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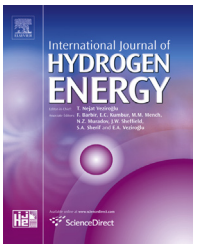

Editorial

An introduction to the special issue section on "The 7th International Conference on Photosynthesis and Hydrogen Energy Production in Honor of Nathan Nelson and T. Nejat Veziroğlu, 19–25 June 2016, Pushchino, Russia"

Keywords:
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Artificial photosynthesis
International Conference
Pushchino

ABSTRACT

The research in photosynthesis and hydrogen energy production provides a unique opportunity for transforming sustainable solar energy into our energy system. This special issue presented the selected and invited papers from the International Conference on Photosynthesis Research for Sustainability in honor of Nathan Nelson and T. Nejat Veziroğlu which was held on June 19–25, 2016, in Pushchino, Russia. These papers offered readers with some of the most recent and exciting progresses in photosynthesis and hydrogen energy production. The potential limitations and future efforts with open questions were also offered to stimulate the further research endeavors in the field.

Introduction

It is increasingly clear that as photosynthesis is a process by which plants, algae, cyanobacteria, in nature capturing and storing solar energy in a large scale, it provides an ideal and a perfect model for biomimetic hydrogen energy production [9,12,14–16,18]. Hydrogen is a clean, zero carbon emission and renewable energy carrier, with a high specific heat of combustion. Photosynthesis includes oxygenic and anoxygenic organisms. Some of the anoxygenic bacteria are able to generate hydrogen efficiently, and certain green algae under anaerobic conditions can use starch as a source to produce hydrogen gas. In cyanobacteria, hydrogen can be generated from water using hydrogenases [1]. The global fossil fuels, which are produced by photosynthesis over the millions of years, are limited and not environment-friendly energy sources to support and sustain life on earth [7,10,13].

To address this global energy crisis, vast efforts have been made on artificial photosynthesis for producing solar fuels including hydrogen energy using the principles and mechanisms observed in nature [8,11,19]. However, many questions especially the details of photosynthesis and hydrogenases remain unanswered. The International Conference on Photosynthesis Research for Sustainability in honor of Nathan Nelson and T. Nejat Veziroğlu held on June 19–25, 2016, in Pushchino, Russia, has provided a unique opportunity for top international experts and leading scientists to share their recent progress and advance in the field and promote the international collaborations.

In this special issue, we are delighted to present the selected and invited papers from the conference to highlight the recent achievements in photosynthesis and hydrogen energy production. The major topics in this issue include (1) energy for the future – hydrogen economy, (2) elevating climate change, (3) biological hydrogen production, (4)

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Fig. 1 – A group photograph of the participants and the organizers of the 7th International Conference "Photosynthesis Research for Sustainability-2016: in honor of Nathan Nelson and T. Nejat Veziroğlu".

Fig. 2 – A group photograph of winners of young talent awards, with others. Front row, from left to right Tatsuya Tomo, Oren Ben-Zvi, Suleyman I Allakhverdiev (wearing Robert Emerson's apron), Govindjee, Anna Smygalina, Eva Pšidová, Margarita V. Rodionova, Sonal Mathur, Lyubov Surova, and Gergely Nagy. Back row, from left to right Volker Hartmann, Lilit Hakobyan, Milrad Yuval, Azat V. Abdullatypov, Pini Marcu, Marina Kozuleva, Zinaida Eltsova, Kaichiro Endo, Yoshifumi Ueno, Arjun Tiwari and Anatoly A. Tsygankov; missing in the photograph is: Vinzenz Bayro Kaiser.

