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Editorial

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Success!*

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In the words of Henry Ford, "Coming together is the beginning, keeping together is progress, working together is success." In the field of Preparedness and Response, although we meet often and create multiple committees, alliances, and partnerships, there are precious few examples of truly working together. Unfortunately, this has been a hallmark of disaster preparedness and response through the ages[1]; and again, unfortunately, this lack of truly working together is as concerning today as it was in the past and runs through all phases of what is commonly known and accepted as the Disaster Cycle, from Response, through Recovery, Mitigation, and Preparedness.

This state of affairs has long been recognized, but most attempts at setting a correction have only partially succeeded as they have been too narrowly focused, often designed from the perspective of a given individual or a single profession or discipline. As a result, we have developed an array of "centers of excellence" as exemplified by the multitude of societies, sections within societies, academic entities, and a host of departments and branches at all levels within state and federal agencies, all operating in an, at best, semi-autonomous manner addressing some limited subset of Preparedness and Response such as Disaster Nursing, Emergency Response, and Search and Rescue.

As pointed out by Dr "Skip" Burkle, recognized both globally and domestically as one of our leading thinkers in the area of Preparedness and Response, if we are to be successful in reducing morbidity and mortality in the face of catastrophic events we need a holistic systematic approach that is both transdisciplinary and multidisciplinary and brings together all the disparate players that have a significant role in Preparedness and Response, from the citizen responder through the multiple levels of health care providers to the academicians and research scientists, as well as the non-medical disciplines and professions that are essential to the provision of population health and Global Health Security[2]; and, as with most human endeavors, the whole is predictably greater than the sum of the parts.

Today it is exciting to publish herewith a special section of *Disaster Medicine and Public Health Preparedness* that documents an accomplishment in our better understanding of the biologic interplay of the effects of chemical and radiological agents that clearly demonstrates the effectiveness of, and benefits from, truly working together.

Chemical and radiological agents cause toxicity through different mechanisms; however, the multiorgan injuries caused by these threats share many similarities that converge on the level of basic biological responses. To further understand these similarities and learn from successes in each space, the National Institute of Allergy and Infectious Diseases (NIAID) Chemical Countermeasures Research Program (CCRP) and the Radiation and Nuclear Countermeasures Program (RNCP), in collaboration with the Biomedical Advanced Research and Development Authority (BARDA) Radiological and Nuclear Countermeasures Branch, Thermal Injury Program, and Chemical Countermeasures Program, hosted a 2-day workshop on January 13–14, 2022, titled "Overlapping Science in Radiation and Sulfur Mustard Exposures of Skin and Lung: Consideration of Models, Mechanisms, Organ Systems, and Medical Countermeasures." The goals of this workshop were to examine pathologies in pulmonary and cutaneous injuries following chemical or radiological/nuclear insults; discuss animal models and medical countermeasures (MCMs) under study in both fields; and identify existing gaps, challenges, and needs for translational application in both mission spaces.

There are many similarities and differences between radiation and sulfur mustard injury responses among tissues and species that were identified in this workshop. Some of the articles review the radiation and sulfur mustard literature and find some similarities among injury response and potential mechanisms by which exposure to these agents causes injury to tissues. Many common mechanism themes were identified, including inflammation and oxidative stress. The review by Jackson[3] discusses some of the studies that were done to develop medical countermeasures to mitigate pulmonary injury due to chemical, radiological, or nuclear weapons exposure. The review compares some of the clinical responses from exposure to these agents and some of the underlining mechanisms they share. The commentary by Day[4] discusses oxidative stress as a possible shared mechanism of injury between radiation and sulfur mustard-

