuals originating from SEARCH (HARS 1-4), an outpatient facility (H0) and hospitals (e.g. leukemia patients, H4).

Results: Those individuals with H0 score were easily separated from exposed persons based on developing lymphopenia and granulocytosis. The separation of H0 and H1-4 became more prominent with increasing hematological severity scores and time. On the first day, lymphocyte counts were most predictive for discriminating binary categories followed by granulocytes and thrombocytes. For days 2 and 3, an almost complete separation was achieved when combining BCC from different days, supporting the measurement of sequential BCC. We found an almost complete discrimination of HO versus radiation exposed individuals during model validation (negative predictive value, NPV >94%) for all three days while the categorization correct prediction of radiation exposed individuals increased from day 1 (positive predictive value, PPV 78-89%) to day 3 (PPV > 90%). The models were unable to provide predictions for 10.9% of the test samples, because the PPVs or NPVs did not reach a 95% likelihood defined as the lower limit for a prediction. We developed a prediction model spreadsheet to provide early and fast diagnostic predictions and therapeutic recommendations.

Conclusion: Clinical outcome of radiation injury patients can be rapidly predicted within the first 3 days after radiation exposure using peripheral BCC.

Lessons Learned from the 2015 University of Colorado Hospital National Exercise
Patrick Conroy, EMT-P, BS, MS, FACHE

In August of 2015 the University of Colorado Hospital conducted a national level RITN exercise in conjunction with the Federal Coordinating Center Denver National Disaster Medical System.
This session will review the important lessons learned from that exercise.

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In 2015 the University of Colorado Hospital (UCH) was selected as one the sites for a national level RITN Exercise. As the timing of this exercise coincided with the annual Federal Coordinating Center Denver National Disaster Medical System (NDMS) Exercise UCH partnered with them to develop a joint exercise.

As UCH is part of the UCHealth System it was decided to expand on the scope of the exercise to incorporate our hospitals in Colorado Springs and Fort Collins, Colorado. This was done as both of these hospitals maintain comprehensive Cancer Centers so it was decided to target them with a number of patients. The goal was to test the ability of the UC Health system to respond to a large-scale event.

The exercise resulted in 53-patients being delivered from the NDMS patient reception site at Denver International Airport to UCH. Patient acuity ranged from critical to ambulatory. Smaller numbers of patients were received at Memorial Hospital in Colorado Springs and Poudre Valley Hospital in Fort Collins, primarily low acuity.

The exercise was very comprehensive in that twenty-one specific objectives were developed for the UCH portion of the exercise that spanned several days. Additional local goals were developed in Colorado Springs and Fort Collins.

While a number of valuable lessons were learned overall the exercise was tremendous success.
This session will review some of those lessons learned not just for UCH as the RITN Center but from a health system perspective as well.

Integrating RITN Center Response with Local. State and Regional Preparedness Partners
Linda A. Reissman, MS, CHEP, CIS

Emergency response and sustained recovery for radiological events requires cooperation and organization between RITN Centers and local, regional, state and federal stakeholders. As private community partners, hospitals often struggle with integration into community exercises and response. This presentation will identify common gaps and provide integration strategies for RITN Centers.

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As a result of lessons learned during a yearly RITN exercise conducted our Center concluded:

1. Mass casualty management for patients with Acute Radiation Syndrome requires a comprehensive planning approach with multiple stakeholders.
2. Local, regional, and state emergency management and public health entities were unfamiliar with the role of a "cancer hospital" in mass casualty management scenarios.
3. Because our Center was not perceived as a disaster response "player" we were not fully integrated into local planning and exercises for radiological events.
4. A process improvement was necessary to increase awareness of RITN and MSK's potential role in radiological disasters among emergency management agencies and public health response partners.

In addressing this process improvement an action plan was developed to broaden awareness about RITN and the role of MSK in radiological disaster response.

Description:

Emergency response and sustained recovery for radiological events requires cooperation and coordination between RITN Centers and local, regional, state and federal stakeholders. As private community partners, hospitals often struggle with integration into community exercises and response. This can be more so for RITN hospitals and supportive partners that are not usually recognized as a resource in mass casualty response. This presentation will identify common gaps and provide strategies that will increase awareness of RITN and the role of an RITN centers in a radiological response. Moreover, these strategies are focused on the identification and development of stakeholder relationships to foster seamless communication and operational coordination during RITN activation.

The Intersection of Public Health, Radiation Control, and Healthcare Priorities for Radiation Emergency Preparedness
Raymond Puerini, MPH

This session will convene stakeholders from public health, radiation control, and healthcare institutions to discuss their overlapping radiation preparedness priorities. NACCHO will present the public health perspective then facilitate a discussion to gather feedback on opportunities to leverage existing initiatives to advance radiation preparedness in a coordinated fashion moving forward.

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Over the past year, the National Association of County and City Health Officials (NACCHO) has been an advocate for espousing the needs of local health departments (LHDs) to advance their radiation preparedness work. NACCHO has served in this role through the formation of a policy statement to inform federal and national policy and decision makers of LHD radiation preparedness needs and through convening federal and national radiation stakeholders to better define the actions items that will advance radiation preparedness at the local level.

NACCHO has also conducted a variety of research activities with the Radiation Injury Treatment Network and the Centers for Disease Control and Prevention (CDC) that have uncovered substantial gaps in local health department radiation preparedness efforts as well as gaps in awareness as to the role of healthcare and RITN partners.

NACCHO believes that there are alignments between the needs of local radiation preparedness programs and the recommendations that may enhance and expand partnerships and connections between RITN sites and health departments. This session will convene representatives from the public health, radiation, and healthcare communities to strategically align the needs of the three sectors to better public health, radiation, and healthcare activities moving forward.

NACCHO will present on some of the research findings on the current capabilities of local health department radiation preparedness programs and awareness of RITN services. Following this presentation, NACCHO will present the major priorities and some of the previously recommended actions to help advance local radiation preparedness efforts. Following this presentation, NACCHO will conduct a facilitated discussion with the audience to explore where overlapping priorities may exist in both the radiation control and healthcare sectors. This discussion will build towards the formulation of recommendations that can be used to align future national, state, and local radiation preparedness efforts to better serve the needs of all key public health, radiation, and healthcare partners in the future.

Preparing for Radiation Casualties: When to Administer Radiation Mitigators?
Joel S. Greenberger, M.D., F.A.C.R.O., F.A.C.R.

Signature directed delivery of multiple radiation mitigators.

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Increased severity of radiation injury is directly related to volume, total dose, radiation source (x-ray photon, neutrons, or mixed beam) and magnitude of the dose-rate. With radiation emitting isotopes-from fallout or from ingested/inhaled emitters, the same principals apply but not with the added concern for anatomic sites of isotope deposition, half-life of the isotopes and total body burden. With radioisotopes, chelation agents and/or measures to speed decorporation/excretion are relevant. Two concepts are of concern presently: 1) Radiation Disease is the term now used to describe the sequence of activation of cellular, organ, and organ system death pathways that follow ionizing radiation exposure-apoptosis, necroptosis, ferroptosis, inflammatory cytokine mediated injury, and organ failure with a major concern for the bone marrow and small intestine. Several new mitigators undergoing development, and time to administer will be discussed. 2) In the case of a dirty bomb or fission bomb, the number of expected casualties with combined injury will be high (radiation plus: thermal burn, organ trauma, bone fractures, traumatic brain injury, blood loss, and penetrating wounds). Exposed individuals with no obvious combined injury will be categorized by hematopoietic, GI, and CNS syndromes, each of which is clinically related to estimated level of radiation sustained.

Discussion Points:

- Radiation Mitigation
- Combined Injury
- Concept of Operations of Administration

The Value of Conducting a Multi-Disciplinary Real-Time Functional Exercise
Jay M. Johnson, MS, CEM, MEP

The session provides an overview of the planning processes and delivery of a complex real-time Functional Exercise that simulated RITN Center actions from event awareness to first patient arrival.

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In late 2015 Mayo Clinic committed to conducting a Functional Exercise that would simulate response to and management of a Radiation Injury Treatment Network activation of the Mayo Clinic Rochester RITN Center. Collaborative planning efforts involving a wide array of Mayo Clinic resources, the Radiation Injury Treatment Network, as well as multiple Federal and State agencies allowed us to develop an interesting and engaging exercise that explored our ability to communicate, coordinate, and cooperate across disciplines and agencies.

A radiation exposure device (RED) incident served as the precipitating event and the number of affected persons was scaled to eventually necessitate RITN Center activation. The simulation timeline was fully coordinated with all participating partners to allow for maximized participation and to control the flow of information in a manner that emphasized this was an exercise.

Information was provided to participants over the course beginning on August 5th using multiple information pathways that included the use of a fully controlled simulated social media environment, simulated new reports, and hospital incident command communications. Over the course of several days information was provided that was available to guide decision making and provide situational awareness during the exercise that would replicate the information (and lack thereof) that would likely become available during an actual event.

Participants in the exercise engaged with colleagues in a real time hospital incident command environment using virtual briefings and webinars to make decisions and assign tasks each day, beginning on August 5th and culminating in a live hospital command center activation on August 11th during which the participants provided a simulated response to every aspect of patients arriving as a result of the Mayo Clinic RITN Center being activated.

The exercise provided an opportunity to work through communications plans and processes, operational needs and challenges, and functional steps that are frequently overlooked during high level simulations. The scheduled release of information to participants combined with the use of a simulated social media environment allowed us to create a realistic experience for the participants that led to the identification of improvements that were noted in the after action report, tracked and implemented across the institution. Ultimately, the exercise provided Mayo Clinic and our partners with an excellent return on our investment of time and resources through the facilitation of administrative and operational improvements to our processes and relationships.

NDMS Patient Movement
Ken Hopper, BA, M.S.M, MPA

Provide an overview of the National Disaster Management System (NDMS) patient movement process from the disaster area through the Federal Coordinating Center (FCC) to the Patient Reception Area (PRA) in the receiving community.

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This session will provide attendees with a basic understanding of how the National Disaster Management System (NDMS) is organized to provide support for the movement of patients following a national level incident. Including an overview of the NDMS patient movement process from the disaster area through the Federal Coordinating Center (FCC) to the Patient Reception Area (PRA) in the receiving community; patient tracking will be conducted using the Joint Patient Assessment and Tracking System (JPATS) as they are transported to a definitive care site.