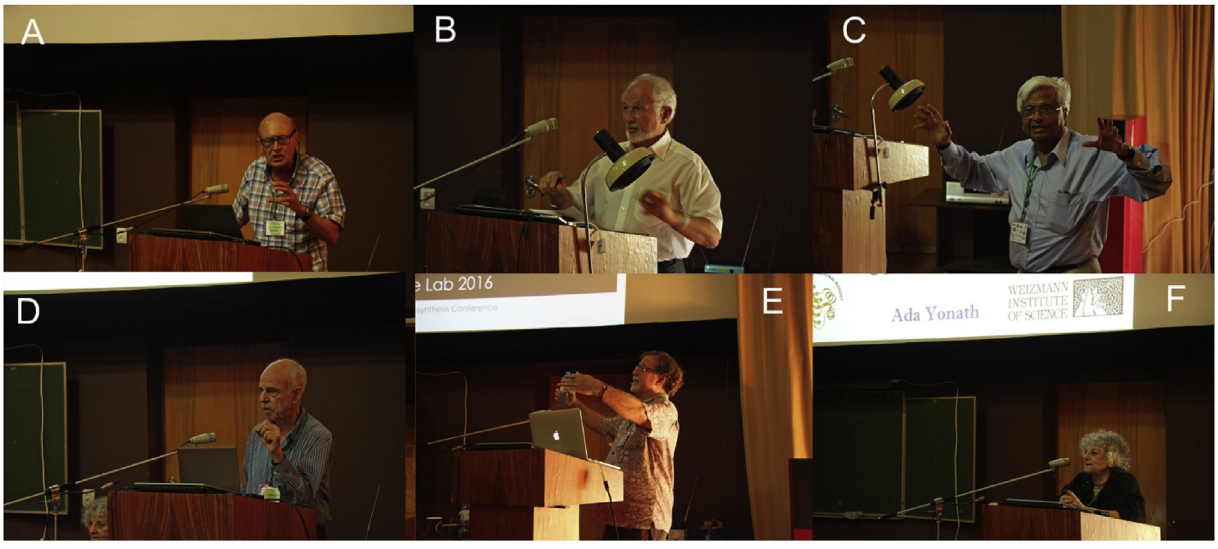

Fig. 3 – Invited speakers at the conference. A: James Barber, Andrey (Andrew) B. Rubin, C: Govindjee, D: Nathan Nelson, E: Barry Bruce, F: Ada Yonath, 2009 Nobel Prize winner in Chemistry.

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hydrogenases, (5) proton reduction catalysts, (6) reduction of carbon dioxide, (7) artificial photosynthesis for hydrogen energy, (8) hydrogen energy education, and (9) emerging techniques for studying of hydrogen energy.

Conference program

The conference program was quite exciting and informative [17]. This the seventh in the series of conferences, 2004 in Canada, 2007 in Russia, 2011 in Azerbaijan, 2013 in Azerbaijan, 2014 in Russia, 2015 in Greece [2–6]. The conference had about 170 participants from 22 countries (Fig. 1). The conference provided great opportunity for the participants including students, postdoctoral researcher, scientists, and professors from around the world to share their excitements and achievements in photosynthesis and hydrogen energy production.

During the conference, a group of young scientists were selected and received either a monetary award or a book award for their outstanding posters or oral presentations by an Awards Committee (Fig. 2). The top international scientists

