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Special issue in honor of Prof. Suleyman I. Allakhverdiev

A life in light: celebrating the 75th birthday of Professor Suleyman I. Allakhverdiev

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Abstract

This Special Issue of *Photosynthetica* is dedicated to celebrating the distinguished scientific life and 75th birthday of Professor Suleyman I. Allakhverdiev (born 1 August 1950), whose contributions have left an enduring mark on modern photosynthesis research, photobiology, and bioenergetics. His pioneering studies of Photosystem II advanced the field in fundamental ways, including establishing pheophytin as the primary electron acceptor, defining the functional Mn_4 water-oxidizing cluster and its reconstitution, and clarifying the redox properties of key cofactors such as Q_A, Q_B, and P_{680}. He also significantly deepened understanding of photoinhibition by distinguishing donor- and acceptor-side processes and illuminating broader roles for bicarbonate in proton management and repair. Building on these mechanistic insights, his work helped inspire artificial photosynthesis, catalytic systems for water oxidation and hydrogen evolution, and biohybrid energy platforms. As a scholar, editor, organizer, mentor, and scientific diplomat, Professor Allakhverdiev has built a truly global legacy that this Special Issue is proud to honor.

Keywords: applied photosynthesis; artificial photosynthesis; electron transfer; hydrogen production; pheophytin; photoinhibition; water oxidation; water-oxidizing complex.

Highlights

- This tribute honors Professor Suleyman I. Allakhverdiev's enduring scientific legacy
- His work on electron transfer and photoinhibition redefined Photosystem II functions
- He fostered global collaboration, deep mentorship, and scientific dialogue worldwide

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Abbreviations: BBA – *Biochimica et Biophysica Acta*; Chl – chlorophyll; CPL – Controlled Photobiosynthesis Laboratory; D1 – Photosystem II reaction-center D1 protein; Em – midpoint redox potential; EPR – electron paramagnetic resonance; ICP – International Conference on Photosynthesis; P_{680} – primary electron donor of Photosystem II; P_{713} – primary donor in chlorophyll *d*-containing Photosystem II; Pheo – pheophytin; PHRS – Photosynthesis and Hydrogen Energy Research for Sustainability; PNAS – *Proceedings of the National Academy of Sciences of the United States of America*; PRS – Photosynthesis Research for Sustainability; Q_A – primary quinone electron acceptor of Photosystem II; Q_B – secondary quinone electron acceptor of Photosystem II; RAS – Russian Academy of Sciences; RC – reaction center; WOC – water-oxidizing complex.
Conflict of interest: The authors declare that they have no conflict of interest.

Preface

It is both an honor and a joy to recognize Professor Suleyman I. Allakhverdiev (Fig. 1) on his 75th birthday. Over the decades, Suleyman has distinguished himself not only as a brilliant experimentalist and thought leader in photosynthesis, photobiology, and bioenergetics but also as an extraordinary catalyst for international scientific collaboration. Few scientists have contributed so profoundly to both the advancement of knowledge and the advancement of community. Although he has published hundreds of papers and stands among the most cited researchers in his field, Suleyman's true legacy extends beyond his own achievements. He has devoted equal energy to highlighting the work of others, particularly early-career and young scientists, often providing them with their first opportunity to present, publish, or connect with senior colleagues. His generosity of spirit and commitment to mentorship have launched and strengthened many careers worldwide.

Throughout his life, Suleyman has shown that science is most powerful when it brings people together, as symbolized by the global diversity of scientists who have added personal comments to this tribute (Fig. 2). Through the international meetings he has organized, he has gathered scientists from across the globe – including Nobel Laureates such as Sir John Walker and Ada Yonath, as well as distinguished researchers from Middle East, Europe, Central and East Asia, and North America – creating spaces for genuine intellectual exchange and friendship. Those who attended these gatherings will fondly remember the barbecues around the fires in Pushchino, where discussions of photosystems and redox kinetics mingled with laughter, good food, and camaraderie. These events embodied Suleyman's belief that science, at its best, nourishes both the intellect and the human spirit.

Equally important, Suleyman's efforts have transcended politics. By welcoming colleagues from nations whose leaders may not always communicate easily, he has practiced a form of scientific diplomacy that keeps intellectual channels open and ensures the free and global flow of knowledge. In this way, he has quietly yet powerfully advanced not only science but also understanding among people and nations.

This Special Issue celebrates the scientific life and legacy of Professor Suleyman Ifkhanoglu Allakhverdiev on his 75th birthday (born 1 August 1950). Few scholars have had a comparable impact across so many layers of photosynthesis research – from foundational discoveries on Photosystem II (PSII) charge separation and the Mn_4 water-oxidizing complex, to clarifying photoinhibition mechanisms and redefining the role of bicarbonate at the donor side. Fewer still have simultaneously advanced artificial photosynthesis and hydrogen energy, building translational bridges from biophysics to sustainable technologies. Prof. Allakhverdiev's editorial leadership and his stewardship of the "Photosynthesis and Hydrogen Energy Research for Sustainability" conference series (Fig. 3 taken in Hyderabad) have further shaped the field's

Fig. 1. Professor Allakhverdiev, scientist educator, organizer, and friend (2011, Baku). Photo by Barry D. Bruce.

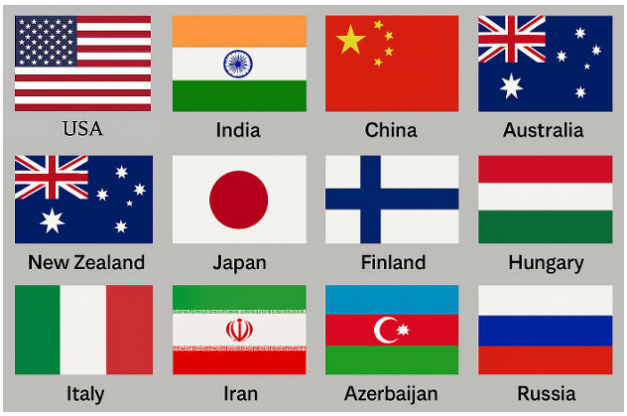

Fig. 2. A global tribute to Professor Suleyman I. Allakhverdiev from friends around the world in honor of his 75th birthday.

global conversation. At the same time, his mentoring has launched generations of scientists on every continent.

Introduction

Modern photosynthesis research is built on a framework articulated by Prof. Allakhverdiev. Early work from his laboratories and collaborations established pheophytin (Pheo) as a bona fide primary electron acceptor in PSII reaction centers, resolving a long-standing debate and refining our kinetic and energetic models of primary charge separation. Parallel efforts on the water-oxidizing complex (WOC) defined the functional Mn_4 cluster, demonstrated reconstitution after Mn depletion, and linked donor-side integrity to photodamage susceptibility. With collaborators, he parsed photoinhibition into acceptor- and donor-side regimes and showed that primary charge separation can remain intact even as downstream bottlenecks accrue.