Reversal of Radiation Damage to Marrow Stem Cells by Mesenchymal Stem Cell Derived Vesicles
Peter Quesenberry, MD

We have demonstrated that injury induced by irradiation to murine marrow, either in vitro or in vivo, can be partially or completely reversed by exposure to human or murine MSC-EVs.

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Extracellular vesicles (EVs) including exosomes and microvesicles, have been studied for many years and were initially felt to be cell junk largely from platelets and erythrocytes. More recently, EVs have been found to deliver both mRNA and transcriptional modulators to target cells and affect their phenotype. Mesenchymal stem cells (MSC) have been shown to reverse radiation damage to bone marrow stem cells. In this study, we ask if MSC-EVs would reverse radiation damage to marrow stem cells. Significant restoration of marrow cell engraftment at 4, 24 and 168 hours post-irradiation by exposure to MSC-EVs was evaluated at 3 weeks to 9 months after transplant and further confirmed by secondary engraftment. The in vivo biodistribution and localization of EVs detected by fluorescence molecular tomography indicated a radiation dose dependent accumulation of EVs at the site of injured bone marrow and spleen tissue, but undetectable in lung, heart and kidney. In addition, three different fractions of human MSC EVs, microvesicles, exosomes, and microvesicles+exosomes combined fractions, were investigated for reversal of murine bone marrow damage both in vitro and in vivo. FDC-P1 hematopoietic cells were exposed at 500cGy irradiation and cultured with or without the addition of 3 fractions of murine WBM/ human MSC-EVs for 7 days. A significant increase in cell proliferation was observed after 3 different vesicles treatments. However, exosomes were clearly inferior, microvesicle and the combined exosome and microvesicle population showed superior radiation mitigation. The capacity of human MSC-EVs of different fractions on reversal of murine bone marrow damage was also evaluated in vivo. Again, the combined fractions showed a significant increase donor chimerism in bone marrow at 6 month post-transplant with 5x's the level of engraftment compared to irradiation control. Exposure to vesicles in irradiated FDC-P1 cells downregulated the DNA damage marker phosphorylated H2AX, and decreased apoptosis marker, PARP cleavage part. The characterization of three different fractions of vesicles derived human MSC were evaluated by deep sequencing respectively. Several MSC-EV associated miRNA possibly responsible for the reversal of radiation damage were evaluated. Our data indicate that MSC-EVs have the capacity to ameliorate radiation-induced damage to marrow.

CDX-301 - A Novel Radiation Countermeasure
Vidya P. Kumar, Ph.D.

CDX-301, a soluble human recombinant protein, a Flt3 ligand, when administered 24 h prior to radiation, protected mice from lethal dose of total body radiation. CDX-301 pre-treatment was found to protect mice from radiation-induced hematopoietic and GI injury. CDX-301 plays a critical role in radiation-induced hematopoiesis by modulating miR-mediated signal transduction pathways.

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There is an immediate medical need for development of radiation countermeasure that would benefit many such as first responders or military personal going into harm's way and for patients to be used prior to radiation therapy to protect normal cells. Fms-related tyrosine kinase 3 ligand (Flt3L), a hematopoietic four helical bundle cytokine, structurally homologous to colony stimulating factor 1 is known to stimulate the proliferation and differentiation of various blood cell progenitors. CDX-301 (by Celldex Therapeutics Inc.) is the 153 N-terminal amino acids of the human Flt3L extracellular domain after the cleavage of the N-terminal signal peptide as a soluble recombinant human protein.

CDX-301 when administered as a single dose of 0.8 mg/ kg resulted in survival of 91% of CD2F1 mice when exposed to lethal gamma radiation of 9.25 Gy and significant survival benefit was observed when exposed to 11 Gy. Accelerated recovery from radiation-induced peripheral blood cytopenia and restoration of bone marrow cellularity was observed by day 14 post-irradiation (7 Gy) in mice pre-treated with CDX-301. The effect of a single administration of CDX-301 (0.8 mg/ kg) on pathophysiology of GI injury was studied at 10 and 12 Gy (0.6 Gy/ min) of radiation at four time-points post-irradiation. There was a significant recovery in crypt colonies compared to vehicle treated group by day 4 post-irradiation at both 10 and 12 Gy. Villi lengths were also found to be significantly protected by day 8 post-irradiation at 12 Gy. Serum levels of serum amyloid A (SAA), a sepsis biomarker of radiation injury, and Erythropoietin (EPO) levels were significantly reduced on pre-treatment of CDX-301.

MicroRNAs (miRNA) are a class of small noncoding RNA molecules (on average 22 nucleotides long) found in eukaryotic cells. They have the ability to post-transcriptionally regulate gene expression via targeting the untranslated regions (UTR) of messenger RNA transcripts. MicroRNAs could regulate the cellular changes required to establish stress-induced cell damage phenotypes. Expression profile of 5053 miRs were analyzed in serum from CDX-301-treated irradiated mice and compared with those from vehicle-treated mice on days 1, 4, 7 and 14 post-irradiation. Time-dependent variation in miR expression in response to radiation was observed. Expression of 69 miRs were altered on day 14 as compared to 26 miRs on day 4 and 33 miRs on day 7. Of the 69 differentially expressed miRNAs, 7 were elevated, and 62 were reduced on day 14 post-radiation ($p < 0.05$). 28 out of 69 were significantly ($p < 0.0001$) modulated by CDX-301 pre-treatment. Four major network foci (ERK, MAP2K, Smad2/3 and insulin) were identified by ingenuity pathway analysis as a result of irradiation. CDX-301 pre-treatment reversed the effect on these pathways. These results demonstrate that CDX-301 when administered 24 h prior to radiation, protected mice from lethal dose of total body radiation. CDX-301 pre-treatment was found to protect mice from radiation-induced hematopoietic and GI injury. CDX-301 plays a critical role in radiation-induced hematopoiesis by modulating miR-mediated signal transduction pathways.

Thioredoxin Enhances Hematopoietic Stem Cell Recovery and Protects Mice from Radiation-Induced Death
Pasupathi Sundaramoorthy, Ph.D.

TXN reduced radiation induced mice death and stem cell injury through ROS-mediated p53 and mTOR signaling pathway.

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Hematopoietic stem cells (HSCs) are one of the cell type that are most sensitive to radiation injury. Injury to HSCs contribute many of the manifestation of acute radiation syndrome. Protection and/or enhancing the recovery of HSCs is an important goal in the treatment of radiation injury. Using semi-quantitative proteomic approach, we recently screened for proteins that were differentially expressed in the bone marrow supernatant from hematopoietic stem cell transplant recipient mice treated with AMD3100 (a specific and reversible CXCR4 antagonist) or control buffer. We subsequently identified thioredoxin (TXN) as a novel molecule that have marked protective and proliferative effects on HSCs. TXN is a ubiquitous oxidoreductase and its primary function is to maintain redox homeostasis and protect proteins from oxidative damage.

In the current study, we investigate the effects of TXN mitigating radiation-induced HSCs injury and the underlying biological and molecular mechanisms. BALB/c mice were irradiated with 7.25Gy and TXN 32 IJg/mouse were injected intravenously after 24 hours irradiation and then every day for total 5 dose. TXN given at 24 hours after irradiation protected BABUc mice from radiation induced death; 70% of TXN-treated mice were survived, wehre as <30% of saline-treated mice survived (p=0.0273). Peripheral blood cell counts and bone marrow c-Kit+Scal-1 +Lin-(KSL) cells, SLAM+KSL cells and CFUs (CFU-G and CFUs-GEMM) were measured 3 and 6 week after irradiation. TXN given 24 hours after irradiation enhanced the recovery and expansion of HSCs. We also performed extensive mechanistic studies to determine the effects of TXN on DNA repair efficiency such as Fanconi anemia (FA)/BRCA DNA repair pathway gene expression, cell senescence, and the expression of mTOR and p53 following radiation exposure. We found that TXN treatment lead to reduce the level of gamma-H2AX expression and enhance the expression of FAlBRCA repair pathway genes FANCD and FANCG, indicating that more efficiently increase the DNA repair by TXN. TXN reduced radiation-induced cell senescence in vitro and in vivo. Importantly, we found that TXN up-regulate mTOR expression in the early phase of radiation exposure followed by down-regulating p53 at later time point and inhibit the cell cycle arrest induced by radiation. Our data suggest that TXN not only serve as one of the major antioxidants in mammals, but also can interact with redox-sensitive or ROS-independent molecules and modulate diverse cellular processes. TXN has great potential in the treatment of radiation-induced injury.

The Toll-Like Receptor 2 Agonist, FSL-1 Lipopeptide, Therapeutically Mitigates Acute Radiation Syndrome
Hao Guo, Ph.D.

Medical Countermeasure New Research

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We examined radio-mitigation properties of TLR agonists and demonstrated that FSL-1, a synthetic lipopeptide ligand to TLR2, significantly enhanced survival in male and female mice when administered 24-48h after total body irradiation (TBI). While these findings were also true for other TLR2 ligands, FSL-1 treatment resulted in fewer adverse effects during the initiation of acute radiation syndrome (ARS). FSL-1 functioned in a MyD88-dependent manner, as it did not protect MyD88-deficient mice exposed to TBI. Mechanistic examination determined that FSL-1 treatment resulted in accelerated medullary and extramedullary hematopoiesis in bone marrow and spleen, respectively. This was also correlated with an increase in systemic G-CSF which drives hematopoiesis as well as peripheral recovery of WBC. The ability of FSL-1 to drive hematopoiesis is critical, as hematopoietic dysfunction caused by ionizing radiation is observed at a wide range of exposure doses. The efficacy of FSL-1 demonstrated here when administered after TBI reveals a viable radiation countermeasures candidate.

CaMKK2 Regulates the Hematopoietic Stem Cell Response to Radiation
Luigi Racioppi, MD, Ph.D.

Our findings identify CaMKK2 as an important regulator of HSPC regeneration, and demonstrate CaMKK2 inhibition is a novel approach to promote hematopoietic recovery after bone marrow injury.

