



## Progress in heme oxygenase research



Heme oxygenase plays pivotal roles in cellular hormetic stress response and homeostasis. The deregulation of its expression or activity is implicated in pathophysiology of a wide spectrum of human disorders, including cardiovascular disease, diabetes, obesity, pulmonary disease, gastrointestinal ailments, kidney dysfunction, dermatitis, cancer, etc. Therefore, heme oxygenase has been considered as one of the most prominent targets for preventive/therapeutic intervention in the management of many human diseases.

Over the past two decades, a series of International Conference on Heme Oxygenase have been organized to integrate multidisciplinary approaches towards broadening the scope of research on heme oxygenase and related molecules. The 1st meeting was held in New York in 2000, the 2nd in Catania, Italy (2002), the 3rd in Uppsala, Sweden (2003), the 4th in Boston, USA (2005), the 5th in Kraków, Poland (2007), the 6th in Miami, USA (2009), the 7th in Edinburgh, UK (2012), the 8th in Sydney, Australia (2014), and the 9th in Prague, Czech Republic (2016).

The 10th International Conference on Heme Oxygenase was held in the beautiful campus ('Gwanak') of Seoul National University, South Korea on October 31–November 3, 2018 (Fig. 1). More than 250 delegates from different continents participated in this 10th anniversary conference for exchanging innovative ideas, stimulating collaboration, and launching outstanding research programs. The conference was co-organized by Hun Taeg Chung (University of Ulsan) and Young-Joon Surh (Seoul National University) with grant support from National Research Foundation of Republic of Korea for directing their research centers, Meta Inflammation Research Center and Tumor Micro-environment Global Core Research Center, respectively. Hye-Kyung Na of Sungshin Women's University served as Secretary General, managing the entire process of conference planning and organization. This Editorial is a snapshot of the conference program.

On the first day (Oct. 31), there was an Opening Ceremony followed by a Keynote Lecture by Mahin Maines (University of Rochester, USA). Dr. Maines delivered a comprehensive lecture on her pioneering research titled "The heme oxygenase-biliverdin reductase system: the humble beginnings, the precipitous ascent and the bright future". After the Opening Keynote Lecture, the first platform session was run under the subject of "Heme Oxygenase and its master regulator Nrf2 in aging, metabolic/neurodegenerative disorders and cancer". The speakers in this session were Henry Jay Forman (University of Southern California, USA), Young-Joon Surh (Seoul National University, South Korea), Ben Jing Wu (University of New South Wales, Australia), and Jung-Hee Jang (Keimyung University, South Korea).

On the second day, the program started with the session on "Heme oxygenase and iron metabolism/disposition" for which Phyllis Dennery (Brown University, USA), Shinya Toyokuni (Nagoya University, Japan), Des R. Richardson (University of Sydney, Australia), and Gennadiy

Kovtunovych (NICHD, NIH, USA) were speakers. After the break, Hun Taeg Chung (University of Ulsan, South Korea) gave the first of three State-of-the-Art Lectures selected for this conference. The title of his lecture was "The HO-1/CO system expands its territory to metabolism via interorganellar communication". After that, a session on "Physiologic functions of carbon monoxide" followed, and Stefan W. Ryter (Weill Cornell Medical Center, USA), Uh-Hyun Kim (Chonbuk National University, South Korea), Hiroaki Kitagishi (Doshisha University, Japan), and Hongjun Wang (Medical University of South Carolina, USA) gave presentations. The scientific program resumed in the afternoon. In the session titled "Heme oxygenase in cellular immunity and inflammation", Jong-Seok Moon (Soonchunhyang University, South Korea), Tomohisa Takagi (Kyoto Prefectural University of Medicine, Japan), Yeonsoo Cho (University of Ulsan, South Korea), and Sebastian Weis (University of Jena, Germany) talked about their current research reflecting this subject. The rest part of the second day program was Young Investigator Session I, and there were 5 speakers: Nils Schallner (University of Freiburg, Germany), Young Sam Keum (Dongguk University, South Korea), Mateusz Tomczyk (Jagiellonian University, Poland), Youngtae Jeong (DGIST, South Korea), and Do-Hee Kim (Seoul National University, South Korea).