Fig. 3. Tres Amigos – The 2017 Conference in Hyderabad. Govindjee Govindjee (*left*), Barry D. Bruce (*center*), and Suleyman I. Allakhverdiev (*right*). Photo by Nathan Brady.

He then broadened the classical view of bicarbonate, revealing its roles beyond the non-heme $Fe/Q_A–Q_B$ site to donor-side chemistry, cluster reactivation, and possibly proton management.

These mechanistic advances have cascaded outward. By treating natural protein architectures as design blueprints, Prof. Allakhverdiev's group synthesized families of water-oxidation and hydrogen-evolution catalysts. They engineered artificial photosynthetic platforms that move beyond biomimicry toward deployable energy solutions. In parallel, his editorial work has set field standards for clarity, reproducibility, and constructive dialogue, while his international appointments and conference leadership have sustained a uniquely global research network.

The contributions gathered here mirror that arc – from fundamental photochemistry to applied energy science. Several articles revisit primary events in PSII, WOC assembly/repair, and donor–acceptor coupling under stress. Others map photoprotective circuits across scales, integrate lipid–protein organization in thylakoids, or leverage single-particle and time-resolved methods to refine multi-state models. On the applied side, authors evaluate biohybrid catalysts, membrane-embedded photonic devices, and systems-level metrics for solar-to-fuel conversion. Together, these works honor a throughline in Prof. Allakhverdiev's career: meticulous mechanism, open collaboration, and a pragmatic eye for translation.

In addition to recognizing and celebrating his life's work, we have gathered warm personal reflections from many of his longtime collaborators and friends. Together, we dedicate this Special Issue to Prof. Allakhverdiev with deep gratitude – for the questions he has framed, the tools he has sharpened, the communities he has built, and the scientific optimism he continues to inspire.

Biography

Suleyman Ifkhanoglu Allakhverdiev is an honored scientist of the Russian Federation, corresponding member of the Russian Academy of Sciences (RAS), the chief scientific officer of the Institute of Fundamental Biology of the RAS (Pushchino, Russia), and the Head and chief scientist of the Controlled Photobiosynthesis Laboratory (CPL) at the K.A. Timiryazev Institute of Plant Physiology, RAS (Moscow). Additionally, he is a Professor at Moscow State University, Moscow Physico-Technical Institute, Bahçeşehir University (Istanbul, Turkey), Foshan University (China), and Al-Farabi Kazakh National University (Kazakhstan). He is Head of the International Bio-nanotechnology Laboratory at the Institute of Molecular Biology and Biotechnologies of the Azerbaijan National Academy of Sciences (Baku, Azerbaijan). All his friends and research colleagues admire and revere him for his intense, deep, and exceptional involvement in research and administration.

Early life and education

Suleyman Allakhverdiev was born on 1 August 1950, in the village of Chaykend in the Qarakoyunlu valley in Armenia (ex-USSR). His father was Ifkhan M. Allakhverdiev, and his mother was Ayisha H. Aliyeva. He grew up in Chaykend, near Lake Goycha, which is known for its beauty. He graduated from High School in Gelkend, a nearby village. For higher education, he moved to Baku, the capital city of Azerbaijan. After graduating from the Physics Faculty of the Azerbaijan State University (now Baku State University) in 1973, he returned to Chaykend and taught Physics at the Chaykend High School until 1976.

Here, we should mention that during the conflict between Armenia and Azerbaijan over the Nagorno-Karabakh Region (Azerbaijani Territory) between 1988 and 1990, a significant displacement occurred. As a result of the war, all Azerbaijani populations residing in Armenia – numbering over 500,000 people, including his family – were forcibly deported from Armenia. Many of his family members, along with other Azerbaijani refugees, relocated to Azerbaijan and Russia to escape the violence and instability.

Graduate research

Since Suleyman was deeply interested in science, his research spirit led him to return to Baku. In 1977, he worked in the Plant Physiology Laboratory at the Institute of Agriculture, which was headed by one of the rare personalities, Jalal Aliyev, a most distinguished scientist, and an intellectual of the highest order of the Azerbaijani science; we know that his research enthusiasm was extremely high, and he wanted the best for all his collaborators. Thus, in October 1977, Suleyman was sent to a highly distinguished postgraduate program (majoring in Biophysics) at the Photosynthesis Institute of the USSR Academy of Sciences (in Pushchino). There, Suleyman joined the research group led by the academician Alexander Abramovich Krasnovsky and Vladimir (Vlad) A. Shuvalov.

Degrees

In 1984, he defended his doctoral thesis (in Physics and Mathematics [Biophysics]), with the title "*Photoreduction*

of Pheophytin in Reaction Centers of Photosystem II in Higher Plants and Algae" at the Institute of Biophysics, the USSR Academy of Sciences, Pushchino, Moscow Region, Russia. Later, in 2002, Suleyman earned the Doctor of Science degree – the highest scientific qualification – in Plant Physiology and Biochemistry from the Institute of Plant Physiology, RAS, Moscow, with a thesis on "*Functional Organization and Inactivation of Photosystem II*".

Research contributions

The story on pheophytin

Suleyman worked on the investigation of pheophytin in photosynthetic reaction centers (RCs) of PSII under the supervision of Vyacheslav (Slava) Klimov and Academician A.A. Krasnovsky. At that time, two identical papers on pheophytin were published, one in English (Klimov *et al.* 1977) and one in Russian (n.a.). But this work was criticized by other researchers, who stated that it was an artifact! However, together with others, Suleyman showed that the participation of pheophytin in reaction centers of PSII is not an artifact, for which he published several papers in Russian (Klimov *et al.* 1978, 1979a,b; 1980, 1986). The experimental evidence for pheophytin participation, and the energetics and kinetics of electron transport in PSII in the presence of pheophytin, was summarized in his PhD thesis. In 1984, he defended his doctoral dissertation with the title above. Later, in 2002, he earned the Doctor of Science degree.