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Hematopoietic stem cells (HSC) are predominantly quiescent in adults, but proliferate in response to bone marrow injury. We found that deletion of Ca2+/Calmodulin (CaM)-dependent protein kinase kinase 2 (CaMKK2) promotes HSC regeneration and hematopoietic recovery following radiation injury. Accordingly, HSC from Camkk2 null mice have a high proliferative capability when stimulated in vitro in the presence of bone marrow-derived endothelial cells. At the mechanistic level, we found that deletion of Camkk2 in HSC results in a significant down regulation of genes associated with the quiescent signature. Interestingly, we demonstrated that CaMKK2 is required to couple the radiation-induced proximal signaling to the AMPK anti-proliferative pathway. Accordingly, Camkk2-/- HSCs fails to upregulate phospho-AMPK and Tpr53 following radiation, and in turn have an enhanced stimulation of mTOR/S6rp pathway. Moreover, we observed that systemic administration of the small molecule CaMKK2 inhibitor, STO-609, to irradiated mice enhanced HSC recovery and improved survival. These findings identify CaMKK2 as an important regulator of HSC regeneration, and demonstrate CaMKK2 inhibition is a novel approach to promote hematopoietic recovery after bone marrow injury.

Recommendations for the Operation of Contaminated Hospitals after an IND Detonation
Scott White, Ph.D.

The Integrated CBRN Terrorism Risk Assessment Program within the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) assessed the potential influence of radioactive fallout on Critical Infrastructure operations in the aftermath of an IND detonation. The report details operational health and safety guidelines for 7 critical infrastructure sectors aimed at protecting first responders involved in the restoration and operation of critical infrastructure (CI). This presentation will focus specifically on radiological hazards affecting healthcare infrastructure, as well as provide an overview of human health and safety guidelines for the operation of contaminated hospitals following the detonation of an improvised nuclear device (IND).

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The emergency response to the detonation of an Improvised Nuclear Device (IND) would be enormous, requiring thousands of people to work in concert to save lives and stabilize the affected region. Critical infrastructure – infrastructure key to both the effectiveness of the response and to the wellbeing of the general population – must continue to operate following a nuclear detonation. For these critical facilities and systems, the challenge becomes a balancing act between mounting a timely response, assuring continuity of operations, and safeguarding responders and the critical workforce against the hazards presented by radioactive fallout.

Hospitals and the larger public health infrastructure serve as the front-line in saving lives after a domestic IND detonation. As dangerous radiation hazards may extend for tens or hundreds of miles from the detonation site, many hospitals will be within the fallout contaminated area and, for those hospitals close to the damage zones, may be inundated with those reporting for care. This presentation details a flexible set of guidelines for the operation of healthcare facilities contaminated by radioactive fallout outside the immediate physical damage caused by an IND. Recognizing that it is impossible to predict all circumstances that may arise at these hospitals during an IND response, the presented guidelines can be applied to any facility or activity circumstances may require.

This presentation details specific guidelines we developed for hospitals regarding lifesaving activities. These recommendations cover when and how to perform outdoor triage and decontamination, as well as when it is safe to treat patients in windowed or non-windowed rooms. Also included in the hospital recommendations are guidelines for emergency evacuation of hospitals, including minimum and optimal times for evacuation based on outdoor contamination levels.

Together, these guidelines allow critical infrastructure operators to decide if, and in what capacity, they can safely respond to, restore, and operate critical infrastructure systems/facilities contaminated by radioactive fallout from an IND detonation.

Enhancing National Preparedness through Biodosimetry
Lynne Wathen, Ph.D.

All potential radiation disasters, will involve a number of complex radiation exposure scenarios. Therefore, performing triage and definitive radiation biodosimetry will require multiple tests to measure absorbed dose and guide effective responses.

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In the aftermath of an improvised nuclear device (IND) detonation or a nuclear accident, having rapid and accurate measurements of absorbed doses in exposed persons can inform life-saving medical decisions. Qualitative point-of-care tests are being designed to be administered quickly to determine whether an individual has absorbed a minimum threshold radiation dose and needs further medical care. Quantitative high-throughput laboratory-based tests that estimate the actual absorbed dose a person has received to enable more accurate clinical management. Five promising biodosimetry tests are currently funded by the Biomedical Advanced Research and Development Authority (BARDA) within the U.S. Department of Health and Human Services to identify the most relevant proteomic, genomic and cytologic radiation biomarkers and validate their utility using animal models and humans. Algorithms integrate multiple individual biomarker results into a single test result. The two point of care tests in development use immune-capture technology. One uses multiple test lines on a nitrocellulose lateral flow device with upconverting phosphor signal output, and the other uses a spotted array in a cartridge with an electro-chemiluminescent reporter. Both technologies use capillary (finger stick) blood samples to detect host protein biomarker levels that increase (or decrease) following gamma or x-ray exposure. Of the three high-throughput tests under development, two use changes in gene expression patterns to determine the extent of radiation damage, and the third measures chromosomal damage and micronucleus generation to predict absorbed dose. BARDA's work with federal and industry partners will enable the development, regulatory review by the United States Food and Drug Administration, and acquisition of radiation biodosimeters. These activities will help the United States prepare for and respond more effectively to a nuclear incident.

Important Issues to Consider in the Implementation of a Biodosimetry Program
Adela Salame-Alfie, PhD

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Much progress has been made in the last few years in the development of new tools to quickly assess doses from external exposure to radiation. BARDA has sponsored projects that aim to develop rapid, accurate, FDA-cleared biodosimetry diagnostic assays/systems to inform patient management, improve health and psychosocial outcomes, and save as many lives possible. Understanding that biodosimetry is only one of many pieces of information that will be needed during the response to a radiological incident, it is important to assess the best use for each type of existing biodosimetry tool as well as those currently being developed. Some of the key questions that need to be answered prior to selecting a tool are:

- What is the purpose of the measurement?
  - Is it to assist with screening and triage?
  - Is it to inform medical care/need for medical countermeasures?
  - Is it to indicate when countermeasures need to be discontinued?
  - Is it to support dose reconstruction?
- What level of accuracy is needed?
  - Yes/No decision
  - Actual dose
- How quickly do we need the results?
  - Hours/days/months?
- Where will be tool be used?
  - In the field
  - In a hospital setting
  - In a laboratory
  - In a RITN center
- Is it fixed or deployable?
  - If deployable, how, where, when, will it be available?
- How would the target population be selected?
- What is the throughput needed?
- What are the basic needs to operate the tool - fixed or deployable?
- What are the staffing and training requirements needed?
- What other resources (beyond staffing) are needed?

The existing and upcoming biodosimetry tools will be reviewed in the context of the above questions.

Overview of the Medicare and Medicaid Programs; Emergency Preparedness Requirements for Medicare and Medicaid Participating Providers and Suppliers; Final Rule
Caecilia Blondiaux, B.A.

Provide information regarding the Emergency Preparedness Final Rule, to include the four core elements, and provide resources available to providers and suppliers.

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The Centers for Medicare and Medicaid Services Final Rule on Emergency Preparedness requires healthcare providers and suppliers to develop a comprehensive emergency program to include risk assessment, policies and procedures, communication plan and a training and testing program. Additionally, this rule requires providers and suppliers to coordinate their emergency planning with community partners, including public health, state and local emergency officials and others to ensure patient safety. The overview of this regulation and its Conditions for Participation, Conditions for Coverage or requirements will provide guidance to the Radiation Injury Treatment Network and potentially identify areas in which this network plays part in assisting hospitals through disasters.

ASPR TRACIE: Your Healthcare Emergency Preparedness Information Gateway
Audrey Mazurek, MS

Learn more about ASPR's Technical Resources, Assistance Center, and Information Exchange (TRACIE) and how it promotes better access to healthcare emergency preparedness information, promising practices, subject matter experts, and new knowledge on healthcare system and public health preparedness. Attendees will be introduced to ASPR TRACIE including the website, tool kits, and offerings in an interactive forum and provided an opportunity to provide feedback.

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The US Department of Health and Human Services (HHS) Assistant Secretary for Preparedness and Response (ASPR) Technical Resources, Assistance Center, and Information Exchange (TRACIE) promotes better access to healthcare emergency preparedness information, promising practices, and relevant new knowledge. ASPR TRACIE is designed to identify and remedy knowledge gaps, and assist with unique and complex technical assistance to states, healthcare coalitions, communities, and involved individuals in meeting healthcare system and public health preparedness objectives.

ASPR leads the country in preparing for, responding to, and recovering from the adverse health effects of emergencies and disasters by supporting our communities' ability to withstand adversity, strengthening our health and response systems, and enhancing national health security. To execute this mission, ASPR works closely with partners from the federal, state, and local governments, non-profit organizations, and private sector entities to plan, organize, equip, train, exercise and evaluate all components of the nation's public health and healthcare system to help enhance resiliency. ASPR TRACIE integrates and connects stakeholders with resources through a tiered level of services including: self-service support using a searchable website; remote support by accessing a toll-free hotline connected to information specialists, webinars, conference calls, podcasts, and other media; and direct support by attending workshops, requesting technical assistance by ASPR TRACIE preparedness planners and subject matter experts. ASPR TRACIE also provides a restricted access Information Exchange platform where users can post threads, respond to peer inquiries and exchange information on disaster healthcare delivery in a real-time environment.

During this Session attendees will be introduced to the entire spectrum of support services offered by ASPR TRACIE including the website, tool kits, and offerings. ASPR TRACIE presenters will discuss current and future trends in technical assistance and will provide real-life examples of how ASPR TRACIE can be used (to include our CBRNE resources). Attendees will be provided an opportunity to provide feedback on how to improve ASPR TRACIE to better meet their needs and interact with ASPR TRACIE staff on practical aspects of this new initiative which includes the ability to:

• Assess technical assistance needs from end users,
• Research and compile a database of already developed technical assistance materials and make them available,
• Identify, develop, and disseminate needed material
• Facilitate information exchange among healthcare preparedness professionals
• Provide direct training and technical assistance to partners in need through various methods,
• Support jurisdictions that are actively responding to or recovering from a disaster or emergency

Development of Sargramostim (rhu GM-CSF; Leukine®) as a Medical Countermeasure for the Treatment of Hematopoietic Acute Radiation Syndrome under the "Animal Rule"
Nicholas Clayton, MS

Overview of the development program of Sargramostim (Leukine®; rhu GM-CSF) for the treatment of Hematopoietic Acute Radiation Syndrome (H-ARS) including the results from the pivotal confirmatory efficacy study in a non-human primate model of H-ARS

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Hematopoietic acute radiation syndrome (H-ARS) occurs in individuals that are exposed to high levels of radiation over a short period of time. The destruction of bone marrow leads to pancytopenia, which increases the incidence of infections, hemorrhages, and accounts for the majority of morbidity and mortality. Sargramostim (Leukine®), yeast-derived recombinant human granulocyte-macrophage colony-stimulating factor (rhu GM-CSF), is a pleiotropic cytokine that supports proliferation, differentiation, maturation and survival of multiple lineages of hematopoietic cells. Sargramostim is approved in the United States for five hematology oncologic indications. Three of the approved indications are for the acceleration of neutrophil recovery following exposure to myelosuppressive chemotherapy with or without total-body irradiation (TBI). In addition, sargramostim can decrease the duration of infectious episodes and hospitalization.

