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Tribute and a Perspective

Reto Jörg Strasser: An innovator, a wonderful friend and "Professor of the World"[1]

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After presenting a very brief insight into the life of Reto Jörg Strasser, we provide here first a glimpse of his joint research with Govindjee, in the 1990s, done at the Bioenergetics laboratory, University of Geneva, Switzerland. They both had the most wonderful time there; Reto's collaborative spirit was superb. The two have interacted with each other since then and have continued even after their retirement(s). This is followed by a brief description of this interaction as well as a glimpse of Reto's life and career. Then, Alaka Srivastava and Sandra Stirbet, who have worked with Reto for around eight years, in Geneva, Switzerland, Vineet Soni, who did a post-doc with Reto, and Neera Bhalla Sarin, who had worked with Reto in New Delhi, India, provide their tributes to Reto by remembering their time with him. We all honor Reto Jörg Strasser on his 75th birthday that was in December, 2018. Some of us expect our collaboration to continue in the future. To all of us, Reto is an innovator of the highest order, and a wonderful friend. He is dedicated to his family, his friends, his students and all his collaborators–worldwide. He is indeed a special person; we have included here several photographs to document our camaraderie with him.

Key words: Chlorophyll *a* fluorescence, Collaboration in Science, Energy Flux Theory, History of Science, The JIP test, The OJIP(SM)T transient, Plant Efficiency Analyzer.

INTRODUCTION

Amongst the authors of this tribute to Reto Jörg Strasser, Govindjee was the first one to meet him at the first International Congress on Photosynthesis, organized, in June, 1969, by Helmut Metzner, in Freudenstadt, Germany. He was highly impressed with Reto's enthusiasm for research on the on-going physico-chemical aspects of photosynthesis. Reto's interests were in tune with Govindjee's background and thoughts, who had presented, at the 1969 congress, two papers on the measurements and understanding of the fast (within a second) and slow (up to a few minutes) chlorophyll (Chl) *a* fluorescence changes over time in green algae (see Kautsky and Hirsch, 1931; Munday and Govindjee, 1969; Papageorgiou and Govindjee, 1969; cf. Govindjee, 1995). The two of them had fun talking, in a detailed manner, about each other's research interests. Govindjee had already been

[1] ***This personal tribute and perspective was written at the invitation of C.P. Malik to Govindjee, a longtime friend and collaborator of Reto J. Strasser; note that although Govindjee's legal name is now "Govindjee Govindjee", he continues to publish under one name only.***

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looking at Chl *a* fluorescence for almost ten years, by that time (see e.g., Govindjee *et al.,* 1967). It was refreshing for him to hear Reto's highly original ideas —and, that too, stated with great fervor.

Govindjee's next meeting with Reto was not until the late 1970s when Reto came to deliver a seminar, at the University of Illinois at Urbana-Champaign, on his research and his ideas on the primary events of photosynthesis as well as on the organization of the photosystems including their antenna. This took place when Reto was returning to Switzerland after he had finished his in-depth novel research, using Chl *a* fluorescence, in the laboratory of Warren L. Butler (at the University of California San Diego (UCSD), USA; see Satoh et al. (1976); Strasser and Butler (1976, 1977a, 1977b); and Butler and Strasser (1977); for information on Butler (b.1925-d.1984), see Bishop (1986), Govindjee (1986) and Benson (1998)).

Reto Strasser is known best for the so-called *Energy Flux Theory* (EFT); he is the one who developed it in late 1970s and early 1980s. He published this Theory as articles in edited books (see Strasser, 1978, 1981,1982). There, he provided an ingenious way to formulate energetic communication and energy transduction by photosynthetic systems. Before we describe joint research of Govindjee with Reto, and recollections of the other co-authors, we would like the readers to know a bit about Reto's life and academic training, but first we show him in action. **Figure 1** shows two photographs of Reto Strasser, one lecturing, and the other in a laboratory setting, the one he enjoys the most (see Jajoo *et al.,* 2009 for the report of a conference in Indore, India).