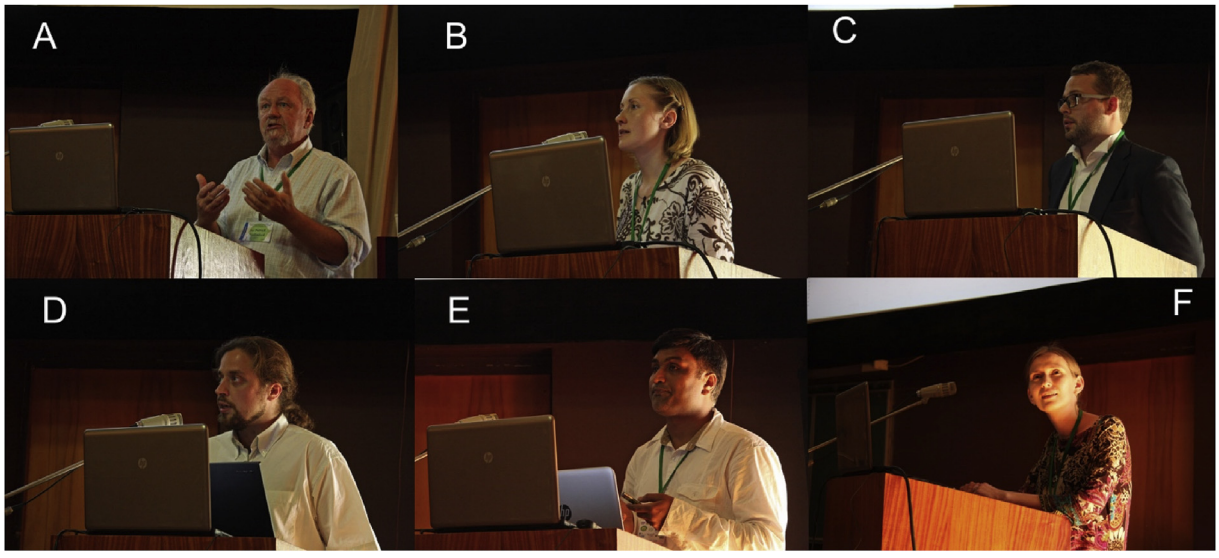

Fig. 4 – Invited speakers at the conference. A: Patrock C. Hallencbeck, B: Zinaida Eltosova, C: George Sytchev, D: Franz-Josef Schmitt, E: Arjun Tiwari, E: Marina Kozuleva.

Fig. 5 – Invited speakers at the conference. A: T. Nejat Veziroğlu, B: Dmitry Dunikov, C: Iftach Yacoby, D: Vinzenz Bayro Kaiser, E: Evelina Slavcheva, F: Gadi Schuster.

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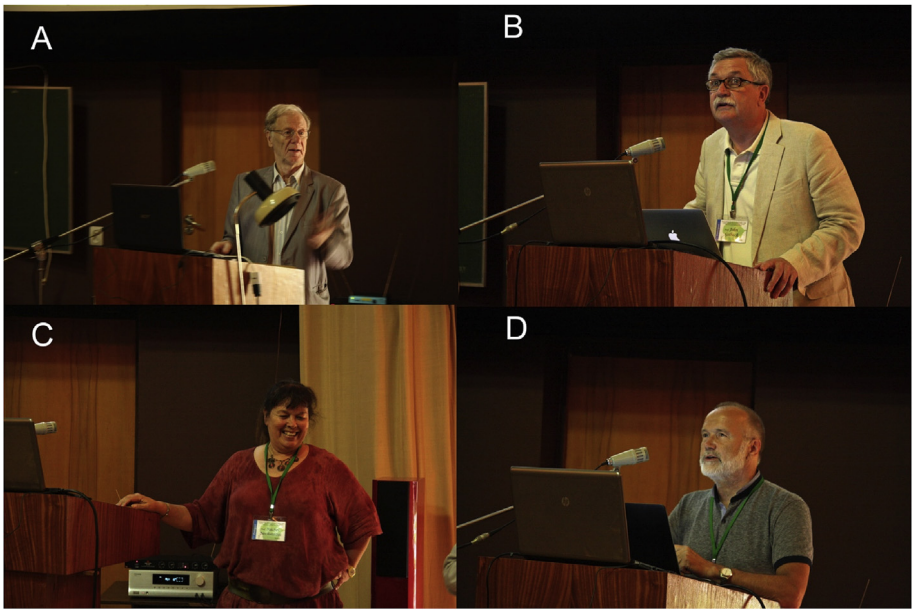

Fig. 6 – Invited speakers at the conference. A: Vladimir A. Shuvalov, John Golbeck, C: Rachel Nechushtai, D: Arvi Freiberg.

