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Report

# Report on the 2nd Educational Symposium on RADIATION AND HEALTH by Young Scientists (ESRAH2015)

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## 1. Overview of the Symposium

The 2nd Educational Symposium on RADIATION AND HEALTH by Young Scientists (ESRAH2015) was held from May 23 to 24, 2015 at Hirosaki University Graduate School of Health Sciences, Hirosaki, Japan (Photo 1). This international symposium was chaired by Prof. Hiroyuki Date (Faculty of Health Sciences, Hokkaido University), offering young scientists around the world an opportunity to understand each other through discussion of their research on "RADIATION AND HEALTH," and to make new friendships and networks. The planning and running of the symposium programs were carried out by graduate students and staff from the Hirosaki University Graduate School of Health Sciences, with the cooperation of graduate students from Hokkaido University.

One-hundred and six researchers from six countries, including the UK, Sweden, Germany, France, and Hungary, gathered for ESRAH2015. The program contained five educational lectures for young researchers delivered by five noted authorities in the radiation sciences: Dr. Christian Streffer (Radiation biology, University Clinics Essen, Germany); Dr. Tibor Kovács (Radiochemistry and Radioecology, University of Pannonia, Hungary); Dr. Gerry Kendall (Natural ionizing radiation effects, Oxford University, UK); Dr. Suminori Akiba (Radiation epidemiology, Kagoshima University, Japan); and Dr. Andrzej Wojcik (Radiation protection and dosimetry, Stockholm University, Sweden). The poster presentation and discussion by young researchers were carried out between the educational lecture II and III. In addition, a panel discussion on "Oxidative stress and lycopene" was coordinated by Dr. Yasushi Mariya, Hirosaki University, Japan. The Symposium Program is shown in Table 1.

**Photo 1.** Main conference room

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**Table 1.** Symposium Program of ESRAH2015

| | *Saturday, May 23, 2015* |
|---|---|
| 10:00 - 11:00 | Registration |
| 11:00 - 11:10 | Opening Remarks |
| 11:10 - 12:10 | Educational Lecture I<br>Dr. Cristian Streffer; Clinical Radiobiology: Historical Aspects and Challenges for the Future |
| 14:00 - 15:00 | Educational Lecture II<br>Dr. Tibor Kovács; Radon issues in our environment |
| 15:10 - 16:40 | Poster Presentation and Discussion (28 Titles) |
| 16:50 - 17:50 | Educational Lecture III<br>Dr. Gerry Kendall; Natural and Artificial Radiation and Childhood Cancer |
| 17:50 - 18:50 | Educational Lecture IV<br>Dr. Suminori Akiba; Cancer risk among atomic bomb survivors |
| 19:30 - 21:00 | Banquet |
| | *Sunday, May 24, 2015* |
| 9:00 - 10:30 | Panel Discussion |
| 9:00 - 9:20 | Dr. Hiroyuki Suganuma; Variety of health-promoting activities of lycopene, one of the mostpotent singlet oxygen quenchers rich in tomato |
| 9:20 - 9:40 | Dr. Yasushi Mariya; Analysis of oxidative stress-related markers in the patients accompanied with thyroid cancer undergoing 131-I radionuclide treatment |
| 9:40 - 10:00 | Dr. Siamak Haghdoost; Antioxidative effect of lycopene |
| 10:00 - 10:30 | General Discussion |
| 10:40 - 11:40 | Educational Lecture IV<br>Dr. Andrzej Wojcik; Radiation accidents and individual dosimetry: the past, the present and the future |
| 11:40 - 12:00 | Award Ceremony and Closing Remarks |

## 2. Educational Lecture

In the Educational Lecture I, Dr. Christian Streffer talked about "Clinical Radiobiology: Historical Aspects and Challenges for the Future" (Photo 2). Ionizing radiation treatment has been a potent tool for cancer therapy since the discovery of X-rays by Roentgen (1895) and radioactivity by Becquerel (1896). In cancer treatment, it is important to consider the fundamental observations such as the different radio-sensitivity of different tissues and organs, fractionation of irradiation in order to avoid serious side effects, and oxygen conditions for radio-sensitivity. It is necessary to suppress the proliferation of cancer cells by two mechanisms; one is apoptosis and the other is unstable chromosomal aberrations, which causes the cells to become incapable of reproduction. Cancer cells, however, have internal defense mechanisms against DNA damage, such as DNA repair and cell cycle control as do normal cells.