Figure 1(A): Reto J. Strasser delivering his lecture on 'chlorophyll *a* fluorescence and photosynthesis' at Indore, India, and (B): Reto J. Strasser explaining the "ins" and "outs" of measuring and analyzing chlorophyll *a* fluorescence from plant leaves to an eager group of students in Indore, India. These photographs were taken in 2008 by Mahendra Rathore (see Jajoo et al., 2009). Source: Archives of Anjana Jajoo.

A glimpse of Reto Strasser's life and academic career

Reto was born in Bern, Switzerland, in 1943. He has a wonderful family: his wife Norma, three sons (Bruno; Pablo; and Roland) and a daughter (Tamara). Bruno is Professor of Philosophy and History of Science at the University of Geneva (UNIGE); Pablo is working towards a PhD in Theoretical Physics, also at UNIGE; Roland is a physician, on an internship in Australia; and Tamara has graduated in Sport and Sports Medicine from the University of Lausanne, Switzerland.

Reto Strasser first studied mathematics and physics, and then graduated (with a masters' degree) from the University of Bern, in 1968, in Biology, with focus on plant physiology, biochemistry and chemistry (Strasser, 1968). Soon thereafter, in 1970, he obtained his doctoral degree, from the same University, with a

thesis on '*Correlation between biological sulfide oxidation and photosynthetic electron transport*' (Strasser, 1970), which was for work done in the laboratory of Helmut Metzner (b.1925-d.1999), at the University of Tübingen, in Germany; during this period, he held a prestigious DAAD (Deutscher Akademischer Austauschdienst) grant. Then, Reto spent the next ten years doing top-level independent and advanced research, first at the University of Stockholm as an EMBO (European Molecular Biology Organization) fellow (1970-1971), then at the University of Liège, Belgium (1971-1974), in the lab of Cyrille Sironval (b.1922-d.2017); and finally at the University of California San Diego (UCSD, in the lab of Warren L. Butler (b.1925- d.1984), as a faculty associate (1974-1978). After all this, Reto became an independent Research Investigator, at the University of Geneva (Plant Physiology and Bioenergetics; 1978-1980). By then, Reto Strasser had, in addition, Habilitation not only in Photobiology, but also in Bioenergetics. Thus, we can understand why Reto has such a broad and deep background and training – making him a superb biologist of the highest order, with an in-depth knowledge of mathematics and physics. His research is indeed unique. From 1980 till 2009, he served, for almost 30 years, as a Professor at the University of Geneva, retiring from that position, as well as from being the Director of the Experimental Station of Botany (Bioenergetics Laboratory; and the Microbiology Laboratory). After his retirement in 2009, he has held prestigious appointments as Chair Professor (Nanjing Agriculture University, China) and as Professor Extraordinary (South West University, Pochefstroom, South Africa).

From our joint perspective, Reto Strasser is "*THE PROFESSOR of the WORLD*" since he travels to all parts of the World (wherever there is a need) to teach — carrying his own instruments and sits down anywhere, where there is space, and teaches Bioenergetics with great fervor and enthusiasm. We constantly learn from him each time we meet him.

Joint Research, with one of us (Govindjee): Collaboration with many

Historical background: Delosme (1967), in a paper published in French, showed the existence of an inflection "I" between the O and the P levels ("O" and "P" being the nomenclature of Lavorel (1959)) during Chl *a* fluorescence transient. When Munday and Govindjee (1969) measured it in the green alga *Chlorella pyrenoidosa*, they discovered that there was a clear inflection "I" (followed by a dip D) between the O and the P levels; further, this "I" was a clear "peak", with a pronounced dip "D", under anaerobic conditions. [We note that neither Munday, nor Govindjee knew about Delosme's paper, and thus had missed citing it.] Further, Neubauer and Schreiber (1987) reported, a second inflection between "O" and "P", Delosme's "I" being called "I_1" and the newer inflection "I_2".