In 2013, the Office of the Assistant Secretary for Preparedness and Response, within the US Department of Health and Human Services (HHS), working through the Public Health Emergency Medical Countermeasures Enterprise (PHEMCE) and the Biomedical Advanced Research and Development Authority (BARDA) awarded a contract to Sanofi for the acquisition of sargramostim for the Strategic National Stockpile and the advanced development of sargramostim as a medical countermeasure (MCM) for the mitigation of neutropenia arising from exposure to ionizing radiation. Using the FDA guidance Product Development Under the Animal Rule, Sanofi established a comprehensive non-clinical development program to assess the efficacy of sargramostim in a non-human primate (NHP) model of H-ARS that consists of two pharmacokinetic and three efficacy studies.

The confirmatory efficacy study evaluated repeat administrations of sargramostim (7 µg/kg/day) in a blinded, GLP-compliant study in total body irradiated non-human primates (NHPs) when administered 48 h post-irradiation with minimal supportive care (e.g., no blood products or individualized antibiotics). The primary objective was to assess the efficacy of sargramostim versus vehicle on mortality rate at Day 60 in irradiated male and female NHPs at LD50-60/60 (n=36/group). Secondary objectives included the efficacy of sargramostim on overall survival and its effect on hematology parameters versus vehicle. The study included an exploratory arm of male and female NHPs that were irradiated at a LD70-80/60 (n= 18/group) and received the same treatments. Sargramostim decreased the mortality rate at Day 60 by 36% in the LD50-60/60 group ($p=0.0018$) and by 44% in the LD70-80/60 group ($p=0.0076$). Additionally, neutrophil, platelet, lymphocyte, and white blood cell levels demonstrated accelerated recovery in the sargramostim-treated NHPs in the LD50-60/60 and LD70-80/60 groups.

Results of the sargramostim H-ARS development program suggest that treatment with sargramostim (7 µg/kg/day) beginning at 48 h post-irradiation, in the absence of blood products and individualized antibiotics, is a viable therapeutic strategy for the treatment of H-ARS in a mass casualty event.

This project has been funded with Federal funds from the Office of the Assistant Secretary for Preparedness and Response, Biomedical Advanced Research and Development Authority, under Contract No. HHSO100201300005I.

Placenta-Derived PLX-R18 Stromal Cells as Mitigators of H-ARS – Pre-Clinical Findings and MoA
Racheli Ofir, Ph.D.

The potential of allogeneic Placenta derived cell therapy to mitigate H-ARS. The talk will include pre-clinical data from both mice and NHP as well as studies of the MoA by which the cells support recovery of the hematological system.

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Acute Radiation Syndrome (ARS) is a syndrome involving damage to multiple organs caused by exposure to a high dose of ionizing radiation over a short period of time; even low doses of radiation damage the radiosensitive hematopoietic system (causing H-ARS). PLacenta eXpanded (PLX)-R18 is a 3D-expanded placenta-derived stromal cell product designated for the treatment of hematological disorders. These cells have been shown in vitro to secrete hematopoietic proteins, to stimulate colony formation, and to induce bone marrow migration. In the study presented here, we assessed the potential effect of PLX-R18 treatment on H-ARS. PLX-R18 cells were administered intramuscularly to C3H/HeN and C57BL/6 mice, 1 and 5 days after (LD70/30) total body irradiation. Weight, survival, peripheral blood and BM cellularity were monitored at several time points up to 23 days. PLX R18 treatment significantly increased survival after irradiation and rescued radio-induced weight loss. In addition, PLX-R18 treatment significantly increased the number of colony forming hematopoietic progenitors in the BM and raised peripheral blood cellularity to values near those of un-irradiated control values. PLX-R18 cells responded to radiation-induced hematopoietic failure by transiently secreting hematopoiesis related proteins to enhance reconstitution of the hematopoietic system. CyTOF analysis or bone marrow and peripheral blood indicated rescue of the blood lineages to levels near those of naïve mice when PLX-R18 cells were administered to irradiated mice. Taken together, PLX-R18 stromal cells have the capacity to alleviate bone marrow failure symptoms in the H-ARS model.

Radiation Biodosimetry Test Systems
Bob Terbrueggen, Ph.D.

The session while provide an overview of radiation biodosimetry test systems, concept of operations, and performance data.

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A direct from stabilized blood, gene expression based high throughput biodosimetry system has been developed. The system consists of a 1.0 ml draw blood collection tube, an 18-plex gene expression assay, the Thermo Fisher 3500xL Ox Genetic Analyzer, and a custom software module enabling automated processing of assay results. The collected blood samples are stable at ambient temperature for 14 days, and the system is able to deliver results in less than 6 hours with a throughput of 600 samples per 24-hour day. The system was developed using samples from total body irradiated (TBI) non-human primate (NHP) and TBI human cancer patients. An overview of the system performance and key comparisons between NHP and human model systems will be presented.

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Status of the Development of Lyophilized Human Platelets for Treatment of Radiation Injury
Todd Getz, Ph.D.

Cellphire Inc., Rockville MD has developed a lyophilized human platelet product which has superior shelf-life (-1-3 yrs) compared to liquid-stored platelets (5 days) and could provide supportive care to ARS casualties. Data indicating that lyophilized human platelets reduced hemorrhage and extended time to death in a LD50/30 NZWR radiation injury model.

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Cellphire Inc., Rockville MD has developed a lyophilized human platelet product (Thrombosomes) which has superior shelf-life (-1-3 yrs) compared to liquid-stored platelets (5 days). Preclinical studies demonstrated safety and efficacy in New Zealand White Rabbits (NZWR), canine, and nonhuman primate (NHP). These data supported FDA approval of an early Phase 1 (exploratory IND) microdose study in normal healthy human subjects. The Biomedical Advanced Research Authority (BARDA) funded the exploration of Thrombosomes use for supportive care in patients with radiation injury in parallel with additional human and preclinical studies needed to support routine use of Thrombosomes as a hemostatic agent to treat active hemorrhage.

A proof of concept study in NZWR with radiation injury LD50/30 was completed. Approximately 50% of animals survived and recovered without supportive care in control and treated groups. Animals that were dosed and died prior to day 30, had a Thrombosomes dosing-dependent reduction in hemorrhage score (Control 7.75, Thrombosomes QAD 5.89, daily 4.25). Hemorrhage score in the total GI (Control 4.5, Thrombosomes QAD 3.75, daily 2.25) and lungs (Control 2, Thrombosomes QAD 1.25, daily 0.75). A reduction in time to death was also demonstrated, time to death was extended approximately two days in non-survivors.

A canine coronary artery bypass graft (CABG) surgery model was completed evaluating three dose levels. Lyophilized canine platelets were used in these studies to eliminate cross species complications. Efficacy comparable to 2-day old liquid stored platelets was demonstrated at the medium and high dose levels.

Lessons Learned from the Advanced Development of AEOL 10150 as a Medical Countermeasure against Radiological and Chemical Threats

John McManus, BS

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Aeolus will provide vital feedback from the FDA-Division of Medical Imaging Products on proposed pivotal animal efficacy and human safety studies for Lung ARS and from the FDA-Division of Pulmonary, Allergy and Rheumatology Products on the species, models and efficacy requirements for sulfur mustard gas exposure. Aeolus will share animal models, efficacy data, regulatory requirements and data on the common mechanisms and pathways to lung damage from radiation and chemical exposure, which provide insights and potential solutions to the unique scientific and regulatory challenges of MCM development for the delayed effects of radiation exposure.

Aeolus and the University of Maryland have developed animal models and completed dose finding efficacy studies demonstrating that AEOL 10150 treatment for 60 days beginning 24 hours after radiation exposure significantly improves survival.

Aeolus, National Jewish Health and the University of Colorado have developed animal models for the pulmonary effects of sulfur mustard gas exposure and demonstrated that AEOL 10150 treatment for 2 days beginning one hour after exposure significantly improves survival.

AEOL 10150, a superoxide dismutase mimetic, protects tissue from damage and increases survival in animal models of lung damage after radiation and chemical exposure by mitigating and/or preventing apoptosis, inflammation and fibrosis through its action on oxidative stress and regulation of growth factors and chemokines, and by impacting subsequent signaling pathways of reactive oxygen species production, inflammation and fibrosis. $105 million has been invested in the development of AEOL 10150 including more than $50 million in grants and contracts from NIH-NIAID, NIH-CounterACT and BARDA.

Development of Human Ghrelin as Mitigator for Acute Radiation Injury
Weng-Lang Yang, Ph.D.

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There is a growing threat of radiation exposure from nuclear power plant leakage and terrorism activities. Currently, there are limited drugs available to treat acute radiation syndrome. Human ghrelin is a 28-amino acid peptide hormone with broad effects on various body systems and known to regulate physiological activities directly relevant to the intestinal recovery after radiation injury, including food intake, energy metabolism, gastrointestinal motility, and enterocyte proliferation and homeostasis. Using a rodent model of total body irradiation, TheraSource has demonstrated that subcutaneous administration of human ghrelin for 6 days, starting at 24 or 48 hours post-total body irradiation, significantly increased the survival rates and reduced body weight loss. We further demonstrated that treatment with human ghrelin improved intestinal integrity and reduced gut apoptosis and permeability. Human ghrelin can be readily synthesized in large quantity for mass emergency needs. Moreover, human ghrelin has an excellent safety profile, as indicated by its use in around 2,000 human subjects as part of clinical trials for other disease indications. TheraSource is currently performing detailed studies of human ghrelin's efficacy as a radiation medical countermeasure in the hematopoietic and gastrointestinal systems in mice. In addition, we will conduct an exploratory study using a nonhuman primate model to further evaluate the effect of human ghrelin treatment for gastrointestinal and hematologic acute radiation syndromes.