Therefore, it is necessary to make cancer cells have a higher sensitivity to radiation. In addition, there are two phenomena in cancers that reduce the success of therapy. One is the presence of hypoxic regions due to vascular structure, and the other is that resting G0-cells can start cycling again and contribute to cell proliferation. Because these phenomena are affected by genetic factors and individual differences, he stated that it is desirable to establish experimental setups in order to study such individual differences before and/or during cancer therapy so that appropriate individual therapy treatments are used in the future.

In the Educational Lecture II, Dr. Tibor Kovács talked about "Radon issues in our environment" (Photo 3). Dr. Kovács started his talk by describing his research at the University of Pannonia on radon in environment. Radon is a chemically inert radioactive noble gas. It emanates from rocks and soils, and tends to concentrate in enclosed spaces like underground mines or badly aerated buildings. Radon is a major contributor to the ionizing radiation dose received by the general population. Furthermore, radon is the second cause of lung cancer in the general population (the first cause is smoking). Owing to these facts, the survey and control of radon levels in enclosed spaces is important. According to the results of the research conducted at his laboratory at the University of Pannonia, estimation of the radiation dose of residents and workers caused by radon can be carried out via radon level monitoring or personal dosimetry. He stated that the health risk due to radon can be mitigated in all investigated areas.

Dr. Gerry Kendall talked about "Natural and Artificial Radiation and Childhood Cancer" in the Educational Lecture III (Photo 4). The history of the epidemiologic study and some hypotheses were offered to explain


**Photo 2.** Educational Lecture I by Dr. Christian Streffer, University Clinics Essen


**Photo 5.** Educational Lecture IV by Dr. Suminori Akiba, Kagoshima University

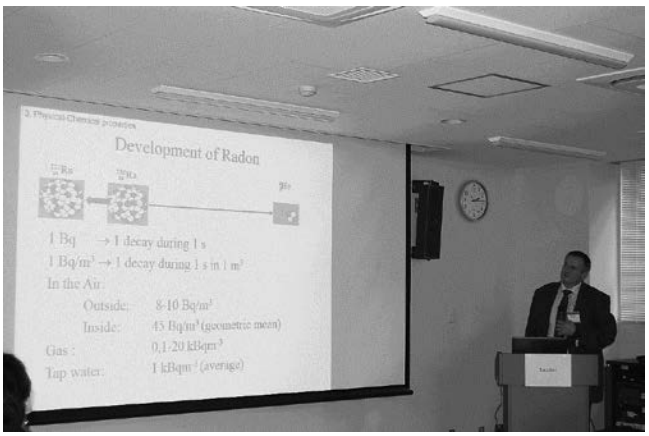


**Photo 3.** Educational Lecture II by Dr. Tibor Kovács, University of Pannonia


**Photo 4.** Educational Lecture III by Dr. Gerry Kendall, Oxford University

high rates of childhood leukemia around the British Nuclear Reprocessing Plant at Sellafield. Dr. Kendall introduced a case-control study conducted by his group and showed that childhood leukemia may have an epidemiological causal relation to the gamma beams from natural background sources, although there is still room for discussion. There are suggestions that radiation, particularly artificial radiation, is much more dangerous than is generally believed. Others argue that radiation is harmless or even benign until doses reach many times the natural background level. Dr. Kendall's group argues that the middle ground is most likely and that conventional risk estimates are plausible.

The lecturer for the Educational Lecture IV was Dr. Suminori Akiba, who talked about "Cancer risk among atomic bomb survivors" (Photo 5). The LSS (Life Span Study) cohort consists of about 94,000 survivors of the 1945 atomic bombings in Hiroshima and Nagasaki, Japan, who were identified by the supplementary schedules to the national census in 1950. The LSS cohort includes 44,000 men and women of all ages who were within 2.5 km of the hypocenters at the time of the bombings and still resided in Hiroshima or Nagasaki in 1950. Among them, 27,800 survivors were exposed within 2.0 km from the hypocenter. It also includes a randomly selected sample of survivors who were exposed 2.5-10 km distant from the hypocenter. Excess cases of leukemia became apparent about 2 to 3 years after the bombings, and reached a peak at about 6–8 years after exposure. Increased risks of solid cancers were observed around 10 years after the bombings. The ERR (Excess Relative Risk) of all solid cancers combined increased linearly with radiation dose, around a 40% to 50% increase per Gy for both mortality and incidence when considering the sex-averaged risk at an attained age of 70 years following exposure at age 30 years. Risks of radiation-induced cancer can be affected by factors other than radiation.