For an early thoughtful paper on different physical models in photosynthesis, see Strasser (1986), and for detailed reviews on Chl *a* fluorescence and its implication for the photosynthesis process, see chapters in books, edited by Govindjee et al. (1986), Papageorgiou and Govindjee (2004) and Demmig-Adams et al. (2014).

1991-1992 : Chlorophyll *a* fluorescence transient, the OJIP rise

Strasser and Govindjee (1991) reported Chl *a* fluorescence transient in pea leaves and in the green alga *Chamydomonas (C.) reinhardtii* and its DCMU-4 mutant (S264A). They described in detail the OJIP(S)T transient (from 20 microseconds to 20 minutes), plotted on a log time scale. In continuation of Govindjee's earlier research, at the University of Illinois at Urbana-Champaign, on the effect of bicarbonate on the electron acceptor side of Photosystem II (see Govindjee, 2019) , Govindjee and Reto observed, together with Beatrix Schwarz and Jean-David Rochaix (Govindjee *et al*., 1991) that bicarbonate removal (by formate treatment) has no effect on the OJIP transient of L275F mutant of *C. reinhardtii* compared to the wildtype; this gave them an early clue on the possible binding site of bicarbonate in Photosystem II. Strasser and Govindjee (1992) extended these OJIP measurements to two other D1 mutants of *C. reinhardtii*: G256D (AR204) and Fu-D3 (PSI RC (minus)), and to pea thylakoids. After making new measurements on the time dependence of DCMU effect, and the effect of two artificial quinones (dimethyl quinone, DMQ; and dichloro-benzoquinone, DCBQ), the two authors proposed a working hypothesis for the redox status of

Q_A and Q_B, not only at the O, J, I and P steps, but at the "dips" between "J" and "I , and between the "I" and "P" levels. In collaboration with Klaus Pfister (of Ciba Geigy, Basel), and Peter Eggenberg (in Strasser's Lab), Govindjee *et al*. (1992) measured differences in Chl *a* fluorescence decay after a flash of strong light in wild type and in herbicide resistant D1 mutants (F255Y; S264A; G256D; L275F) with and without bound bicarbonate. These differences allowed Strasser *et al*. (1992) to formulate one of the earliest equilibration models of electron flow on the electron acceptor side of Photosystem II.

1995; 1998-1999: Going deeper in understanding Chlorophyll *a* fluorescence transient

With a gap of three years, Govindjee's collaboration began again with Reto Strasser. This involved going deeper into the understanding of the OJIP curve, from the herbicide mutants, and the bicarbonate effect, and serious modeling of Photosystem II. Now, Reto had a new research team; it included Alaka Srivastava, and Alexandrina (Sandra) Stirbet (see below for recollections of Alaka and Sandra). Srivastava et al. (1995) published a detailed paper on the effects of DCMU and on the removal of bicarbonate (by formate addition) on the OJIP transients of D1 mutants, used earlier, plus two more D1 mutants (V219I and A251V). They discovered a clear hierarchy (difference) in the time needed for the filling up of the plastoquinone pool in these mutants, a phenomenon that still needs understanding at the molecular level.

It was in 1995 that Reto's team produced the first numerical simulation model for the OJIP transient (Stirbet *et al*., 1995); it was, however, finalized only in a detailed form in the paper of Stirbet et al. (1998), published in the *Journal of Theoretical Biology*; here, all the assumptions, and all the mathematical models & equations, as well as pros and cons, were presented. On the other hand, Strasser *et al*. (1995) had earlier provided some of the crucial /key experimental results on the OJIP transient in higher plants (peas and Camelia) when they studied its dependence on light intensity as well as on dark-adaptation times; further, this 1995 paper "touched" on OJIP transients in cyanobacteria – some of them are quite different than all other systems since they have a much higher ratio of Photosystem I to Photosystem II. Extending the results of Strasser and Govindjee (1992), Srivastava *et al*. (1995) provided detailed and extensive information on the differential effects of DMQ and DCBQ on Chl *a* fluorescence transient in spinach thylakoids; they concluded that their effects were much more complex than had been thought before and suggested that further research was needed to deal with the question of "active" and "inactive" PSII centers: a problem that is still not resolved.