In the morning on the third day of the conference, a session on "Regulators/targets of heme oxygenase and its products" consisted of presentations by Chhanda Biswas (Children's Hospital of Philadelphia, USA), Hyeyoung Kim (Yonsei University, South Korea), Sabine Amslinger (University of Regensburg, Germany), and Hye-Kyung Na (Sungshin Women's University, South Korea), which was followed by the second State-of-the-Art Lecture titled "Heme oxygenase in vascular health and disease". Roland Stocker (University of New South Wales, Australia) delivered this special lecture. The subsequent session covered the subject of "Bilirubin and biliverdin reductase" in which David Stec (University of Mississippi, USA), Liber Vitek (Charles University, Czech Republic), Karl-Heinz Wagner (University of Vienna, Austria), and Youn Kyung Choi (Konkuk University, South Korea) participated as speakers. In the afternoon platform session titled "Heme oxygenase in tissue repair, remodeling, and protection", Miguel Soares (University of Louvain, Portugal), Ki Baik Hahm (CHA University, South Korea), Asif Ahmed (Aston University, UK), and Jerzy W. Kupiec-Weglinski (UCLA, USA) lectured. The scientific program on the third day ended with Poster Discussion. In that evening a Gala Dinner hosted by local organizers for invited speakers, chairs and guests were held in the modern chic and lively atmosphere of the upper floor (Vista) of the Floating Island Convention Center in Seoul 'Sevit' islet (Fig. 2).

On the last day, a morning session on "Heme oxygenase and other mediators of cellular stress response" included presentations by Jesus Araujo (UCLA, USA), Yoshito Kumagai (University of Tsukuba, Japan), Chuen-Mao Yang (Chang Gung University, Taiwan), and David Haines

<https://doi.org/10.1016/j.ab.2020.108321>



Fig. 1. A group photo of organizers, speakers, chairs, and guests of the 10th International Heme Oxygenase held in the Cultural Center of Seoul National University, South Korea on October 31 to November 3, 2018.



Fig. 2. An exciting atmosphere of Gala Dinner evening, November 3, 2018 (Venue: the 3rd Floor, Floating Island Convention Center in Seoul).

(National Health Systems, USA). This session was followed by the third State-of-the-Art Lecture that Jozef Dulak (Jagiellonian University, Poland) presented under the title of “Heme oxygenase-1 in stem cells: More than cytoprotection”.

In a session titled “Heme oxygenase and Nrf2 in cell differentiation, proliferation, and survival, Shaw-Fang Yet (National Health Research Institute, Taiwan), Jin Won Hyun (Jeju National University, South Korea), Roberta Foresti (Mondor Biomedical Research Institute,

France), and Anna Grochot-Przeczek (Jagiellonian University, Poland) talked about their research related to the session title. The afternoon session started with presentation by Roberto Motterlini (Mondor Biomedical Research Institute, France) and subsequently by Binghe Wang (Georgia University, USA), Stephan Immenschuh (Hannover Medical School, Germany), and Sylvain Doré (University of Florida, USA). The last part of the scientific program on day 4 comprised presentations by five prospective postdoctoral fellows/graduate students.

The speakers for this second Young Investigator's session included Laura Braud (Inserm U955, Germany), Kaniz Fatima Binte Hossain (Hokkaido University, Japan), Vijith Vijayan (Hannover Medical School, Germany), Claudia Anna Lang (University of Vienna, Austria), and Siriwoot Butsri (Khon Kaen University, Thailand). The conference ended with Closing and Award Ceremony.

As a whole, the 10th International Conference on Heme Oxygenase highlighted the latest scientific advancement and progress ranging from basic to population-based and clinical studies on heme oxygenase and its catalytic by-products (carbon monoxide, bilirubin and iron). The conference also provided an excellent platform for our next generation investigators, including graduate students, postdoctoral fellows, and medical trainees, to learn the recent breakthroughs in science and technology on heme oxygenase research and related fields, to get innovative ideas, and to build up global networking for their future professional career.

As Guest Editors, we are pleased to publish a special issue that features some of the highlights of the above conference. There are 7 review articles and 10 original research papers. In timely completing this production, we cordially thank all the authors for their contribution. We would also like to express our gratitude to Dr. Henry Jay Forman, Editor-in-Chief of *Archives of Biochemistry and Biophysics*, for his generous offer to use this journal as a platform for publishing the

Special Issue. Our special thanks are extended to the editorial staffs of Elsevier, especially Claire Louise Brimilcombe and Divya Pillai, for their excellent administrative support and assistance.

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