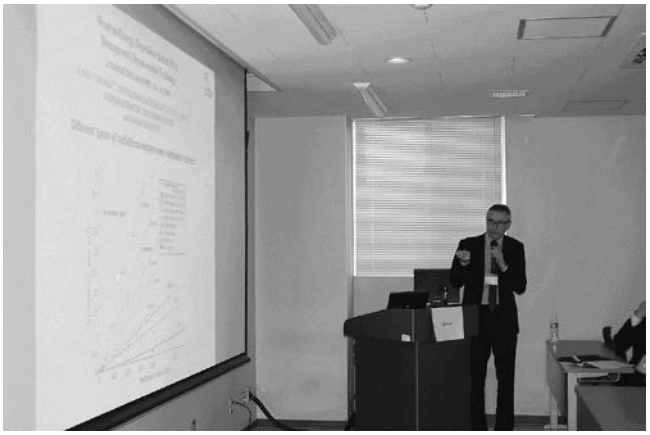

**Photo 6.** Educational Lecture V by Dr. Andrzej Wojcik, Stockholm University

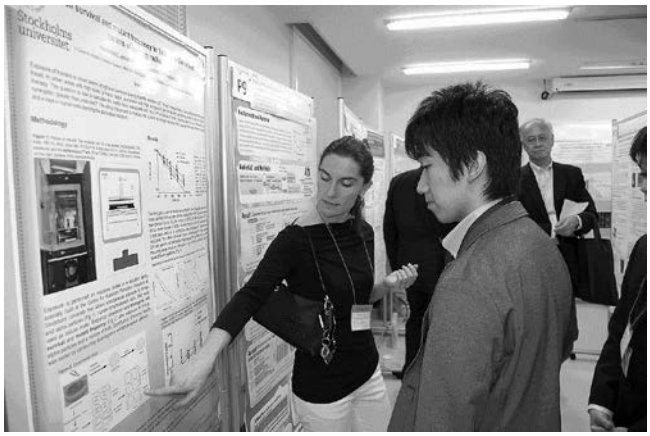

**Photo 7.** Poster presentation and Discussion

Although there has been little evidence for confounding by life-styles, medical irradiation may influence cancer risk related to atomic-bomb radiation. In addition, interactions between radiation and other risk factors can modify the risk estimates of radiation effects.

In the Educational Lecture V, Dr. Andrzej Wojcik talked about "Radiation accidents and individual dosimetry: the past, the present and future" (Photo 6). First, Dr. Wojcik introduced the Cochabamba accident as a radiation accident in the past, which occurred in Bolivia in April 2002. Through the example of this case, we should recognize the importance of accurately assessing the exposure dose by biological dosimetry. Then he described specific biological dosimetry methods in current use. Accurate biological dosimetry requires four conditions to be met, namely, it is possible to 1) detect even in partial exposure, 2) be stable over the time course, 3) be specific to radiation exposure, and 4) be able to create the calibration curve. As a way to meet these criteria, chromosome analysis of peripheral blood lymphocytes has been well-studied using the dicentric (DIC) assay and the premature chromosome condensation (PCC) assay. When a large-scale exposure accident occurs, the importance of speed in the inspection has been emphasized in biological dosimetry. In addition to the development of simplified and automated inspection equipment, formation of a network with experts in each field in the radiation exposure area is important. Finally, as an exposure dose evaluation method in the future, the establishment of a system of personal dosimetry using a smart phone as EPR (Electron Paramagnetic Resonance) tool was introduced.