Further, while in Reto's lab, Govindjee *et al*. (1998) provided some of the early measurements on Chl *a* fluorescence, related to the period 4 oscillations, due to the "*Oxygen clock*" in greening pea leaves (cf. Shinkarev *et al*., 1997). Then, Srivastava et al. (1999) provided a detailed understanding of the greening process in pea leaves (under two different conditions: intermittent radiation and under one-ms flash condition) by measuring, in parallel, several parameters: Chl *a* fluorescence transient; 77 K emission spectra; changes in the "O" level; Delayed Light Emission; and Photosystem I activity through changes in P700, reaction center of PSI. Greening under continuous light was shown to occur in two distinct phases: formation of reaction centers and of antenna took place at different times.

2010–2015: Collaboration, as extended to India, Eastern Europe, and China

***India*:** The first collaboration in this period was that with Neera Bhalla Sarin (at Jawaharlal Nehru University (JNU), New Delhi). Using Chl *a* fluorescence measurements, and analysis *à la* Reto Strasser, Yusuf *et al*. (2010) made an important observation: transgenic *Brasicca juncea* plants overexpressing gamma-tocopherol methyl transferase gene had enhanced tolerance to several abiotic stress conditions (high salt; heavy metal; and osmoticum), providing evidence for a highly important role of gamma tocopherol in plant growth (see below for recollections of Neera Bhalla Sarin). The next collaboration with Gert Schansker provided a much more complete "way" of measuring photosynthesis— when Reto introduced the idea of parallel measurements at 820 nm transmission change,

involving P700 and plastocyanin (for Photosystem I reaction) with that of Chl *a* fluorescence (for Photosystem II reaction), using pea (*Pisum sativum*) and *Camellia* sp.; here, Alaka Srivastava (who had come from India) continued her collaboration (see Strasser *et al*., 2001; Schansker *et al*., 2003). These quantitative measurements became the heart of future research. The next collaboration with a laboratory in India was that with the research group of P. Pardha-Saradhi (of Delhi University); here, Shabnam *et al*. (2015) made an important discovery that mitochondrial electron transport protects floating pondweed leaves, as opposed to those submerged, against photoinhibition!

***Eastern Europe*:** In collaboration with Hazem Kalaji & Karolina Bosa (of Poland), Vasilij Goltsev (of Bulgaria) and Suleyman Allakhverdiev (of Russia), Reto and Govindjee wrote an extensive review on *in vivo* measurements on light emission (both prompt and delayed) in understanding photosynthesis (Kalaji *et al*., 2012); it was dedicated to David Walker (b.1928-d.2012), one of the greatest pioneers of photosynthesis. Soon thereafter, with Marián Brestic (of Slovak Republic), the 2012 review was extended to include novel questions and results (Kalaji *et al*., 2014).

***China*:** Reto's collaboration has been world-wide. However, Govindjee had the privilege of being included in another collaboration, and this time it was with Shen Qiang/ Shigeo Chen (of Nanjing Agricultural University). This had two new dimensions as far as we are concerned: (i) contribution of reactive oxygen species in chemical-induced leaf necrosis in *Arabidopsis thaliana* plants (Chen *et al*., 2012a); and (ii) the functioning of a novel natural tenuazonic acid: these were shown to affect plants, just as some known herbicides (e.g., diuron) do, i.e., by displacing Q_B from the D1 protein (Chen *et al*., 2012b).

We end this section with two photographs of Reto to show that besides research and experiments, he and his family love outdoors and camaraderie with visitors and friends (**Figure 2**; also see recollections of Alaka Srivastava).