Neupogen and Neulasta: Short-Term Gain, Long-Term Benefit or Consequences? (Panel)
Thomas J. MacVittie, Ph.D., Catherine Booth, Ph.D., Eric P. Cohen, MD

MCM development has focused on the mitigation of organ-specific effects of the ARS or DEARE. MCM will likely be administered during the concurrent evolution of the multiple organ injury characteristic of the acute and delayed sequelae, e.g., GI, hematopoietic, lung, kidney and heart. This session will address the potential acute and long-term effects of lethal irradiation and administration of neupogen or neulasta in a nonhuman primate model of ARS and DEARE.

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Medical countermeasure (MCM) development against the ARS and the delayed effects of acute radiation exposure (DEARE) has been pursued for over a decade. The FDA "Animal Rule" (AR) criteria "raised the bar" for assessing MCM efficacy. The primary clinically relevant parameter to establish efficacy is a statistically significant increase in survival or mitigation of key signs of morbidity consequent to lethal radiation exposure. During this time only two MCM, Neupogen® and Neulasta®, have received FDA-approval under the AR. Each MCM significantly increased survival in a NHP model of the lethal H-ARS. However, questions remained about concomitant effects on other organs and long-term effects of lineage-specific MCM. A comprehensive approach to radiation-induced multiple organ injury (MOI) was required to assess the additional questions. A model of partial-body irradiation with marrow sparing (PBl/BM5, BM2.5) provided a means to assess the ARS and DEARE characterized by MOI to the GI, lung, kidney and heart.

MCM efficacy can be addressed using both tactical (survival H-ARS) and strategic (Gl-ARS, MOI) objectives. It is critical to assess the effect of lineage-specific MCM on other organ sequelae, the effect of MCM administration in concert with co-morbidities, the effect of MCM against the lethal effects of the ARS on the latency, incidence, severity, progression and resolution of MOI characteristic of the DEARE, and other relevant considerations dependent on mechanism of action, schedule of administration and combined MCM. This session will focus on an assessment of the acute Gl-ARS and DEARE following the administration of the FDA-approved MCM, Neupogen® and Neulasta® for acute H-ARS. The administration schedules of the MCM that mitigated the acute H-ARS, survival through 180d post exposure, the concurrent evolution of the acute Gl-ARS, prolonged GI injury, the development of MOI, characterized by acute and chronic kidney injury, and delayed injury to the lung in the NHP will be discussed. Animals were administered Neupogen® or Neulasta® at delayed schedules relative to 1 OGy or 11 Gy (6MV LINAC-derived photons) using the PBl/BM protocols. All NHP were administered supportive care based on individual clinical signs. Dose- and time-dependent organ-specific injury to the GI system, kidney and lung was assessed in control and treated cohorts through the 180d study duration. Parameters evaluated included mortality and mean survival time, organ-specific histopathology to include fibrosis, intestinal crypt damage and recovery, bacterial translocation, mucosal epithelial cell integrity, citrulline analysis, clinical parameters of kidney damage, (dehydration, BUN, creatinine) and lung injury (non-sedated respiratory rate, saturation of peripheral oxygen, radiographic evidence of pneumonitis and fibrosis). The evidence to date suggested that early administration of Neupogen® or Neulasta® did not significantly influence mortality or the latency, incidence, severity or progression of acute and delayed injury in the GI, kidney or lung.

Funding for this study provided by the National Institute of Allergy and Infectious Diseases (NIAID), through the UMSOM, NIAID contract# HHSN277201000046C and SRl/NIAID contract# HHSN2722015000131

Emerging Scientific Advances and Their Implications for Security
Rocco Casagrande, Ph.D.

In this talk, we present a methodology for the assessment of future technologies on the security environment. We use the example of the field of synthetic biology and discuss possible implications of scientific advances that are upcoming.

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We present the concept of predicting which scientific advances will be forthcoming by examining what new capabilities the technology affords, which is commonplace, IN COMBINATION with understanding the market forces that will draw those technologies forward through development. We use this framework to investigate the field of synthetic biology, the most rapidly advancing technological field with very wide-ranging implications. We then identify a few possible upcoming technologies that are likely to foster significant changes in society in the coming decades.

Michael Abend, Prof. Dr. MSc.

Michael Abend earned several professions such as a medical doctor degree at the University Cologne, a professorship in radiobiology at the Technical University Munich and studied Epidemiology (Master degree) at the Gutenberg University in Mainz, Germany. He worked at different international scientific Institutions such as the Armed Forces Radiobiology Research Institute, Bethesda MD or the National Cancer Institute (Radiation Epidemiology Branch), Rockville, USA. Michael Abend did win several scientific awards, published about 100 peer reviewed scientific papers, holds offices at NATO groups and is currently in the position of a Deputy Director and leader of the Genomic department of the Bundeswehr Institute of Radiobiology.

Eric Alberts, B.S., CEM, CHS-V, FPEM, FPEM-HC, CDP-1, CHPP, CHEP, SEM, CFRP, FABCHS

Eric Alberts began his career in Emergency Management in 2002. Eric has responded to emergencies of all different types and sizes to include; a Terrorist Attack, 4 Hurricanes, Tropical Systems, a Special Communicable Disease, Severe Weather, Wildfires, Multi-type vehicle accidents, Mass Casualty Incidents, etc. He is currently the Manager, Emergency Preparedness for Orlando Health, Inc. hospital system in Central Florida. A position he transitioned to in February of 2010. Orlando Health has a total of 1,710 beds within 5 hospitals (two of which are the level 1 trauma centers for adults and pediatrics), cancer center, 2 ambulatory care centers, 3 medical helicopters, numerous corporate ancillary and support facilities, and 15,000 employees.

Eric obtained his BS degree in Criminal Justice from Fairmont State College in West Virginia. Eric is certified as: Certified Emergency Manager (CEM), Certified in Homeland Security-5 (CHS-5), Certified Healthcare Emergency Professional (CHEP), Florida Professional Emergency Manager (FPEM), Florida Professional Emergency Manager- Healthcare (FPEM-HC), Certified in Disaster Preparedness-1 (CDP-1), Certified Homeland Protection Professional (CHPP), Emergency Management Specialist (SEM), and Certified First Response Professional (CFRP). He also has achieved the Master Military Emergency Management Specialist (MEMS) designation.

He is also a member of the Department of Health & Human Services - National Disaster Medical System - FL-6 DMAT (Disaster Medical Assistance Team) as a Logistician, SMRT-5 (State Medical Response Team) as the Deputy Planning Chief, member of the RDSTF AHIMT (Regional Domestic Terrorism Task Force All-Hazards Incident Management Team), and State of Florida Division of Emergency Management AHIMT as a Qualified Liaison Officer (LOFR).

Caecilia Blondiaux

Caecilia Blondiaux (Cece) joined CMS in May 2014 and currently serves as the SCG lead for coordination of policy development and regulations in support of the Director, Deputy Director and the Division of Nursing Homes, Division of Continuing Care Providers, Division of Acute Care Services, and the Division of Laboratory Services. Cece also serves as the lead for Emergency Preparedness, with the implementation of the Emergency Preparedness Rule, writing the interpretive guidelines and working with stakeholders to address concerns in the provider/supplier community. Additionally, she is the lead for internal emergency preparedness for the Center for Clinical Standards and Quality (CCSQ) and manages the COOP process, Regional and Central Office collaboration, and emergency crises such as the Ebola and Zika Virus. Prior to joining CMS, Cece worked for the HIV/AIDS Bureau within HRSA responsible for the management of international travel, coordination with PEPFAR executives and administrative improvement processes for the Division of Training and Capacity Development.

Cece is also currently a Staff Sergeant in the United States Army and has been working for the Joint Chief of Staff J2 and Defense Intelligence Agency for the past three years of her 10 years of service. She created the first SharePoint Site for the Reserve elements supporting the Joint Chief of Staff and serves as the Equal Opportunity Representative for over 250 personnel within the Military Intelligence Readiness Command. In addition to her deployments overseas, she has also worked in transition care planning for the Wounded Warriors in the Warrior Transition Unit.

Catherine Booth, Ph.D.

Catherine Booth completed her Ph.D. at the University of Cambridge UK and then worked as a postdoc with Prof. Chris Potten in Manchester UK, working on the growth factor regulation of intestinal epithelial cell proliferation and the control of stem cell function. During this time she co-developed various mucositis models, using them to evaluation potential prophylactic and therapeutic treatments for radiation damage induced during oncology therapy. These models have since been applied to the biodefence field, specifically validating models and evaluating mitigators for acute and delayed radiation syndrome (ARS and DEARE). She co-founded Epistem in 2000 to provide contract research services, with emphasis on epithelial tissues, particularly the gastrointestinal epithelium. She joined the NIAID funded MCART program headed by Dr. Tom MacVittie in 2006 as GI specialists, developing mouse models of radiation injury and evaluation of medical countermeasures. Most recently this has involved understanding the DEARE changes in irradiated NHP intestine with the MacVittie team. Dr. Booth has published over 60 papers and continues to work with the DoD and assist clients developing oncology supportive care therapies.

Rocco Casagrande, Ph.D.
Rocco Casagrande began his public sector career as a U.N. weapons inspector in pre-war Iraq where he led the U.N.'s biological analysis laboratories. Today, as a founder and Managing Partner of Gryphon Scientific, he is a widely respected thought leader on the risks and medical responses to naturally occurring infectious diseases as well as intentional CBRN events. Dr. Casagrande has provided intellectual leadership to dozens of CBRN defense projects for health and defense agencies. In one notable collaboration with DHS and CDC, he developed a methodology to incorporate risk in the choice of supplies in the Strategic National Stockpile, the nation's largest repository of medicines available for a public health emergency.

Dr. Casagrande has a particular interest in the benefits and threats of emerging biotechnologies--innovations that may have transformative effects on life sciences but raise considerable challenges for policy and governance. In one project, Dr. Casagrande and his team studied whether and how to regulate the synthetic DNA industry to minimize the risk that a terrorist group could synthesize the genome of a dangerous viral or bacterial agent. To balance the positive, environmental, industrial and medical applications of the technology against the biosecurity risks, Dr Casagrande proposed guidelines for screening customers that have become standard industry practice. Similarly, Dr. Casagrande designed a study to address the risks and benefits of engineered influenza viruses after NIH imposed a moratorium on all research to make pathogens of pandemic potential more transmissible or pathogenic, which have been incorporated into government policy.