## 3. Poster Session

The total number of poster presentations by young researchers reached 28, covering various fields such as radiation biology, radiation therapy (X-ray and proton beam), radiation biophysics, radiation measurement and protection, and radiation technology sciences (Photo 7, and Table II). In the radiation biology field, there are some reports on the evaluation of radiation effects from the cellular level to the DNA level such as "Effect of a c-Mpl agonist on mice exposed to lethal ionizing radiation (Masaru Yamaguchi, Hirosaki University)" and "DNA damage and repair after a combined exposure to alpha radiation and X-rays (Lei Chen, Stockholm University)," and the analysis of low-dose exposure, which has gained attention in recent years, such as "Effect of fractionated exposure with a short-time interval using hyper-radiosensitivity (Shingo Terashima, Hirosaki University)." In the radiation therapy field, there are some reports on the point of view of theoretical physics such as "Radiosensitizing effects of gold nanoparticles in proton and X-ray irradiation (Jihun Kwon, Hokkaido University)" and "Dose rate effect on cell survival in the fractionated radiotherapy (Takaaki Kimura, Hokkaido University)." There are also reports from the point of view of biophysics such as "Cell-killing model considering DNA damage repair and cell phase (Yusuke Matsuya, Hokkaido University)" using a mathematical model considering the amount of DNA damage.

In addition, it was interesting to see some presentations on cross-cutting issues such as "Naturally occurring radionuclides and radiation dose assessment in building materials using Mahallat (Amin Shahrokhi, University of Pannonia)" in the radiation measurement and protection field, and "The evaluation of size correction factor for the SSDE in 320 rows ADCT scanning (Kazuhusa Mizonobe, Sapporo Medical University)" and "Exposed dose simulation analysis for X-ray computed tomography according to age and body type (Takakiyo Tsujiguchi, Hirosaki University)" in the radiation technology science field.