induced lung injury and the positive effects of catalytic antioxidants in animal models of radiation and sulfur mustard-induced lung injury and death. The article by Laskin et al.[5] examines the role of inflammation as a mechanism of pulmonary injury from mustard vesicant agents and the therapeutic potential of TNFα-targeting agents as medical countermeasures. The article by Harvilchuck et al.[6] examines work done in radiation-induced myelosuppression and the use of Neupogen to reverse neutropenia, as well as tests whether Neupogen has benefit in sulfur mustard-induced myelosuppression. The authors found that, although Neupogen did not prevent sulfur mustard hematologic toxicity in a rodent model, it improved clinical recovery. Laskin et al.[5] focused on sulfur mustard-induced skin injury and the differences seen on wound healing between species. The authors found that some species utilize contraction as a mechanism of skin repair, whereas other species, including humans, rely on reepithelialization. The article brings up the importance of animal model selection when examining human medical countermeasure for sulfur mustard-induced skin injury. The article by Wolfe[7] focused on radiation dermatitis and gleaned knowledge gained from retrospective clinical studies of patients receiving radiation therapy and skin care treatments. The article discusses a novel descriptor-based scoring tool that could be useful in examining medical countermeasures for radiation-induced skin damage. Iddins[8] also looks at retrospective cases from the Radiation Emergency Assistance Center/Training Site (REAC/TS) and discusses patterns of injury and treatment options over 44 years of radiation incidents. Marzella[9] discusses key elements of the FDA Animal Rule used to develop medical countermeasures for exposure to radiation and chemical threat agents. Marzella's article addresses the importance of aligning mechanisms of action and clinical conditions in animal models of radiation and chemical threat agents and their use in selecting a maximally effective dose in humans. Rios[10] examines the current state of radiation and chemical threat research and the role that government agencies such as NIH's CounterAct program, BARDA, ASPR, and the FDA play in the development of medical countermeasures to mitigate their harmful effects.

A key outcome emerging from the workshop was identifying areas of overlap between the radiation and sulfur mustard injury space. These included overlap in the mechanisms of action driving damage, animal models, and identification of MCMs with utility in both spaces. These areas are described in the articles published in this special issue.

Injuries caused by acute radiation, such as bone marrow myelosuppression, organ fibrosis, acute and delayed lung and skin injuries, acute respiratory distress syndrome, coagulopathy, neurodegeneration, and neovascularization, may manifest similar to or identical to conditions observed after chemical exposure, and vice versa. As such, the multidisciplinary nature of radiation and chemical injury research potentially lends itself to the establishment of formal partnerships between RNCP- and CCRP-supported researchers. These RNCP–CCRP partnerships would allow leveraging of unique expertise, in vitro and in vivo, small, and large animal models, ex vivo organ systems, specialized exposure facilities, and other core competencies that have been cultivated under the 2 NIH initiatives. To this end, CCRP and RNCP and NIAID published a Notice of Special Interest following the workshop that specifically funded collaborative projects between the radiation and chemical injury space.[1]

As detailed above, scientists from 2 distinct federal agencies and multiple disciplines came together, kept together, and finally worked together to optimize their accomplishments regarding the toxicological effects of chemical and radiological agents. Although a relatively small collaboration in terms of the enormity of Preparedness and Response, the results of the combined effort will have significant and lasting beneficial effects in the development and deployment of common countermeasures. This, in turn, may well lead to the saving of lives through the availability of more products delivered to the point of care in a timelier manner as a result of more efficient logistics.

Even more importantly, the current undertaking serves as an excellent model that can, and should, be emulated, copied, and built upon. This would help pave the way toward realizing Dr Burkle's vision: How successful a Health Crisis Framework would be is dependent on the efforts of the global health community .... But, drastic measures that include strategic level models must be designed with disaster-savvy health care providers of every discipline and researchers who are key to both its implementation and long-term success. The historically based disaster cycle framework remains a viable model to build on. The question is whether the professional global health community is up to the challenge."[2]

In closing, we have achieved Mr Ford's third level of collaboration—we have succeeded! Going forward, our society and journal stand ready to support and document other successes that truly integrate the multidisciplinary skills necessary to succeed. We cordially invite all of you reading this piece to join us on this journey.

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