C. Norman Coleman, M.D.
Dr. Coleman received his BA in mathematics, summa cum laude, from the University of Vermont in 1966 and his MD from Yale University in 1970. He is board certified in three specialties — internal medicine from University of California, San Francisco; medical oncology from the National Cancer Institute; and radiation oncology from Stanford University. He served in the U.S. Public Health Service at the National Institutes of Health [O-4 (ret)]. He was Assistant and tenured Associate Professor of Radiation Oncology and Medical Oncology at Stanford and from 1985 to 1999 and Professor and Chairman of the Harvard Medical School Joint Center for Radiation Therapy. Since 1999, he has been Associate Director, Radiation Research Program and Senior Investigator, with a molecular radiation therapeutics laboratory in the Radiation Oncology Branch of National Cancer Institute. Since 2004 he has also been a Senior Medical Advisor in the Office of the Assistant Secretary for Preparedness and Response in the U.S. Department of Health and Human Services. His focus is on radiological and nuclear preparedness and planning but the programs apply to all-hazards. This includes the Scarce Resources for a Nuclear Detonation project and participation at the U.S. Embassy in Tokyo during the Japan disaster in March 2011. Among his honors are Fellowships in American College of Physicians, American College of Radiology, American Society of Radiation Oncology, and American Society of Clinical Oncology. He is recipient of an Honorary Fellowship, Royal College of Surgeons, Dublin; Honorary Fellow, Royal College of Radiologists (London); the Gold Medal from the American Society for Radiation Oncology; and the 2011 Samuel J. Heyman, Service to America Homeland Security Medal. In 2015 the University of Vermont awarded him a Doctor of Science (honoris causa) for his public service and contributions to society.

Dipanjan Chowdhury, Ph.D.
Dipanjan Chowdhury is an Associate Professor of Medicine at Harvard Medical School, and member of the Division of DNA Repair and Genomic Stability in the Department of Radiation Oncology at Dana-Farber Cancer Institute and Associate Member of Broad Institute of Harvard & MIT. He is also an Affiliate Faculty Member of the Department of Biochemistry and Molecular Pharmacology and the Department of Immunology at Harvard Medical School. Dr. Chowdhury's research focuses on deciphering cellular response to DNA damage, particularly DNA double strand breaks, with the goals of generating strategies for personalized radio and chemotherapy, and countering accidental radiation exposure. His work is supported by NIH and several foundations, including the American Cancer Society, Ann-Fuller Foundation, Tina Brozman Foundation, Claudia Adams Barr Program for Innovative Cancer Research and the Leukemia Lymphoma Society.

Dr. Chowdhury received his Bachelor of Science in chemistry from St. Xavier's College, his Master of Science in biochemistry from Calcutta University, and his Doctor of Philosophy in molecular biology from Brandeis University.

Matthew Clay, Ph.D.
Matthew Clay is a Senior Quantitative Analyst with Leidos. He has spent most of the past decade supporting different government clients, including the Air Force and now Health and Human Services, with quantitative analyses and consequence assessments. The work has spanned the gamut from modeling the contamination of an airbase from a ballistic missile filled with chemical agent to estimating the economic savings from a change in vaccine manufacturing technology.

For HHS, Dr. Clay supports the Biomedical Advanced Research and Development Authority's Division of Analytic Decision Support. There he helps with planning for CBRN events, evaluating clinical trials, and evaluating medical countermeasures. During the recent outbreaks, he assisted coordinating the Ebola and Zika Modeling Coordination Groups, which brought together scientific modelers with policy makers across the government and nonprofit communities in an effort to help provide the most science-informed decisions for the response operations.

Dr. Clay's Ph.D. is from Northwestern University in Applied Mathematics and, while his career has taken a turn from the academic, he still manages to use his research in computational fluid dynamics.

Nicholas Clayton, M.Sc.
Nicholas Clayton is a Program Leader for Rare Diseases at Sanofi Genzyme. He is a member of the Radiation Research Society.

Nick joined Genzyme in 2003, and in 2015, he became involved in the development of Sargramostim for H-ARS. Nick has had many roles at Sanofi Genzyme, including managing early stage R&D programs focused on Rare Diseases and Transplant Immunology, and was Chair of the Sanofi North America IACUC.

Before joining Sanofi Genzyme, Nick was a scientist at Millennium Pharmaceuticals. He received his M.Sc. in Pharmacology from the Massachusetts College of Pharmacy and his B.S. from the University of New England.

Patrick Conroy, EMT-P, BS, MS, FACHE

Patrick M. Conroy is the System Director of Safety and Environment of Care for the University of Colorado Health System. His responsibilities at UCHealth include all aspects of the organizational Environment Health and Safety Program and the Emergency Preparedness Program for a Health System which includes six acute care hospitals and numerous ambulatory facilities along the front range of Colorado. Patrick came to UCH after a 30-year career as a paramedic and firefighter in the Denver metropolitan area. He has served in a variety of supervisory and management positions in the private and public sectors, including serving as the emergency manager for several jurisdictions. He is qualified as an all-hazard Incident Commander and Planning Section Chief at the Type 3 level. He also serves as an Incident Commander and Planning Section Chief on the Colorado Team 1 (Jefferson County) Incident Management Team and has responded to a number of local, regional, and nationwide incidents. As a speaker and instructor, Patrick has presented at conferences across the US for over 25 years.

Todd Getz, Ph.D.

Todd Getz was trained and mentored in the Sol Sherry Thrombosis Research center and the McAllister Heart institute. These are two of the nation's leading centers for studying and understanding the molecular mechanisms of hemostasis, thrombosis, wound healing, and transfusion medicine.
During his graduate and post-doctoral training, he made vast contributions to the literature in these areas. Dr. Getz performed and developed in-vitro methods and models related to understanding platelet function as well as developed a novel in-vivo laser injury hemostasis model.

More recently while working with the US Army, Dr. Getz identified a way to preserve platelet function and increase shelf-life. These efforts have been influential in the FDA's decision to revise their guidance's for use of platelets stored at 4 °C for 3 days.

Joel S. Greenberger, M.D., F.A.C.R.O., F.A.C.R.

Dr. Greenberger is currently Principal Investigator on the Center for Medical Countermeasures Against Radiation (CMCR) Grant from the NIAID. He also is Principal Investigator on Project 1 "MnSOD-PL Intravenous Administration for Prevention of Total Body Irradiation-Induced Toxicity," and the Principal Investigator on the Pilot Projects Core, and the Education and Development Core of the CMCR Grant. The CMCR Program, with its four projects and six cores, seeks to optimize MnSOD-PL gene therapy for systemic radiation protection (agents delivered after radiation exposure) to protect first responders entering a blast area for a dirty bomb or fission bomb terrorist attack. The projects in the CMCR are also focused on developing new small molecule radiation mitigators (agents delivered after radiation exposure) to decrease the toxicity of radiation and stimulate survival of individuals who would normally be victims of bone marrow or intestinal radiation injury. Project 1 seeks to determine the potentially deleterious late effects of total body radiation protection in surviving mice that are protected from otherwise lethal total body irradiation. Male, female, and pregnant female mice are being followed for their lifespan, and litters born to pregnant females who have survived irradiation by small molecule therapy are being followed for tratogemic effects of this radiation protection.

Hao Guo, Ph.D.
Dr. Hao Guo graduated from Shandong University (Jinan, China) with a Bachelor's degree in Biology. She then completed her Ph.D. training in cell biology and immunology at the Institute of Biophysics, Chinese Academy of Science (Beijing, China). During her graduate studies, she worked on Toll Like Receptor 9 translocation and Interferon-I regulation in human plasmacytoid dendritic cells. In 2016, she joined Dr. Jenny P.Y Ting's laboratory in University of North Carolina at Chapel Hill (Chapel Hill, NC, USA). She is now investigating innate immune pathways that mitigate radiation-induced damage and the role of the gastrointestinal microbiota in this process.

Mary Homer, Ph.D.
Mary Homer joined BARDA in 2008 where she worked as a project officer on several contracts focused on advanced development of medical countermeasures. In 2014, she became the branch chief of the radiological/nuclear countermeasure portfolio and currently oversees over 25 projects related to product development of MCMs.

Ken Hopper, MSM, MPA
Ken Hopper is currently serving as the Federal Patient Movement Coordinator. Prior to this position he served as part of the Secretary's Operations Center. Within that role he participated in numerous response operations from Hurricane Ike/Gustav, the Ebola crisis to the Haiti Earthquake. He served the nation for 30 years in the United States Marine Corps, completing five combat tours and serving in ever increasing positions of responsibility. His last assignment was at The Pentagon, Joint Staff as the Branch Chief Homeland Security. His current focus of effort within the Patient Movement Branch includes evaluating the current Federal Coordination Centers, coordinating all Patient Movement documents, and educating the NDMS partners on the Radiological Injury Treatment Network.

Chad Hrdina, M.S., EMT, GC-WMD
Chad Hrdina is the Chief of Medical Countermeasure Utilization and Response Integration in the Division of Medical Countermeasure Strategy and Requirements, Office of the Assistant Secretary for Preparedness and Response. In this capacity he leads a staff that partners closely with CDC, Office of Emergency Management, and BARDA, including others, on the development of policy, strategy, plans, and guidance that will enable seamless and effective utilization of medical countermeasures in a CBRN incident response. He has worked in the field of radiological and nuclear threats and emergency medical and public health preparedness and response for over ten years with many FSLTT, interagency, White House, and international partners; and has been one of the individuals responsible for the development and implementation of many foundational radiological and nuclear incident response strategies, concepts, tools, guidance, and plans, including requirements for medical countermeasures to radiological and nuclear threats.

Naduparambil K. Jacob, Ph.D.
Naduparambil K. Jacob is an Assistant Professor (tenure track) in the Department of Radiation Oncology at the Ohio State University (OSU) College of Medicine, Columbus Ohio. He is a molecular biologist with training and research experience in the areas of molecular carcinogenesis, biomarkers, DNA repair and radiation biology. Dr. Jacob has completed his undergraduate studies in India and received PhD in Biology from University of Tubingen, Germany and postdoctoral training from University of Cincinnati. He is a member of translational therapeutics program in the OSU Comprehensive Cancer Center with federally funded research programs in translational radiation biology. His research integrate the knowhow on systems biology and advances in the molecular epigenomics. Research topics of special interests include understanding the mechanisms of radiation resistance in leukemia and lung cancers, developing circulating non-coding RNAs such as microRNAs and long non-coding RNAs as biomarkers of radiation injury, early prediction of late effects in patients receiving radiation therapy and in victims of radiation accidents.