**Table 2.** Papers for poster session

| No. | Title | Authors | Affiliation |
|---|---|---|---|
| 1 | Effectiveness of hematopoietic recovery of allogeneic umbilical cord blood transplantation for acute high-dose total X-ray exposure. | H Maeda, K-i Terui, M Nakano, K Ito, K Ito. | Hirosaki University, Japan |
| 2 | Characteristics of the immune reconstitution by mixed umbilical cord blood cell transplantation for lethal-dose radiation exposure. | K-i Terui, H Maeda, M Nakano, K Ito, K Ito. | Hirosaki University, Japan |
| 3 | Aberrant DNA damage response-, epigenetic- and growth factor receptor signaling in lung cancer tumor initiating cells. | L Lundholm, P Haag, D Zong, T Juntti, B Mork, R Lewensohn, K Viktorsson. | Karolinska Institutet and Karolinska University Hospital, Sweden<br>Stockholm University, Sweden. |
| 4 | Serum microRNAs as potential biomarkers in mice exposed to ionizing radiation. | M Chiba, S Monzen, I Kashiwakura, T Nakamura. | Hirosaki University, Japan |
| 5 | Implication of endothelial to mesenchymal transition in the development of healthy digestive tissue injury following radiation exposure. | E Mintet. | Institute for Radiological Protection and Nuclear Safety (IRSN), Pierre et Marie-Curie University, France |
| 6 | Effect of 4-methylumbelliferone and irradiation combination on factors related to a variety of invasion and metastasis. | R Saga, S Monzen, H Yoshino, M Chiba, T Nakamura, Y Hosokawa. | Hirosaki University, Japan |
| 7 | Expression analysis of c-Myc in bone marrow cells of mice exposed to ionizing radiation. | K Yokoyama, A Nishiyama, T Tsujiguchi, S Murakami, M Yamaguchi, I Kashiwakura. | Hirosaki University, Japan |
| 8 | Synergistic effect on the survival of TK6 cells wt after simultaneous exposure to mixed beams of alpha particles and X rays. | A Sollazzo, SS Manesh, A Fotouhi, S Haghdoost, A Wojcik. | Stockholm University, Sweden<br>Jan Kochanowski University, Poland |
| 9 | Effect of fractionated exposure with a short-time interval using hyper-radiosensitivity. | S Terashima, T Nakamura, Y Hosokawa. | Hirosaki University, Japan |
| 10 | Mesenchymal Stem Cell (MSC) therapy for the treatment of severe and chronic radiotherapy-induced abdomino-pelvic complications refractory to standard therapy. | B Usunier. | Institute for Radiological Protection and Nuclear Safety (IRSN), Pierre et Marie-Curie University, France |
| 11 | Effects of secondary electrons on DNA double-strand breaks after photon irradiation. | Y Yoshii, Y Matsuya, K Sasaki, H Date. | Hokkaido University, Japan<br>Sapporo Medical University, Japan |
| 12 | Investigation of the radioprotective effect of tomato juice containing lycopene in healthy donors. | A Nakamura, Y Fujishima, S Monzen, T Miura, A Saito, T Yonezawa, H Suganuma, K Aizawa, C Itaki, MA Yoshida, A Wojcik, Y Mariya, S Haghdoost. | Hirosaki University, Japan<br>Hirosaki Central Hospital, Japan<br>KAGOME CO., LTD, Japan<br>Stockholm University, Sweden |
| 13 | DNA damage and repair after a combined exposure to alpha radiation and X-rays. | L Cheng, A Sollazzo, S Haghdoost, A Wojcik. | Stockholm University, Sweden |
| 14 | Characterization of persistent $\gamma$H2AX foci induced in endothelial cells by X-rays. | A Vaurijoux, JF Barquinero, G Gruel. | Institute for Radiological Protection and Nuclear Safety (IRSN), Pierre et Marie-Curie University, France<br>Universtitat Autonoma de Barcelona, Spain |
| 15 | Radiation dosimetry for the internal exposure of the cats in Namie-Town. | Y Fujishima, A Nakata, T Miura, H Tazoe, T Toyoda, K Kasai, K Ariyoshi, M Yamada, N Konno, MA Yoshida. | Hokkaido University, Japan<br>Hokkaido Pharmaceutical Universit, Japan<br>Toyoda Animal Hospital<br>Namie-Town Office |
| 16 | Effects of a c-Mpl Agonist on Mice Exposed to Lethal Ionizing Radiation. | M Yamaguchi, T Hirouchi, M Chiba, S Monzen, H Yoshino, J Ishikawa, T Tsujiguchi, A Nishiyama, S Murakami, J-i Komura, I Kashiwakura. | Hirosaki University, Japan<br>Institute for Environmental Sciences, Japan |
| 17 | Home care organization personnel support after the nuclear power plant accident occurred interviews two and a half years after the event. | R Narita, R Kidachi. | Hirosaki University, Japan |
| 18 | Cell-killing model considering DNA damage repair and cell phase. | Y Matsuya, Y Yoshii, K Sasaki, H Date. | Hokkaido University, Japan |
| 19 | Exposed dose simulation analysis for X-ray computed tomography according to age and body type. | T Tsujiguchi, Y Saito, S Ono, Y Takai. | Hirosaki University, Japan |
| 20 | The evaluation of size correction factor for the SSDE in 320 rows ADCT scanning. | K Mizonobe, Y Shiraishi, H Date. | Sapporo Medical University Hospital, Japan<br>Hoshigaura Hospital, Kushiro, Japan<br>Hokkaido University, Japan |
| 21 | Dose rate effect on cell survivival in the fractionated radiotherapy. | T Kimura, Y Mastuya, H Date. | Hokkaido University, Japan |
| 22 | Radiosensitizing effects of gold nanoparticles in proton and X-ray irradiations. | J Kwon, K Sutherland, T Hashimoto, H Date. | Hokkaido University, Japan |
| 23 | Evaluation of collimator scatter factor measured by using several kinds of mini-phantoms in high energy X-ray. | Y Nakanowatari, T Nara, M Takagi, Y Mariya. | Hirosaki University, Japan<br>Hirosaki Central Honspital, Japan |
| 24 | Naturally occurring radionuclides and radiation dose assessment in building materials using in Mahallat. | A Shahrokhi, G Szeiler, T Kovács. | University of Pannonia, Hungary |
| 25 | Comparison of uranium leaching tests on red mud containing model bricks. | M Hegedqs, E Toth-Bodrogi, J Somlai, T Kovács | University of Pannonia, Hungary |