Manganese in the water-oxidizing complex (WOC) in PSII

During 1977–1986, Suleyman researched Mn in PSII; this was done together with Slava Klimov, Sasha Klevanik, Vladimir Shuvalov, and Prof. Gertz Likhtenshtein's research group (at the branch of the Institute of Chemical Physics of the USSR Academy of Sciences in Chernogolovka, Moscow Region). In this collaborative research, they determined the number of manganese (Mn) atoms acting in the water-oxidizing complex (WOC) of PSII. Their new results now showed for the first time that the WOC on the PSII donor side contains four atoms of Mn, contrasting with the result at that time by Chenie and Radmer, which suggested it was 6–8 Mn per 400 Chl. Reconstitution of the Mn-cluster after a complete removal of Mn from PSII preparations had been shown using Mn(II) as well as various artificial Mn–organic complexes (binuclear and/or tetranuclear). Suleyman and others studied the magnetic interaction of Mn with $Pheo^{-}$ and P_{680}^{+} and evaluated the distance between the main components of PSII. The precise locations of the main components of PSII RC in thylakoid membranes were also analyzed (Klimov *et al.* 1982, 1985, 1990; Allakhverdiev *et al.* 1983, 1986, 1989a,b; Kulikov *et al.* 1983). Further, the effect of enhancement of PSII photoinhibition upon the removal of the Mn-cluster from the WOC was then described (Klimov *et al.* 1990).

On photoinhibition

The above research was followed by Suleyman's collaboration with Ivan Šetlík's group in Třeboň, which showed that under anaerobic and reducing conditions, photoinhibition occurs on the electron acceptor side of PSII at the level of Q_A and Q_B, whereas under aerobic conditions, it occurs not only on the acceptor but also on the electron donor side of PSII; at the same time, however, the separation and the stabilization of charges in PSII RC remain unchanged (Allakhverdiev *et al.* 1987, 1993; Klimov *et al.* 1990, Šetlík *et al.* 1990).

The bicarbonate effect on the electron donor side of PSII

From 1988 to 1995, Suleyman and his collaborators focused on the bicarbonate effect on the electron donor side of PSII. Whereas earlier, a bicarbonate was considered, mainly, to be an essential component for electron transfer between the plastoquinone electron acceptors, Q_A and Q_B, while bound to the non-heme Fe (Shevela *et al.* 2012), Suleyman, with others, found that the removal of bicarbonate also affects the PSII donor side reactions (Klimov *et al.* 1995a,b; 1997a,b; 2003). The availability of bicarbonate for the PSII donor side is especially significant for the reactivation of the Mn-containing WOC after its removal by different treatments. It was suggested that bicarbonate may serve as a ligand to Mn, convert the aqua-ions of Mn^{2+} (non-oxidized by PSII) into an easily oxidizable form $Mn(HCO_3)^{+}$, or act as a structural component essential for the formation of a functionally active Mn cluster, or function in proton transfer (from water to the lumen).

Chlorophyll *d* and *f* in oxygenic photosynthesis

Between 2010 and 2012, Professor Suleyman I. Allakhverdiev and colleagues, working with Profs. M. Mimuro and T. Tomo (Japan) defined the pigment composition and redox energetics of PSII in the chlorophyll *d* (Chl *d*)-dominated cyanobacterium *Acaryochloris marina*. This work confirmed that the PSII special pair is Chl *d*-based. In purified PSII core complexes, pigment stoichiometry (per two pheophytin *a*, Pheo *a*) was estimated as 29.6 Chl *d* and 1.9 Chl *a*. They further concluded that the primary donor P_{713} is dimeric, and that Pheo *a* is the primary electron acceptor in *A. marina* PSII particles (Tomo *et al.* 2011, Allakhverdiev *et al.* 2016).

A key outcome is that the high-potential chemistry required for water oxidation is remarkably conserved across oxygenic phototrophs, even when the dominant chlorophyll changes. The midpoint potential of Pheo *a*/Pheo a^{-} is –536 ± 8 mV in S*ynechocystis* sp. PCC 6803 *vs.* –478 ± 24 mV in *A. marina*. Likewise, the special-pair potential remains near ~1.2 V with P_{680} of *Synechocystis* at ~1.20 and P_{713} in *A. marina* at ~1.18 V, confirming that the ~1.2 V oxidizing power is required for water splitting in both Chl *a*- and Chl *d*-based PSII (Allakhverdiev *et al.* 2010). Energetic measurements of the primary quinone acceptor reinforced this conservation. In *A. marina*,

Em (Q_A/Q_A^-) was +64 mV in Mn-depleted PSII and was estimated to shift to ~ –66 to –86 mV in Mn-intact PSII (a 130–150 mV shift), consistent with other oxygenic systems. In *Synechocystis*, Em (Pheo/Pheo$^-$) was measured at –525 mV with the Mn cluster; Mn depletion shifts this by ~ –77 mV, and applying this shift to *A. marina* yields an estimated Em (Pheo *a*/Pheo a^-) ≈ –401 mV. From these values, ΔG(PhQ) is ~ –325 mV (*A. marina*) *vs*. ~ –383 mV (*Synechocystis*), indicating a shared energetic "design" for PSII electron transfer despite pigment substitution (Allakhverdiev *et al.* 2011).

Among the chlorophylls found in oxygenic phototrophs, Chl *f* is the most red-shifted and was first identified in *Halomicronema hongdechloris*. Cryo-EM structures of PSI cores grown under white *vs*. far-red light showed that far-red PSI binds 83 Chl *a* and 7 Chl *f* molecules. Importantly, Chl *f* resides mainly at peripheral antenna sites and does not appear to participate directly in the PSI electron-transfer chain. Instead, its appearance tracks far-red-induced PSI gene expression, supporting a role in far-red light harvesting and uphill excitation energy transfer, with specific sequence features enabling Chl *f* binding (Kato *et al.* 2020). Together, these studies show how oxygenic phototrophs extend photosynthetically useful absorption into the far-red (*via* Chl *d* and especially Chl *f*) while preserving the core thermodynamic architecture of PSII needed for water oxidation. Professor Suleyman I. Allakhverdiev's contributions are central to this synthesis: in *A. marina*, Chl *d* defines a distinct special pair (P_{713}), yet Pheo and Q_A tuning and the maintenance of an ~1.2 V oxidizing potential remain closely aligned with Chl *a*-based PSII, establishing a conserved high-potential photochemical framework. In parallel, PSI adaptation to far-red light incorporates Chl *f* primarily at antenna/peripheral sites, consistent with enhanced light capture and energy transfer rather than direct participation in charge separation. Overall, Professor Allakhverdiev's work highlights a guiding principle: chlorophyll diversification broadens light harvesting, while the energetics that power water oxidation remains deeply conserved, enabling robust oxygenic photosynthesis across diverse spectral niches.