Jay M. Johnson, MS, CEM, MEP
Jay Johnson is an Emergency Management Associate. With years of experience in Healthcare Emergency Management, Fire-Rescue and Emergency Medical Services (EMS), Jay brings a broad range of knowledge to the Emergency Management Team. Having extensive involvement in multi-agency coordination and through leadership roles in Regional Healthcare Preparedness Coalition implementation, Jay brings a collaborative community-based perspective to the team. Mr. Johnson has Bachelor of Science in Public Safety Administration and Master of Science in Leadership with a concentration in Crisis Management and Emergency Preparedness from Grand Canyon University. He is also pursuing a Doctor of Education in Organizational Development from Grand Canyon University.

George W. Korch, Ph.D.
George W. Korch is the Acting Assistant Secretary for Preparedness and Response. He previously served as the Acting Principal Deputy Assistant Secretary and as the Senior Science Advisor to the Assistant Secretary for Preparedness and Response, Health and Human Services. Dr. Korch has also been on the faculty of the Department of Molecular Microbiology and Immunology, The Johns Hopkins Bloomberg School of Public Health as Visiting Professor for over seven years, and currently as an Adjunct Faculty member. His federal experience during his tenure at HHS has also included a number of leadership roles, such as co-chair of the Executive Committee of the Public Health Emergency Medical Countermeasures Enterprise (PHEMCE), co-chair of the Federal Expert Security Advisory Panel (FESAP) under the National Security Staff, Office of the President, and as co-chair of the Department of Health and Human Services Biosafety and Biosecurity Coordinating Council.

He retired from the U.S. Army Medical Department in 2008, where he had served in a number of leadership roles, including the Commander of the U.S. Army Medical Research Institute of Infectious Diseases and the Director of the Department of Defense Medical Chemical and Biological Defense Research Program. He also served as one of the first Directors of the National Biodefense Analysis and Countermeasure Center, Department of Homeland Security. His area of expertise is in viral and rickettsial zoonotic diseases, science management and in biodefense medical countermeasure development (vaccines, therapies and diagnostics).

Vidya P. Kumar, Ph.D.
Scientist at AFRRI with the Henry M Jackson Foundation, Bethesda, MD. Reviewer for journals: Photochemistry and Photobiology, Oxidative Medicine and Cellular Longevity, International Immunopharmacology and Radiation Research.

Work Experience
At AstraZeneca India, Bangalore, India (June 1990 – July 2007)
Drug development of antimalarials, broad spectrum antibacterials and drugs/ combinations against MDR Mycobacterium tuberculosis

At University of Oklahoma, Norman, OK (Aug 2007 – Jan 2012)
As a graduate student studied mechanistic enzymology

At Yale University School of Medicine, New Haven, CT (Feb 2012 – Jan 2015)
• Pre-steady state kinetics and protein crystallography with inhibitors of TS-DHFR Instructor for Structure based drug-design course
• Developed flowcytometric assays as an alternative to traditional microscopy for Babesia. Murine model to screen new drugs against Babesia infection.

At AFRRI, Bethesda, MD (Feb 2015 – present)
• As a Scientist – co-PI on IACUC protocols
• Screening and development of radiation countermeasures
• Training the team of coworkers.

Onora Lien, M.A.
Onora Lien is the Executive Director for the Northwest Healthcare Response Network (the Network), a non-profit emergency management healthcare coalition serving the greater Seattle metropolitan area. The Network is largest healthcare coalition in Washington State serving healthcare organizations that provide nearly half of the state's hospital and long term care beds.

Ms. Lien has worked with the Network and its predecessor, the King County Healthcare Coalition, since 2006, previously at Public Health – Seattle & King County. Prior to assuming the Executive Director role, she served as a program manager for the coalition. In this capacity, she led numerous regional healthcare emergency response and preparedness initiatives across the continuum of healthcare and with public health and the emergency response communities.

Ms. Lien has more than 16 years of experience in healthcare and public health emergency management. She frequently serves as an adviser to healthcare coalitions around the country, and to local, state and federal healthcare preparedness initiatives.

Prior to her work in Seattle, she was a research and policy analyst on domestic health security in Baltimore, Maryland with both the Johns Hopkins Center for Civilian Biodefense Strategies and the UPMC Center for Biosecurity (now Johns Hopkins Center for Health Security). She earned her Master's degree in Sociology from Johns Hopkins University, where her research focused on the organizational and community impacts of public health emergencies, disaster response and community based strategies for building resilience.

Thomas J. MacVittie, Ph.D.
Thomas MacVittie is a professor of radiation oncology and pathology at the University of Maryland, School of Medicine. He has more than 40yrs of experience as a radiobiologist in the field of experimental hematology and has published 184 peer-reviewed manuscripts and 47 book chapters or proceedings. He was an inaugural member of the National Biodefense Science Board and was Director of a 10 year NIAID-sponsored Consortium focused on medical countermeasures against radiological threats (MCART).

Dr. MacVittie has demonstrated a consistent record of accomplishment in research and management skills focused on integrating experts of multiple disciplines to achieve common goals. This effort continues with the evolution of the team's approach to understanding the link between the ARS and DEARE. The team is focused on developing a more strategic approach to MCM development and the refinement of animal models for the H-, GI-ARS, lung damage and multi-organ injury to include the heart and kidney.

Libero (Louis) Marzella, M.D.
Libero Marzella is the Director of the Division of Medical Imaging Products (DMIP) of the Food and Drug Administration (FDA). He has been at FDA since 1994 and during this time has served as a Clinical Team Leader in the Center for Drugs Evaluation and Research (CDER) and in the Center for Biologics Evaluation and Research (CBER). In these positions he has performed primary and secondary reviews of Investigational New Drugs and New Drug Applications (INDs and NDA/BLAs) for diagnostic and therapeutic drugs and biologics. He has also contributed to the development of regulatory policy for these products. Before joining FDA, Dr. Marzella conducted academic research in cell biology and pathology and taught at the University of Maryland School of Medicine (Dept. of Pathology) and at the Maryland Institute for Emergency Medical Services starting in 1980. He received clinical training at the University of Maryland (M.D.) and graduate training at the Karolinska Institute (Ph.D.).

Audrey Mazurek, M.S.
Audrey Mazurek has worked at all levels of government for over 14 years in public health preparedness and homeland security. She was a program manager with the National Association of County and City Health Officials (NACCHO) Project Public Health Ready (PPHR) program, supported the US Department of Homeland Security (DHS) in the development of an accreditation and certification program for private sector preparedness, and served as a public health emergency preparedness planner for two local public health departments in Maryland, where she developed over 30 preparedness and response plans, trainings and exercises. She is currently the ICF TRACIE Deputy Project Director for the US Department of Health and Human Services, Assistant Secretary for Preparedness and Response (ASPR) Technical Resources, Assistance Center, and Information Exchange (TRACIE) program.

John L. McManus
John McManus is President and Chief Executive Officer of Aeolus Pharmaceuticals and has served as project manager of the Company's contract with the Biomedical Advanced Research and Development Authority (BARDA) to develop AEOL 10150 as a medical countermeasure to mitigate lung damage after radiation exposure ("Lung ARS"). Under his leadership, Aeolus has established partnerships with leaders in the fields of radiation oncology, radiation biology, chemical vesicants, epilepsy and interstitial lung disease, which have generated more than $50 million in grants and contracts from the US government and patient advocacy groups. These investments have leveraged more than $55 million invested by Aeolus to establish AEOL 10150 as a potential broad spectrum medical countermeasure and promising treatment for patients suffering from IPF and other lung conditions.

John and the Aeolus team have worked with research partners, FDA, NIH and BARDA on: the development and validation of animal models for radiological and chemical threats, IND filings for Lung ARS and Sulfur Mustard Gas Exposure, FDA approval for studies in healthy subjects, and orphan drug designation for Lung ARS and IPF. He is a co-inventor of a drug under development by Aeolus for Parkinson's disease and another as a treatment for cystic fibrosis and as a broad spectrum anti-microbial.

Michelle Nalabandian, M.S.
Michelle Nalabandian joined NTI in 2009 and serves as program officer for the scientific and technical affairs program. In this role, she manages operational elements of the program, focusing on the security of nuclear and radiological materials globally, cybersecurity for nuclear facilities, and biosecurity threats. Prior to joining NTI, Nalabandian worked in the financial sector for asset management firms Global Environment Fund and Sciens Capital Management. Nalabandian holds a bachelor's degree in biology and a master's degree in forensic science from George Mason University, and received a certificate of mastery from the John F. Kennedy School of Government at Harvard University.

She was a 2015 Center for Strategic and International Studies Project on Nuclear Issues
Nuclear Scholar and a 2015 Fellow of the Emerging Leaders in Biosecurity Initiative. She is also a member of Women in International Security and the Institute of Nuclear Materials Management.

Racheli Ofir, Ph.D.
VP of Research of Pluristem Ltd. Holds a Ph.D. from the Technion, Israel institute of technology.
Dr. Ofir is responsible for the development and characterization of PLX cells, Pluristem's leading placenta derived cell product candidate, including pre-clinical evaluation of the biological activity of the cells, determining the safety profile and PK of PLX cells, and all pre-clinical aspects of the PLX regulatory process, including the communications with the relevant regulatory authorities worldwide. Dr. Ofir has extensive research experience in molecular cell biology, embryology and cytogenetics as well as broad professional experience in the field of human cell therapy. Dr. Ofir is the co-author of numerous peer reviewed articles and a co-inventor on numerous patents and patent applications in the field of cellular therapy.

Raymond Puerini, MPH
Mr. Puerini serves as the lead of NACCHO's Medical Countermeasure Project and Radiation Project, in addition to serving as the NACCHO exercise team lead. Raymond has planned numerous functional and discussion based exercises on a variety of chemical, biological, radiological, nuclear, and explosive (CBRNE) topics and has completed relevant Homeland Security Exercise Evaluation Program (HSEEP) Training. In addition, Raymond was previously involved with the development of curriculum and training materials for the Roadmap to Ready program which is a training and mentoring program for new local preparedness coordinators.