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| 26 | A study on the regional characteristics of the equilibrium factor for exposure dose evaluation by radon and thoron. | Y Ito, S Tokonami, K Iwaoka, M Hosoda, C Pornnumpa, H Kudo. | Hirosaki University, Japan |
| 27 | Correlation between water chemistry features and natural radioisotopes of remediated Hungarian polymetallurgical Zinc/Lead mine. | T Szanto, Z Sas, E Toth-Bodrogi, T Kovács. | University of Pannonia, Hungary<br>Social Organization for Radioecological Cleanliness, Hungary |
| 28 | Comparison of cylindrical NaI(Tl) scintillation crystal and rectangular NaI(Tl) scintillation crystal mounted detectors in radiographical examination point of view. | P Bator, G Bator, T Kovács. | Social Organization for Radioecological Cleanliness, Hungary<br>University of Pannonia, Hungary |

**Photo 8.** Panel discussion (From left to right: Dr. Hiroyuki Suganuma, KAGOME Co; Dr. Yasushi Mariya, Hirosaki University; Dr. Siamak Haghdoost, Stockholm University)

**Photo 9.** Poster Award Ceremony

**Photo 10.** Group photo of the participants from abroad and our staffs

The research fields represented seemed to be more diverse than that of ESRAH2014, which was held last year, and the participants engaged in vigorous discussions. The wide diversity of the research fields was exciting for the young researchers, who brought various opinions from different fields. It was a stimulating opportunity for young scientists to interact with foreign researchers of the same generation.

## 4. Panel Discussion

The Panel Discussion was carried out by three panelists (Dr. Hiroyuki Suganuma, Kagome Co., Japan; Dr. Yasushi Mariya, Hirosaki University, Japan; Dr. Siamak Haghdoost, Stockholm University, Sweden) on the theme of Reactive Oxygen Species and Tomato Lycopene (Photo 8).

Prior to the discussion, the three panelists gave their lectures based on their own research data. Dr. Suganuma talked about "Variety of Health-Promoting Activities of Lycopene, One of the Most Portent Singlet-Oxygen Quenchers Rich in Tomato." Dr. Suganuma introduced lycopene as the red pigment of tomatoes that has been defined as one of the most powerful singlet oxygen quenchers, and talked about how lycopene has a preventive effect for singlet oxygen-mediated oxidation of low density lipoproteins, with protective effects on senescence-accelerated mice models, and a protective effect against radiation injury of abdominally radiated mice. Next, Dr. Mariya introduced research for the purpose of clinical evaluation and use of oxidative stress markers in RI internal therapy on the theme of "Analysis of oxidative stress-related markers in the patients accompanied with thyroid cancer undergoing $^{131}$I radionuclide treatment". His group analyzed the oxidation stress marker 8-hydroxy-2'-deoxyguanosine (8-OHdG) in the urine of the patients with thyroid cancer undergoing $^{131}$I radioactive nuclide treatment. They found that a change of oxidation stress induced *in vivo* by radioactive iodine was detectable. A lecture on the anti-oxidant action of lycopene titled "Antioxidative effect of lycopene" was provided by Dr. Siamak Haghdoost. His lecture started with talk about the role of reactive oxygen species in the living body and genetic damage by reactive oxygen species. He explained that reactive oxygen species were related to age-related diseases such as cancer and

progeria. Dr. Haghdoost stated that an intake of lycopene (tomato juice) exerts antioxidant effects on the body and reduces the risk of carcinogenesis and stroke. In animal experiments, there is a protective effect against radiation. Then, based on these presentations, an active discussion was developed about reactive oxygen species and lycopene, including the results of ongoing studies such as a clinical study about the intake of lycopene (tomato juice) for reductions in adverse events during radiation treatment.

ESRAH is an international symposium held in cooperation by Hokkaido University and Hirosaki University, and the first meeting was held last year (2014). EASRAH2015, the second meeting of ESRAH, was also positioned as a satellite symposium of the 15th International Congress of Radiation Research (ICRR2015), which was held in Kyoto from May 25 to 29, 2015. Most members of the executive committee of ESRAH2015 were young faculty and graduate students. In addition, especially for young researchers, it seemed to be a valuable experience to interact with experts in a variety of radiation-related research fields. The Poster Awards were given to two young researchers on the last day of the symposium (Photo 9). ESRAH is planned to be held every year, and we are expecting the participation of many radiation researchers.

Finally, we offer our thanks to the five scientists who accepted our offer to give the educational lectures, and to the three panelists who carried out the active panel discussion (Photo 10).