Research in Japan

His work in Japan, in Norio Murata's laboratory, was also highly successful. This research encompassed several key areas. First, a new type of dark repair of PSII was discovered in photoinactivated *Synechocystis* cells at low temperatures (0–10°C). This repair occurs without the need for new synthesis of the D1 protein and is inhibited by salt stress and reactive oxygen species, such as H_2O_2 and $^1O_2$, which interfere with the transcription and translation of the *psbA* gene that encodes the D1 precursor (Allakhverdiev *et al.* 2003a, Mohanty *et al.* 2007). Second, the protective role of glycine betaine was demonstrated; it not only preserves the oxygen-evolving function of PSII *in vitro* but also safeguards other electron transfer reactions, including stability of P_{680} photooxidation and Pheo photoreduction, during thermal and photoinactivation. Organisms capable of synthesizing glycine betaine, such as transformed *Synechococcus* cells expressing the *codA* gene, show increased resistance of PSII to these stresses (Allakhverdiev *et al.* 2003b). Third, a model describing PSII inactivation under salt and hyperosmotic stress was proposed, revealing that salt stress causes a two-phase inactivation – rapid, reversible, and slower, irreversible – while osmotic stress results only in a fast, reversible phase. The irreversible phase is attributed to Na^+ ions disrupting the recovery mechanisms of PSII (Allakhverdiev *et al.* 2000a,b; 2001; Nishiyama *et al.* 2001, 2004). Additionally, salt and hyperosmotic stresses influence gene expression: salt stress activates *slr1390* and *slr1604*, which encode FtsH metalloproteases involved in the degradation and processing of the D1 protein, whereas these genes are not induced under hyperosmotic conditions (Kanesaki *et al.* 2002). Water channels also play a crucial role in the adaptation of PSII to hyperosmotic stress (Shapiguzov *et al.* 2005). Fourth, the significance of unsaturated fatty acids in conferring resistance to salt stress was established; cells capable of synthesizing polyunsaturated fatty acids are more resilient, as evidenced by studies on *Synechocystis* mutants deficient in *desA* and *desD* genes, which encode lipid desaturases. Modifying the unsaturated fatty acid content in *Synechococcus* membranes further enhanced the salt stress resistance of PSII (Allakhverdiev *et al.* 1999a, 2000b). Finally, the research highlighted that PSII inactivation in plants and cyanobacteria under stress results from both the accelerated degradation of endogenous PSII components and the inhibition of transcription and translation processes necessary for their *de novo* synthesis and repair (Allakhverdiev *et al.* 2005, Nishiyama *et al.* 2005, 2006; Murata *et al.* 2007).

Artificial photosynthesis for energy

In addition to his foundational work in traditional photosynthesis research, he has successfully pioneered innovative approaches that blend classical and modern methodologies. His contributions encompass the fields of bioenergetics, artificial photosynthesis, and advanced molecular hydrogen technologies. Under his visionary leadership, the research team has achieved remarkable breakthroughs in nanobiotechnology, notably the synthesis of over 60 distinct catalysts designed for water oxidation and hydrogen production (Allakhverdiev *et al.* 1994, 1999b; Hotchandani *et al.* 1999, 2000; Nagata *et al.* 2007). A significant aspect of this work involves the development of artificial photosynthetic systems that leverage natural protein structures, mimicking and enhancing the efficiency of natural processes. These advancements not only advance our understanding of biological energy conversion but also hold immense potential for practical applications, particularly in sustainable energy production through molecular hydrogen. This research paves the way for cleaner, renewable energy sources that could significantly reduce reliance on fossil fuels and mitigate environmental impact. Moreover, it makes a meaningful contribution to global efforts toward sustainable development, addressing energy security and environmental preservation on a broader scale. His work exemplifies the integration of

cutting-edge science with real-world solutions, fostering a promising future for renewable energy technologies (Najafpour *et al.* 2016, 2020; Allakhverdiev 2024, Mousazadeh *et al.* 2025).

International collaboration and field-level impact

After Suleyman and collaborators published the above results, the research groups of Arnold Hoff and Hans van Gorkom (in the Netherlands), of Rafael Picorel (in Spain), and of Göran Samuelsson (in Sweden) contributed to the shaping of their studies (Klimov *et al.* 1995a,b; 1997a,b; 2003; Wincencjusz *et al.* 1996, Allakhverdiev *et al.* 1997, Hulsebosch *et al.* 1998, Yruela *et al.* 1998, Shutova *et al.* 2008). These studies have been included in world-renowned textbooks and have played a leading role in shaping fundamental knowledge in the field.

We emphasize that a scientist's research activity is characterized by international cooperation; in the case of Suleyman Allakhverdiev, his network covered more than 30 countries; he has, *e.g.*, worked as a visiting professor in Canada, Japan, Korea, Singapore, Turkey, India, France, Germany, Australia, leading many international projects. Professor Allakhverdiev has worked for many years (1990–2007) at, *e.g.*, the National Institute for Basic Biology in Okazaki, Japan (together with Prof. Morio Murata). Further, earlier (1988–1999), he had worked at the Faculty of Chemistry and Biology at Trois-Rivières University, Quebec, Canada (together with Prof. Robert Carpentier).

The Allakhverdiev–Barber collaboration on Sustainability Conferences

Over the past two decades, the accelerating global demand for sustainable energy has made it increasingly clear that photosynthesis – an ancient, highly optimized biological process – offers profound lessons for future energy technologies. Many in the community recognized that the fundamental chemistry and physics of light harvesting, charge separation, and water splitting could inform new strategies for solar fuels and renewable energy. It was precisely this convergence of basic photosynthesis research with the emerging sustainability agenda that repeatedly brought Suleyman I. Allakhverdiev, James (Jim) Barber, and others together, and that ultimately shaped their long-standing collaboration on the Photosynthesis Research for Sustainability (PRS, now PHRS) series.

From the very beginning, this meeting was conceived as an international conference series, launching in 2004 in Trois-Rivières, Canada, under the title "Photosynthesis and Post-Genomics Era". It was established by Suleyman I. Allakhverdiev (Russia), Vyacheslav ("Slava") Klimov (Russia), Robert Carpentier (Canada), and Prasanna Mohanty (India) as a companion conference designed to alternate with the larger International Congress on Photosynthesis, which at that time convened every three years. In 2011, the series was renamed the International Conference on Photosynthesis (ICP). Its scope expanded in 2013 to include hydrogen production, and in 2015 it adopted its current title: "International Conference on Photosynthesis and Hydrogen Energy Research for Sustainability". Over the past two decades, the conference has rotated among venues in North America, Europe, and Asia, consistently attracting researchers presenting new advances in photosynthesis, hydrogen-related bioenergy, and sustainability science. A hallmark of this conference series is its strong commitment to supporting young scientists and to building collaborations at the broadest international level, unconstrained by geopolitical barriers. The 13th meeting will be held in Gaeta, Italy, in May 2026, and will be organized by Giuseppe Spazzafumo and Barry D. Bruce. Recently, this unusual and highly successful conference series has been documented in a recent manuscript by colleagues of Suleyman (Larkum *et al.* 2025).

