The Boice Report #30

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Las Vegas, Radiation, and the Next Generation

The King and I—Presidents Francis Cucinotta (RRS, left) and John Boice (NCRP)
Photo courtesy of Bruce Kimler

When Elvis was King (Creole that is) in the 1950s, tourists would come to Las Vegas to view the spectacular detonations of nuclear weapons at the Nevada Test Site. Since then there has been an explosion of knowledge on the late health effects following radiation exposure. But there is more to be learned as highlighted during the 60th Annual Meeting of the Radiation Research Society (RRS), September 2014. A focus on the next generation of leaders, essential for the well-being of our nation, included the Scholars in Training workshops held by the RRS and the mentoring and encouragement of young investigators, primarily epidemiologists and biostatisticians, who attended the Conference on Radiation Health (CRH). The joint meetings were a wonderful melding of the disciplines of radiation biology, physics, epidemiology, and medicine. The 2nd Health Physics Society (HPS)/RRS symposium covered radiation and children. The 2nd National Council on Radiation Protection and Measurements (NCRP)/RRS symposium was on integrating radiobiology with epidemiology for improved risk assessment at low doses. The atmosphere was rich with innovative discussions about future needs and opportunities for radiation scientists.

HPS/RRS Symposium on Children. John Zimbrick and Wesley Bolch chaired this well-attended session on exposures in childhood (photo on page 15). Jerrold Bushberg set the stage with an overview of diagnostic exposures and computed tomography (CT) examinations and programs such as Image Gently that strive to minimize unnecessary examinations and to lower exposures to "as low as diagnostically achievable." Bolch provided a remarkable overview of the methods to compute organ doses following diagnostic procedures given to children at all ages. Sandy Constine discussed the effects of radiotherapy on children and summarized parts of the landmark publication by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) on childhood sensitivities which concluded that, despite common belief, children are not more sensitive than adults for all cancer types. Peter Inskip provided a tour de force overview of the risks of second cancers following radiotherapy procedures in children.

NCRP/RRS Symposium on Biology and Epidemiology. Following the European symposium on biology and epidemiology (DoReMi), the NCRP symposium addressed biology, epidemiology, clinical relevance, and ways forward to integrate and improve risk assessment at low doses (<100 mGy) and low dose rates (<5 mGy h^{-1}). Jac Nickoloff led off summarizing the treasure of radiation biology information on molecular, cellular, and tissue responses to low-dose radiation. Next, Jonine Bernstein presented the WECARE study that combines epidemiology, genetics (including gene sequencing and genome-wide association studies analyses), and dosimetry to evaluate the interplay between genetic susceptibility and radiation dose in causing contralateral breast cancer. Simon Powell asked whether epidemiologic studies really have an impact in the clinic—there was an "all shook up" moment for some of us before hearing that the answer was YES: studies of contralateral breast cancer following radiotherapy led to the elimination of wedges from medial tangential fields (reducing the dose to the opposite breast). Studies of heart disease after radiotherapy for breast cancer led to techniques to reduce heart exposure. Julian Preston provided a marvelous roadmap of possible approaches to combine biology with epidemiology to improve the quantitation of ad-

verse health effects: apply methods used for chemical assessments (where human data on health effects is lacking), make greater use of basic biology data from animal models and in vitro systems, and incorporate biologically based models and the adverse outcome pathway concept.

CRH Symposiums. The 20th Biennial Conference on Radiation Health was held in conjunction with RRS for the first time. A symposium on new cancer incidence data among atomic-bomb survivors was very well attended and showed again the importance of the U.S.-Japanese collaborations on advancing understanding of human health effects. In 1946 President Harry S. Truman approved the "long range, continuing study of the biological and medical effects of the atomic bomb on man," making the Life Span Study the longest running epidemiologic study in history. A symposium on the latest research on CT examinations among children and subsequent cancer risk was informative and also provoked healthy discussions. Current uncertainties that limit interpretations include not being able to identify and account for the reasons these diagnostic procedures were performed and the lack of individual dosimetry. A symposium on Fukushima was timely, indicating that the ongoing ultrasound examinations of children are detecting thyroid cancers that are not unexpected based on background rates for nodular disease in screened populations; i.e., they are not related to radiation exposure. The doses following Fukushima are estimated to be low or very low and "no discernible increased incidence of radiation-related health effects are expected among exposed members of the public or their descendants" (UNSCEAR 2014).

RRS Presidential Symposium on Space. The RRS Presidential Symposium was mind boggling, informative, and forward looking. It focused on the human desire to go beyond Earth and start the exploration of our solar system. Jeff Davis provided a comprehensive overview of the National Aeronautics and Space Administration (NASA) programs that are in place to support our astronauts on long-term missions. These programs include not only the assessment of radiation dose and consequences, but also the myriad of engineering, psychological, mission-specific factors that go into journeying for 3 years to the Red Planet and back. Mary Helen Barcellos-Hoff provided a stellar overview of the complex biological processes and cellular interactions with radiation exposure that might be experienced in space. Murat Alp provided an overview of the extensive modelling exercises that are necessary to assess the exposure potential to galactic cosmic rays and those exotic particles that are zipping through space at high speeds following the explosion of a supernova. The cleanup hitter was Greg Nelson, who provided a remarkable overview of the landscape of experimental studies as they relate to central nervous system (CNS) disorders and potential cognitive dysfunction associated with galactic cosmic rays. NCRP is partnering with NASA in evaluating the potential for CNS effects related to these high-Z radionuclides in space. One realization is that the interaction between these energetic particles and brain tissue is apparently not related to DNA damage and repair; i.e., new paradigms may be needed for modelling and risk assessment.

Left to right, Mary Helen Barcellos-Hoff (New York University), Murat Alp (University of Las Vegas Nevada), Francis Cucinotta (University of Las Vegas Nevada), Jeff Davis (NASA, Johnson Space Center), and Gregory Nelson (Loma Linda University)

This was one of the most informative and enjoyable conferences I have attended, in part because of the multidisciplinary sessions and the integration of young investigators. "Viva Las Vegas"!

HPS/RRS Symposium—Las Vegas September 2014

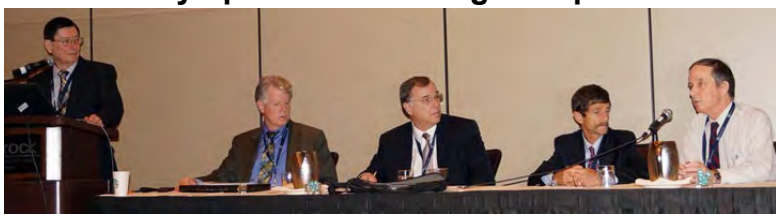

Photo courtesy of Bruce Kimler

Left to right, John Zimbrick (Colorado State University), Wesley Bolch (University of Florida), Jerrold Bushberg (University of California, Davis), Sandy Constine (University of Rochester), and Peter Inskip (National Cancer Institute)