Mr. Puerini has over 10 years of experience working in a number of sectors in including public health, laboratory science, and the pharmaceutical industry. Raymond previously served as the Medical Countermeasure Coordinator for the Philadelphia Department of Public Health where he led mass dispensing and vaccination exercises, the National Postal Model Planning Initiative, the Closed POD Partners Program, and all mass prophylaxis planning activities including long-term mass dispensing planning. Raymond has worked at the Centers for Disease Control and Prevention at the Laboratory Response Network program office and Division of Healthcare Quality Promotion conducting antimicrobial susceptibility testing. He has a Masters of Public Health from the Rollins School of Public Health at Emory University and a Bachelor's of Arts in Biology and Neuroscience from Wesleyan University.

Peter Quesenberry, M.D.
Peter Quesenberry has a long hisotry of stem cell hematopiesis research. He is director of Hematology/Oncology research at Brown University in Providence, R.I. He lists 332 manuscripts on Pubmed and recently chaired a Gordon conference on vesicles. He presently has a UH3 grant focused on reversal of radiation toxicity to hematopoietic stem cells by exposure to mesecnhymal stem cell derived vesicles.

Luigi Racioppi, M.D., Ph.D.
Luigi Racioppi has been working in the field of Immunology for more than 20 years. First at NIH-NIAID, Bethesda, MD, as Visiting Associate in the Lymphocyte Biology Section, under the supervision of RN Germain, then at University of Naples Federico II, as Associate Professor. In 2011, he relocated to the Department of Medicine/Cell Therapy-Hematological Malignancies Division at Duke, as Assistant Professor. Most of his activity has been aimed at identifying the molecular bases of mechanisms that regulate the immune response. Dr. Racioppi was the first to describe ligands of T-cell receptor displaying a partial antagonistic activity and to characterize the immunological defects in the novel form of immunodeficiency disease, the human Nude/SCID phenotype. His studies have been aimed at establishing the functions of Calcium/calmodulin-dependent kinase family members (CaMKs) in hematopoietic cells. Dr. Racioppi has successfully identified the role of CaMKIV in dendritic cells and in the antibody response to flu vaccine. He has identified the expression of CaMKK2 in macrophages and described its role in the inflammatory response and in granulopoiesis. More recently, he has investigated the roles of CaMKK2 in Hematopoietic Steem Cells using in vivo models of genetically engineered mice. These studies led to the identification of CaMKK2 as a novel druggable target for hematopoietic acute radiation syndrome.

Linda A. Reissman, M.S., CHEP, CIS
Linda Reissman has over thirty five years of experience in the municipal, private, and governmental sectors of the emergency management, public health, and EMS disciplines and is currently the Director of Emergency Management for Memorial Sloan Kettering Cancer Center (MSK) where she is responsible for emergency preparedness and business continuity for the hospital, its research facilities as well as their NYC outpatient sites and business locations.

As a member of DMAT, Linda has participated in the development and execution of integrated Federal/regional exercises, and has deployed to disasters for team activations, including 9/11.
Linda served as Senior EMS Representative and Deputy Administrator, for the New York State Bureau of EMS. In this role Linda coordinated Hospital & EMS disaster response plans and exercises in NYC in cooperation with regional EMS, state and federal emergency management authorities.

As a founding member of her home County's Bioterrorism Committee, Linda helped facilitate the committee's inception and was responsible for the development of the County's first bio-terrorism plan. For these efforts the County's program was highlighted as a promising practice by the National Association of County and City Health Officials (NACCHO). The committee is still active today and has expanded its scope to include an all-hazards approach to county emergency planning.

Linda has presented a national conferences and provided emergency management consultation for a number of hospital institutions, EMS agencies and businesses. Linda has a Master's Degrees in Emergency Management.

Adela Salame-Alfie, Ph.D.
Dr. Salame-Alfie is a Senior Service Fellow in the Radiation Studies Branch in the National Center for Environmental Health, Centers for Disease Control and Prevention (CDC). Prior to this appointment, Dr. Salame-Alfie spent 22 years with the New York State Department of Health in various capacities including being the Director of the Division of Environmental Health Investigation, Director of Preparedness for the Center for Environmental Health, and Director of the Bureau of Environmental Radiation Protection.

Dr. Salame-Alfie is a member of the National Council on Radiation Protection and Measurements (NCRP) and co-chairs the SC3-1 Scientific Committee charged with developing dosimetry guidance for radiation emergency workers. She is a Lifetime member of the Conference of Radiation Control Program Directors where she served as Chair and member of the Board of Directors, and chaired several committees. She is also a Fellow of the Health Physics Society.

Dr. Salame-Alfie has extensive experience in radiological emergency preparedness and has published and co-authored many publications on the subject, including the "Handbook for Responding to a Radiological Dispersal Device – First Responder Guide". She co-chaired the 2017 NCRP Annual Meeting "Assessment of National Efforts in Emergency Preparedness for Nuclear Terrorism: Is There a Need for Realignment to Close Remaining Gaps?"

Dr. Salame-Alfie obtained her Master's and Ph.D. in Nuclear Engineering from Rensselaer Polytechnic Institute in Troy, NY. She obtained her Bachelor's in Energy Engineering from Universidad Autonoma Metropolitana in Mexico City.

Pasupathi Sundaramoorthy, Ph.D.
Pasupathi Sundaramoorthy is from India and has completed a Doctorla degree at College of Pharmacy, Gachon Uiniversity in South Korea during 2013-2016. During my Ph.D., Dr. Sundaramoorthy studied the molecular mechanisms underlying cancer and cancer chemotherapy. He has developed drug-like self-micellizing anticancer lipid, and investigated its cell death pathway in human colorectal cancer cells, specifically PI3K1AKT/mTOR pathway and Focal adhesion kinase.

Currentlly, Dr. Sundarmoorthy is working as a Postdoctoral Associate in Division of Hematologic Malignancies & Cellular Therapy in Duke University Medical Center under Dr. Yubin kang Lab. Here, they are developing drug to mitigate the radiation induced hematopoietic stem cell injury and underlying biological and molecular mechanisms.

Bob Terbrueggen, Ph.D.

Bob Terbrueggen, Ph.D., is the Founder and CEO of DxTerity Diagnostics, a Los Angeles, CA based molecular diagnostics company. DxTerity specializes in the development of low cost, high throughput, blood based genomic tests. Since 2009, DxTerity has been collaborating with Duke University and Thermo Fisher/Life Technologies on the development of the REDl-Dx® High Throughput Radiation Biodosimetry Test System. In September 2016, DxTerity was awarded a multi-year, up to $150.1 million contract by the Biomedical Advanced Research and Development Authority (BARDA), a division of the U.S. Department of Health and Human Services' Office of the Assistant Secretary for Preparedness and Response, for the Advanced Development and Delivery of REDl-Dx®. This contract envisions EUA authorization in 2017 followed by FDA clearance in 2018, and a 400,000 REDl-Dx test and 400,000 DxCollect Blood Collection Stockpile in the Strategic National Stockpile.

Prior to founding DxTerity, Bob was Director of Research and Development for Clinical Micro Sensors (CMS) and Motorola Life Sciences. Bob is an inventor on 20 approved U.S. patents and more than 20 pending applications.

Lynne Wathen, Ph.D.

Lynne Wathen joined the Biomedical Advanced Research and Development Authority (BARDA) in 2010 and currently serves as a Biodosimetry Team Leader in the Diagnostics and Medical Devices (DMD) Division of BARDA within the Office of the Assistant Secretary for Preparedness and Response (ASPR) at the U.S. Department of Health and Human Services (HHS). Her duties include programmatic and technical oversight of advanced development contracts targeting diagnostic development to detect CBRN threats. She is working to help develop Point of Care Qualitative Triage and High-Throughput Quantitative biodosimetry tests. Dr. Wathen previously served as a Global Program Leader for development of vaccines, drugs, diagnostics and devices at pharmaceutical companies and contract research organizations. She led oncology, antiviral, antibiotic, women's health and vaccine clinical studies with novel investigational medications and developed in vitro diagnostics.

Scott White, Ph.D.

Scott White leads the Biological Terrorism Risk Assessment (BTRA) and Integrated CBRN Terrorism Risk Assessment (ITRA) programs for the Chemical and Biological Defense Division (CBD) within the Department of Homeland Security (DHS) Science and Technology Directorate (S&T). He has been involved in terrorist threat and risk assessments, assessment of emerging and engineered threats, and biotechnology applications for over twenty years, and has served at DHS S&T CBD since 2013. Prior to his long-term detail at CBD, Dr. White was a Scientist, Line Manager, and Program Manager at Los Alamos National Laboratory, New Mexico where he developed DNA/RNA multiplex assays, computational tools, and novel technologies to discover, extract and exploit genomic variation information. As a recognized risk analysis SME and thought leader within DHS, Dr. White has led interdisciplinary teams of experimental and computational biologists, instrument developers, mathematicians, and modelers to address complex problems in National Security. Dr. White's current work with the BTRA and ITRA are extensions of his experience and interest in applying multidisciplinary technical and modeling expertise to important challenges in the CBRN-defense and Homeland Security mission space.

Weng-Lang Yang, Ph.D.

Weng-Lang Yang is Chief Scientific Officer at TheraSource, a company focused on developing peptide and protein as drugs to the treatment of medical conditions related to acute radiation injury, inflammation including sepsis, and acute kidney injury. He has led the efficacy and toxicity pre-clinical evaluation of TheraSource-discovered drug candidates. He has served as a Principal Investigator in 2 Small Business Innovation Research (SBIR) Phase II and 5 SBIR Phase I awards from National Institutes of Health. Dr. Yang is also Associate Professor of Surgery at the Hofstra Northwell School of Medicine and The Feinstein Institute for Medical Research, both in NY. His early research interest is to study cellular responses of solid tumors to surgical ablations and bone morphogenetic protein signaling pathway in regulating colorectal cancer metastasis. Currently, his research focuses on studying cellular and immune responses in various organs damaged by radiation, ischemia-reperfusion, and septic shock. He is the author of more than 80 peer-reviewed publications in the areas of cancer and critical care, including one in Nature Medicine. Dr. Yang received his Ph.D. from Rutgers University and postdoctoral training at the Cancer Institute of New Jersey, both in NJ.