Jim Barber's influence on the PRS conferences (Fig. 4) is most clearly seen in the way he, working in close partnership with Suleyman Allakhverdiev, helped transform them from a set of individual meetings into a coherent international series explicitly linking photosynthesis to sustainability and hydrogen energy. The modern identity of PRS began to crystallize with the 2011 meeting in Baku, Azerbaijan ("Photosynthesis Research for Sustainability – 2011: in honor of Jalal Aliyev"), where Barber served as Chairman, Allakhverdiev as Coordinator, and Jalal Aliyev as Honorary Chairman. Already at that meeting, the characteristic PRS format was evident: a distinguished senior figure in the field is honored, the scientific program spans primary processes to bioenergy and sustainability, and strong East–West participation is actively fostered – an approach that reflected, in a very concrete way, the shared vision and complementary leadership of Barber and Allakhverdiev.

The second Baku conference, "Photosynthesis Research for Sustainability – 2013: in honor of Jalal A. Aliyev", further consolidated this model and made Barber's leadership even more visible: he again served as Chairman of the International Organizing Committee, with Allakhverdiev as Coordinator and Irada Huseynova as Secretary. As in 2011, the meeting combined a tribute to Aliyev with strong recognition of young investigators, a pattern that rapidly became a hallmark of the PRS series. In 2014, this template returned to Russia for "Photosynthesis Research for Sustainability – 2014: in honor of Vladimir A. Shuvalov" in Pushchino, with Barber listed as Chairman and Allakhverdiev as Coordinator. The 2015 conference, "Photosynthesis Research for Sustainability – 2015: in honor of George C. Papageorgiou", held at the Orthodox Academy of Crete in Kolymvari (21–26 September 2015), again placed their joint leadership at the center: Barber chaired the International Organizing Committee, formally declared the conference open, and helped select the young-investigator awards, while Allakhverdiev managed much of the day-to-day organization. The 7th meeting in Pushchino in 2016 ("Photosynthesis Research for Sustainability – 2016: in honor of Nathan Nelson and T. Nejat Veziroğlu") continued this pattern and explicitly integrated hydrogen-energy themes. Across these 2011–2016 meetings –

Fig. 4. Jim Barber's influence with PHRS Conferences. (*A*) Prof. Barber in Pushchino for the 2014 PHRS. (*B*) Jim Barber and wife Lynn Barber at the PRS dinner in Crete, 2015. (*C*) Jim Barber and Bill Rutherford in Baku, 2011. (*D*) Suleyman with Tatsuya Tomo, Kimiyuki Satoh, and Norio Murata and Jim Barber, having dinner at the Phoenix in Pushchino, 2014. All photos by Barry D. Bruce.

building on earlier PRS conferences in 2004 (Canada) and 2007 (Russia) – Barber served as the steady international chair and "public face" of PRS, while Allakhverdiev provided enduring coordination and organizational momentum; together, they built a recognizable "brand" based on rotating venues (Azerbaijan, Russia, Greece, and India), clearly identified honorees (Jalal A. Aliyev, Vladimir A. Shuvalov, George C. Papageorgiou, Nathan Nelson, Turhan N. Veziroğlu, Robert Blankenship, Elizabeth Gantt), a focus on sustainability and hydrogen energy, and strong support for young scientists.

From the 2nd conference in 2006 through the 10th conference in 2019, Jim Barber served as Chairman or Co-Chairman of the PRS series. Beginning with the 11th conference in 2023, Prof. Julian Eaton-Rye (New Zealand) assumed the role of Chairman, with Prof. Barry D. Bruce (USA) as Co-Chairman. Throughout this entire period (from the 2nd conference until now), Prof. Tomo Tatsuya (Japan) has served as Conference Secretary. It is also important to note that, since the very first conference, Prof. Suleyman I. Allakhverdiev (Russia) has continuously served as Coordinator of the PRS series. All of us, as authors of this tribute, are deeply grateful to each of them for their sustained commitment and outstanding service to the photosynthesis community.

Overall contributions and broader impact

Suleyman Allakhverdiev is one of the few scientists to have achieved significant success in photosynthesis. His research has played a crucial role in advancing scientific understanding by elucidating the initial stages of the electron transport chain in PSII, as well as excitation energy transfer and the kinetic mechanisms involved (Allakhverdiev *et al.* 2010, 2011). In addition, he has successfully developed both traditional and modern approaches to photosynthesis, including bioenergetics, artificial photosynthesis, and molecular hydrogen technologies. Under his leadership, significant breakthroughs have been achieved in nanobiotechnology, including the synthesis of over 60 different catalysts for water oxidation and hydrogen evolution, particularly in the creation of artificial photosynthetic systems based on natural protein structures. This research opens up opportunities for producing molecular hydrogen as an alternative energy source and contributes practically to sustainable development initiatives (Najafpour *et al.* 2016, 2020; Mousazadeh *et al.* 2025).

Lectures and invited talks

Suleyman, the scientist, has given lectures at more than 100 conferences held in Russia and other countries, and has delivered invited lectures in over 40 countries worldwide, including Australia, Hungary, Japan, Germany, Spain, Canada, the Netherlands, Singapore, France, Sweden, and Turkey.

Collaborations – worldwide (selected)

Norio Murata, Nejat T. Veziroğlu, Robert Carpentier, Eva-Mari Aro, Arnold Hoff, Gernot Renger, Govindjee Govindjee, Hans van Gorkom, Sergey Shabala, Rafael Picorel, Seeram Ramakrishna, Hiroshi Nishihara, Prasanna Mohanty, Julian Eaton-Rye, Marian Brestic, Tatsuya Tomo, Barry D. Bruce, Jian-Ren Shen, Jo-Shu Chang, Harvey Hou, Mahdi Najafpour, *etc*.

Editorial activities and training

Editorial activities

Suleyman is an associate editor of the following journals: *International Journal of Hydrogen Energy*, *Photosynthesis Research*, *Photosynthetica*, and *Functional Plant Biology* (*CSIRO*). He is the section editor-in-chief of *Cells* (*MDPI*), and a member of the Editorial Board of more than 10 international journals, including *Biochimica et Biophysica Acta – Bioenergetics*, and *J. Photochem. Photobiol. B*. In addition, he has served as the guest editor of many (more than 35) special issues in international peer-reviewed journals including *Photosynthesis Research* (2005, 2008,

2012, 2013, 2014, 2015, 2016, 2017, 2019, 2020, 2022, 2023, 2024, 2025); *Biochimica et Biophysica Acta* (2007, 2012, 2014); *Photochemistry and Photobiology Science* (2009, 2011, 2015); *International Journal of Hydrogen Energy* (2012, 2017, 2019, 2024, 2025); *Frontiers in Plant Science* (2014, 2023); *Plant Physiology and Biochemistry* (2014), *Photosynthetica* (2023), *Cells* (2022), and *Functional Plant Biology* (2020, 2023).