Fig. 7 – Invited speakers at the conference. A: Norio Murata, B: Julian Eaton-Rye, C: Hiroshi Ishikita, D: Michael Hippler.

and world leaders including the Nobel Prize winner in Chemistry Ada Yonath have given talks at the conference (Figs. 3–9). These talks provided the current knowledge and the relevance to the global issues, the latest research results, and the views of the future directions in photosynthesis and hydrogen energy production. In particular, the talks pointed the state-of-the-art research efforts and inspired the curiosity and collaborations in the field. The conference also included several social events for the participants in addition to a banquet with live music and dancing, which provided enjoyable and relaxed environment for further interactions and discussions of science (Figs. 10–13).

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Fig. 8 – Invited speakers at the conference. A: Seiji Akimoto. B: Miwa Sugiura, C: Jörg Pieper, D: Mariko Miyachi.

Fig. 9 – Invited speakers at the conference. A: Barry Bruce, B: Gergely Nagy, C: Kentaro Ifuku, D: Yukako Hihara.

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Fig. 10 – Participants at the conference. A: Left to right: Suleyman Allakhverdiev, Nejat Veziroğlu, Veziroğlu's brother, Ayfer Veziroğlu in the front of meeting building; B: Near side, left to right: James Barber, Nejat Veziroğlu; C: Front, Left to right: Ayfer Veziroğlu, Nejat Veziroğlu, Suleyman Allakhverdiev; Back: Veziroğlu's daughter-Lili; D: Left to right: Nejat Veziroğlu, Govindjee, Suleyman Allakhverdiev, Nathan Nelson, when they signed their name to the books given to the awardees.

Fig. 11 – Participants at the conference. A: Suleyman I Allakhverdiev (during interview), B: Poster discussion (from right, Yoshifumi Ueno, Franz-Josef Schmitt), C: get together (from left: Nathan Nelson, Govindjee), D: from left: T. Nejat Veziroğlu, Govindjee.

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Fig. 12 – Participants at the conference. A: from left, Mina Agatsuma, Rajagopal Subramanyam; B: Excursion at Moscow; C: from right: Yukako Hihara, Giuseppe Torzillo and Ilya Naydov; D: from right: Nathan Nelson, Hannah Nelson, Toshiyuki Shinoda.

Fig. 13 – Participants at the banquet of the conference. A: Veziroğlu's family, B: Rachel Nechushtai, C: (clockwise from left front side, Arjun Tiwari, John Golbeck, Michael Hippler, Olaf Kruse, Giuseppe Torzillo, José A. Navarro, Győző Garab, A.S. Raghavendra, Rajagopal Subramanyam D: The group dancing in a ring.

Concluding remarks

In conclusion, the special issue provides readers with some of the most recent and exciting advances and developments in photosynthesis and hydrogen energy production. The papers in this special issue also discuss the potential limitation of the results and address some of the open questions in the field. We hope that these publications are able to provide novel and

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insightful information to readers and stimulate the future research endeavors in the community of photosynthesis and hydrogen energy production.

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Harvey J.M. Hou*
Department of Physical Sciences, Alabama State University, Montgomery, AL 36104, USA

Tatsuya Tomo
Department of Biology, Faculty of Science, Tokyo University of Science, Kagurazaka 1-3, Shinjuku-Ku, Tokyo 162-8601, Japan
PRESTO, Japan Science and Technology Agency (JST), 4-1-8 Honcho Kawaguchi, Saitama 332-0012, Japan

Suleyman I. Allakhverdiev**
Controlled Photobiosynthesis Laboratory, Institute of Plant Physiology, Russian Academy of Sciences, Botanicheskaya Street 35, Moscow 127276, Russia
Institute of Basic Biological Problems, Russian Academy of Sciences, Pushchino, Moscow Region 142290, Russia
Department of Plant Physiology, Faculty of Biology, M.V. Lomonosov Moscow State University, Leninskie Gory 1-12, Moscow 119991, Russia
Bionanotechnology Laboratory, Institute of Molecular Biology and Biotechnology, Azerbaijan National Academy of Sciences, Baku, Azerbaijan

*Corresponding author.
E-mail address: hhou@alasu.edu (H.J.M. Hou)

**Corresponding author.
E-mail address: suleyman.allakhverdiev@gmail.com (S.I. Allakhverdiev)

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