Training

It is important to note that Professor Suleyman Allakhverdiev is not only a leading researcher but also an accomplished educator in scientific personnel training. Under his scientific advice and leadership, several candidates in the sciences have been trained.

Recognitions and awards

In 2016, he was recognized by Thomson Reuters (Clarivate Analytics) as the most highly cited Russian researcher worldwide in Biology. In 2018, he was ranked first among the most highly cited scientists in Russia. He was awarded the "Scopus Awards Russia, 2018" in the category of "Life Sciences", and he has received a special award for his contribution and assistance to the development of science in the Republic of Azerbaijan (Web of Science Awards 2018).

Furthermore, Suleyman has been included in the World Top 2% Scientists List (Stanford List) continuously from 2018 to 2022, acknowledging his sustained impact and influence in the scientific community. In addition, between 2018 and 2023, he was listed among the most influential scientists worldwide in the Web of Science database – an exclusive group comprising the top 1% of the most highly cited researchers globally.

In 2019, Suleyman Allakhverdiev was the winner of the K.A. Timiryazev prize of the Russian Academy of Sciences. In 2021, he became the laureate of the 2021 Global Energy prize, for an outstanding contribution to the development of alternative energy, for his phenomenal scientific achievements of artificial systems for alternative energy, a cycle of scientific works in the field of bioenergy and hydrogen energy, for the promotion of the efficiency, and for environmental safety of energy sources.

In 2022 alone, there were five awards: (i) The Honored Scientist of the Russian Federation; this title was given to him for his outstanding contribution to the development of plant biology and the study of the fundamental principles of photosynthesis. (ii) A gold medal from Al-Farabi Kazakh National University "For Meritorious Science"; (iii) Corresponding membership in the Russian Academy of Sciences; (iv) A medal for "75 Years of the Phystech" (Moscow Institute of Physics and Technology); and (v) 4th position in the field of "Biology and Biochemistry" among Russian scientists in the ranking of the international academic platform for researchers: Research.com – Leading Academic Research Portal.

In both 2023 and 2024, Suleyman had the first position in the field of "Plant Science and Agronomy" among Russian scientists in the ranking of the international academic platform for researchers, Research.com – Leading Academic Research Portal (*see*: https://research.com/). During 2024, there were three more recognitions: (i) the medal "300 Years of the Russian Academy of Sciences" for his outstanding contribution to the development of science, training of scientific personnel, and many years of fruitful research and organizational activities; (ii) the "Nejat Veziroğlu Special Award" for his internationally recognized contributions to the study of hydrogen energy; and (iii) Honorary Professor of MIPT (Moscow Institute of Physics and Technology).

In 2024 and 2025, Suleyman Allakhverdiev was included in the prestigious global Highly Ranked Scholars (ScholarGPS), placing him in the top 0.05% of the world's most influential scientists in the field of photosynthesis.

Conferences organized

In addition to all the above, Suleyman has organized 12 international conferences on "Photosynthesis and Hydrogen Energy Research for Sustainability" (*see*: https://phrs-conference.com).

Publications and metrics

Lastly, Suleyman Allakhverdiev is the author of over 450 scientific articles, 49 book chapters, 7 inventions, and 13 books. The scientist's Hirsch index is 90, and his scientific works have been cited more than 34,000 times.

Congratulatory messages from friends and colleagues (many shown in Fig. 5)

Govindjee, Professor Emeritus, *Departments of Plant Biology and Biochemistry, Center for Biophysics & Quantitative Biology, University of Illinois at Urbana-Champaign, Urbana, IL, USA*

I am delighted to extend my best wishes to my good friend Suleyman Allakhverdiev, a prominent Russian plant physiologist, on his 75th birthday. Suleyman is not only a great scientist in photosynthesis, but also a great friend. In addition to his topmost research, he has been a super editor. He has served as the top editor for many special issues of scientific journals (*e.g.*, *Photosynthesis Research*) and has published papers not only in science but also in education. Personally, I have learned a great deal from him regarding "The Current Challenges in Photosynthesis: From Natural to Artificial", specifically regarding advances in the field and the potential to develop sustainable energy sources in the future. What I have enjoyed and appreciated most is his leadership as a key organizer and a coordinator of international conferences on "Photosynthesis and Hydrogen Energy Research for Sustainability", where we had fun together, especially in recognizing young researchers – our future leaders.

Agepati S. Raghavendra, Former Professor in Life Sciences, *Department of Plant Sciences, University of Hyderabad, India*

It gives me immense pleasure to write this message for Suleyman Allakhverdiev – first, a very happy 75th birthday,

Fig. 5. Suleyman through the years and around the world. (*A*) A young Suleyman in Japan, 2003. (*B*) Suleyman with two of his mentors, Professor Vyacheslav (Slava) Klimov (*left*) and academician Vladimir (Vlad) A. Shuvalov (*right*), in Puschino in 2016. (*C*) Suleyman at a conference held at Foshan University, China, 2019. (*D*) Suleyman and close friend Prof. Tomo Tatsuya in Japan, 2022. (*E*) Tomo and Suleyman in Crete, 2015. (*F*) Suleyman recognizing Prof. A.S. Raghavendra (*seated*) in Hyderabad, 2017 with Prof. Rajagopal Subramanyam (*left*) and Prof. Appa Rao Podile (*middle*). (*G*) Suleyman visiting the lab of Professor Shen in Japan, 2023. (*H*) Prof. Mahdi Najafpour visiting Professor Allakhverdiev in his Moscow office, 2025. (*I*) Suleyman with Professor Lorenzo Ferroni in Istanbul in 2023.

and many returns of the day. I have known Suleyman for several years and have interacted with him at various international conferences on Photosynthesis and Hydrogen Energy Research for Sustainability. I have been impressed by his efficiency as an organizer and an expert coordinator. In addition to his organizational skills, he possesses excellent editing skills, having served on prestigious international journals focused on photosynthesis and hydrogen production. Additionally, he is a great host and offers exceptional hospitality. Above all these factors, I am impressed by his friendly approach and down-to-earth nature, which make him willing to help everyone in every possible way. I have seen several young researchers get inspired by his knowledge of the subject and encouraging attitude. I wish Suleyman a long life, perfect health, and a fulfilling academic career.

Seeram Ramakrishna is a Chair Professor of Tsinghua University, Xinghua Distinguished Chair Professor, and Director of the iWearables Center, *Department of Mechanical Engineering, Tsinghua University, China*

Around 20 years ago, as a Vice-President championing the international research partnerships of the National University of Singapore (NUS), I had invited Professor Suleyman Allakhverdiev to NUS. During his visit, we discussed potential joint research projects involving photosynthetic materials for photosensors. Unfortunately, that program did not take off because a key colleague of mine moved to Canada, which affected the collaboration. However, since then, we have published several critical cross-field papers with Suleyman on new materials, nanomaterials, and hydrogen energy. Over the years, we have developed a very good friendship and professional relationship. I have found Suleyman to be a very dedicated researcher with a broad and insightful perspective. Today, we honor and celebrate a truly remarkable individual – my dear friend and esteemed colleague – on their 75th anniversary. Over the years, his dedication, wisdom, and kindness have left an indelible mark on all of us. Thank you for your friendship, mentorship, and the countless memories we've shared. Here's to your extraordinary 75 years and to many more to come. May this milestone be a celebration of your remarkable life and an inspiration to us all. Happy 75th Anniversary!

Anthony "Tony" Larkum, Professor Emeritus of Plant Sciences, *University of Sydney & Adjunct Professor at the University of Technology Sydney (UTS), Australia*

Suleyman Allakhverdiev has been a dear friend and colleague for over thirty years. Over this time, we have shared many of the wonders of photosynthesis, publishing together and developing ideas that have shaped both of

our scientific paths. Our long-standing friendship has also strengthened our shared commitment to supporting the next generation of researchers in photosynthesis. It has been an absolute pleasure and privilege to work with Suleyman on developing the International Conference on Photosynthesis and Hydrogen Production, which has grown so remarkably into an excellent forum and teaching platform for young scientists interested in the sustainable development of our planet. On his 75th birthday, I warmly congratulate Suleyman and celebrate not only his outstanding scientific achievements but also his generosity, friendship, and unwavering dedication to our community.

Julian Eaton-Rye, Professor and Head, *Department of Biochemistry, University of Otago, Dunedin, New Zealand*

Congratulations on your 75th! Thank you for your dedicated work in the photosynthesis community over the years and for your continued enthusiasm for the "Photosynthesis and Hydrogen Energy Research for Sustainability" meetings. These are always an excellent opportunity for both early-career scientists and more established researchers to present their science and network. It has also been great to co-author papers with you. I wish you the very best for many more successful scientific events in the years to come. Every best wish!

Jian-Ren Shen, Professor & Director, *Research Institute for Interdisciplinary Science, Okayama University, Japan*

Dear Suleyman-san – Congratulations on your 75th birthday. On this occasion, I recall our numerous collaborative works, as well as the series of International Conferences on Photosynthesis and Hydrogen Research for Sustainability, to which I have attended several times with great enjoyment. You have put tremendous effort into organizing these events. I am delighted and feel honored that you have visited and stayed in my laboratory in Okayama, Japan, on multiple occasions, and that you have written many joint papers during these periods, as well as after them. Your knowledge and enthusiasm for elucidating the water-oxidation mechanism by Photosystem II and its potential applications in artificial photosynthesis made this work and publications possible. Regarding the International Conference on Photosynthesis and Hydrogen Research for Sustainability, you showed tremendous hospitality to all of us, despite being the organizer and very busy before and during the meetings. I wish you an even healthier and more productive future.

Eva Mari-Aro, Research Director & Emeritus Professor of Molecular Plant Biology, *Department of Life Technologies, University of Turku, Finland*

I'm delighted to add my voice with wholehearted support. Over many years, Suleyman's scholarship and generosity have had a profound impact on my work in tangible ways – most notably through our co-authored review articles and his tireless leadership in organizing congresses that celebrated colleagues across our field. He has a rare gift for bringing people together: I have seen him foster rigorous, open scientific debate while maintaining a warm and collegial tone, creating spaces where ideas flourish, and friendships deepen. The joyful, inclusive atmosphere he builds has strengthened our international community and inspired countless younger scientists. I offer my deep gratitude and admiration for his career that continues.

Tomo Tatsuya, Professor, *Tokyo University of Science, Institute of Arts and Sciences, Kagurazaka Division, Institute of Arts and Sciences, Japan*

Suleyman is not only a longtime collaborator but also one of my closest friends. He has inspired me for years – not just through his scientific insights, but also through his generosity, energy, and talent for building international collaborations. I've seen him turn a coffee-break discussion into a new project, welcome young scientists into the conversation, and lift the mood of an entire meeting with his enthusiasm. He always finds a way to connect people and ideas. On a personal note, I treasure the many small moments: his encouragement after a tough talk, the impromptu hallway debates that sharpened our thinking, and his unfailing kindness to my students. Working with Suleyman has improved my science – and it has strengthened our community. With warm regards!

Giuseppe Spazzafumo, Professor, *University of Cassino and Southern Lazio, Italy*

I met Suleyman several years ago, and we immediately established a good relationship, even though we never had the opportunity to collaborate. I attended his conference in 2019 in St. Petersburg and greatly appreciated it, so much so that I'm organizing the next one in Gaeta. It's a great honor for me to have a scientist like Suleyman among my friends, and I'm happy to celebrate his 75th birthday, which finds him still fully operational.

Mohammad Mehdi Najafpour, Professor, *Chemistry Department, Sharif University of Technology, Tehran, Iran*

I have been collaborating with Professor Suleyman Allakhverdiev for approximately 20 years, during which we have discussed and developed numerous projects together. Professor Allakhverdiev is a distinguished scientist in the fields of photosynthesis, artificial photosynthesis, and hydrogen energy. Through his roles as a research leader, mentor to young scientists, and active participant in international collaborations and editorial boards, he has made significant contributions to clean and sustainable energy research. He has supported the growth of many young researchers worldwide. Each year, he brings together numerous scientists at his annual conferences – 12 International Conferences titled "Photosynthesis (including Artificial Photosynthesis) and Hydrogen Energy Research for Sustainability" – creating a unique opportunity for us to meet, share ideas, and discuss many fascinating topics. I respect him not only as a leading expert in his field, but also for his dedication, his kindness toward students and colleagues, and his tireless service to the scientific community. I sincerely wish Professor Allakhverdiev good health, continued success, and many more years of inspiring work for a greener and more hopeful future.

Rajagopal Subramanyam, Professor and Head, *Department of Plant Sciences, School of Life Sciences, University of Hyderabad, India*

Your 75th birthday marks a momentous occasion – a time to celebrate your love, legacy, and the remarkable journey you've undertaken. As you reflect on the years gone by, we are sure you are filled with cherished memories of family, friends, and the many accomplishments that have shaped you into the inspiring person you are today. Your life stands as a testament to hard work, dedication, and an unwavering pursuit of excellence in research, particularly in photosynthesis and hydrogen energy. I have known you since 1999, when you worked as a postdoctoral researcher in Robert Carpentier's lab at the University of Quebec in Trois-Rivières, Canada. After you left the lab, I continued working on the same project – studying the effect of high light on Photosystem I – and that's when our scientific interaction truly began. Over the years, we met several times at various conferences, especially at the Photosynthesis and Hydrogen Energy for Sustainability meetings, where you served as an organiser. During these occasions, we exchanged scientific ideas on various topics related to photosynthesis. Later, under your guidance, I had the privilege of organising the 8th International Conference on Photosynthesis and Hydrogen Energy Research for Sustainability in 2017 at the University of Hyderabad, India. Our collaboration has continued through joint research efforts and several co-authored publications. Suleyman, you are one of the most simple, honest, and genuine people I have ever known. May your heart remain full of joy, your spirit stay strong, and your life continue to be filled with purpose, happiness, and discovery. Wishing you a wonderful celebration and a year ahead filled with all your favourite things.

Bekzhan Kosalbayev, Professor, *Satbayev University, Almaty, Kazakhstan*

In the scientific life of our team, Professor S.A. Allakhverdiev occupies a special place: it was precisely our interactions and collaboration with him that inspired us to develop the field of bioenergetics of phototrophic microorganisms and gave new meaning to our research. His far-reaching scientific school, high standards, and demanding attitude, combined with rare human warmth, have helped us grow professionally and achieve significant results on the international stage. In this anniversary year, we bow with deep respect and gratitude to a Scholar whose name has become for us a symbol of genuine dedication to science. We wholeheartedly wish him many more years of good health, creative energy, and new scientific achievements. With deep respect and gratitude.

Asem Sadvakassova, Professor*, Department of Biotechnology, Al-Farabi Kazakh National University, Almaty, Kazakhstan*

The contribution of Professor Suleyman Allakhverdiev to the development of modern photosynthetic and bioenergetic biotechnology can hardly be overstated. His fundamental studies of the photosynthetic apparatus and his bold translation of this knowledge into the realm of applied bioenergetics have largely shaped the trajectory of this field and inspired numerous research teams. For me, collaborating with him marked the beginning of a new stage – a transition from classical studies of phototrophic microorganisms to a deeper understanding and realization of their biotechnological potential. His scientific vision, selfless support, and genuine interest in our ideas have played a decisive role in shaping me both as a researcher and as a person and have enabled the implementation of a number of important projects and publications at the international level. On his 75th anniversary, I would like to express my profound gratitude and sincere respect to a Scholar whose energy, breadth of thought, and human generosity continue to inspire an entire generation of young biotechnologists. With my warmest wishes and deepest respect.

Arvi Freiberg, Professor Emeritus, *Faculty of Science and Technology, University of Tartu, Tartu, Estonia*

To me, Suleyman is more than a kind and friendly colleague – he is a phenomenon. Science is a demanding and highly competitive field. Many of us, consciously or not, focus primarily on individual success, sometimes overlooking or even diminishing the contributions of others. Suleyman stands apart in this regard. For more than two decades, he has been the driving force behind a remarkable conference series whose defining hallmark has been the celebration of outstanding figures in the field of photosynthesis – his own research domain. Such a choice requires not only vision but also courage and generosity. One can only imagine the obstacles, setbacks, and intrigues that may have accompanied this path. On the occasion of his 75th anniversary, I wish Suleyman, above all, good health, personal happiness, and the continued empathy toward people and the world that so uniquely defines him.

Győző Garab, Professor Emeritus, *Institute of Plant Biology, HUN-REN Biological Research Centre, Szeged, Hungary*

Prof. Allakhverdiev's records in photosynthesis research demonstrate that his work over the past few decades has been, and continues to be, at the forefront of the field – a crucial area of research for sustainable development, alternative energy, agriculture, and our local and global environments. Without going into details, I would like to emphasize the significance of his work on the structure, function, and regulation of Photosystem II and the water-splitting enzyme, as well as his more recent research activity on hydrogen evolution. Regarding the services Suleyman provided to the scientific community, I would like to emphasize how much scientists in photosynthesis research appreciated the meetings he organized. The immensely successful series of conferences on Photosynthesis and Hydrogen Energy Research for Sustainability – besides paying tribute to the lifetime achievements of a few distinguished "photosynthetikers" and scientists on hydrogen energy from all over the world – always paid special attention to the new generation of researchers with Young Talent Awards, and Best Poster Awards. Many of the awardees from earlier years are now

well-established, internationally renowned scientists, and evidently cherish the fondest memories of these meetings. Those who have participated in at least one of these conferences can all testify that Suleyman is an excellent and extremely generous host. He is a person who always goes the extra mile and adds a personal touch to whatever he is involved in, which makes his meetings truly special. Another important point, which most likely comes deeply from Suleyman's personality – being "grown up", in "far-away-from-the-center" republics of the USSR – is that he is evidently deeply convinced that "Sustainability of our Civilization" requires joint efforts from all countries and all laboratories – and should not be the privilege of wealthy nations. His special efforts yielded remarkable successes in science policy in a few countries, an example to follow. Finally, Suleyman's meetings provided an excellent opportunity, skillfully offered by Suleyman and his coworkers, to get acquainted with the local culture and build long-lasting friendships among scientists from different countries.

Suleyman, I wish you, also on behalf of your fellow members of the "Club of 49ers" (*cf.* Cogdell and Garab 2016), many active years ahead and much happiness!

Barry D. Bruce, Distinguished Professor, *BCMB Department, University of Tennessee, Knoxville, USA*

I first met Professor Suleyman Allakhverdiev more than fifteen years ago in his home country of Azerbaijan. Since then, our friendship and collaboration have spanned many countries, conferences, and research endeavors. Over the years, we have co-authored more than ten papers and continue to communicate regularly, exchanging ideas and planning new projects across borders. What began as a shared scientific interest has evolved into a genuine friendship, rooted in respect, curiosity, and mutual admiration. On a more personal note, I have many fond memories of time spent in Pushchino, Russia, where Suleyman's hospitality and warmth always made every visit special. I especially cherish the evenings shared with my close friend and mentor, Jim Barber, enjoying long conversations and dinners at the Phoenix restaurant, just a short walk from the Institute of Basic Biological Problems. Those evenings – filled with laughter, stimulating discussion, and deep friendship – captured the true spirit of the Pushchino meetings: a space where science, humanity, and camaraderie flourished side by side. It was not long before Jim's passing, and I will never forget those moments as a celebration of the global scientific community that Suleyman helped bring together and sustain. It was also a rare privilege to meet and discuss science with the late Academician Vladimir Anatolevich Shuvalov, who served as Director of the Institute of Basic Biological Problems for more than two decades. His insight, intellect, and kindness left a lasting impression on all who had the honor of knowing him, and I remain grateful to Suleyman for creating the opportunity for those encounters. I feel fortunate to count Suleyman not only as a distinguished colleague but also as a dear friend – a scientist whose generosity, intellect, and global vision continue to inspire all who know him.

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