Recollections

Alaka Srivastava, who worked with Reto Strasser, in the 1990s and beyond, wrote:

I moved to Geneva, Switzerland, in 1992, to join my husband Utsawa K. Chaturvedi, who was working there as a Scientist at CERN. I had heard of the world-renowned Professor Reto J. Strasser, and as soon as I decided to move to Geneva, I did not want to miss the opportunity to meet him. So, on my second day in the country, I grabbed a bus pass and set off for the University of Geneva. Reto was incredibly welcoming, showed a lot of interest in my work, particularly on my research I had earlier done at the

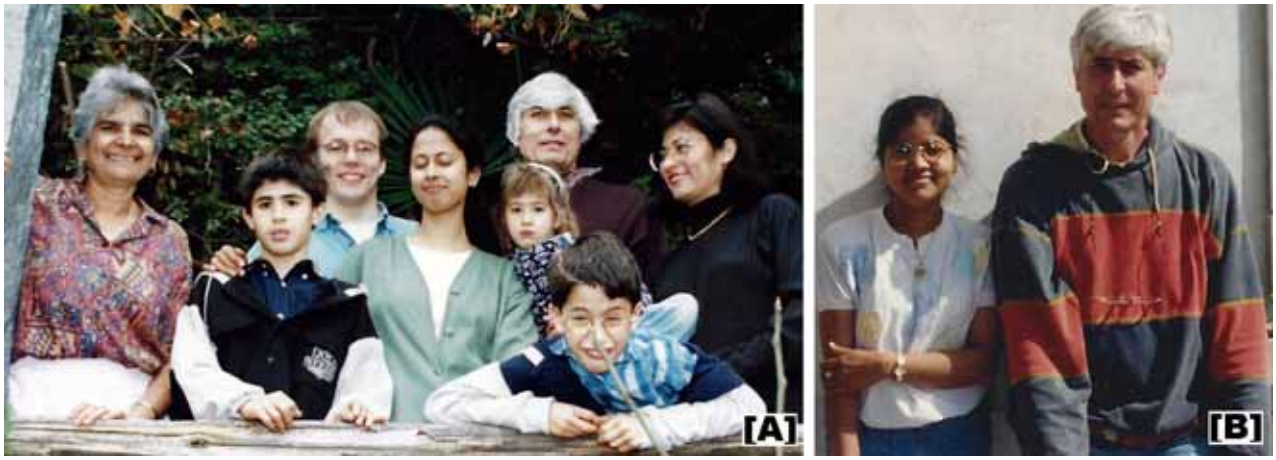

Figure 2(A): A group photograph in Switzerland, in the late 1990s. Left to right: Rajni Govindjee; Pablo Strasser; Christiaan (Aruna's husband) & Aruna Khashnobish (visiting Govindjee from Germany); Tamara Strasser; Reto Strasser; and Norma Strasser; Roland Strasser is in the foreground. Photo was taken by Govindjee. Source: Archives of Rajni Govindjee, and (B): Alaka Srivasatava with Reto Strasser in the late 1990s. Source: Archives of Alaka Srivastava.

University of California at Los Angeles (UCLA) investigating the influence of chlorophyll in stomatal movement (Srivastava and Zeiger, 1995; Zeiger *et al*., 2002). I had the most wonderful feeling since on the same day, he offered me a position in his lab! He was such a caring person that I ended up spending 8 years in his laboratory. His lab felt more like a happy family than an academic institution. We were located in the middle of the countryside, with nothing around us but vineyards, orchards and agricultural fields. This led to a very tight-knit, informal and friendly work environment, filled with academic discussions held outside in the sunlight. We spent long hours planning experiments, executing our methods, discussing long and complicated formulas and the interpretations of our data. I was really inspired by Reto's immense knowledge in solving and understanding the fast (second range) Chl *a* fluorescence transient in plants and algae. The development of Hansatech's Plant Efficiency Analyzer (PEA) is indeed the product of Reto's passion for Chl *a* fluorescence!

My pleasure of working in Reto's lab was enhanced because I had also the opportunity to work with Professor Govindjee, a distinguished scientist and well recognized senior leader of Chl *a* fluorescence research, from USA (see Eaton-Rye, 2019). In his presence, the discussion on science increased on a logarithmic scale: there was a very productive outcome in the form of publications and presentations at international conferences (see e.g., Strasser *et al*. (1995); and Srivastava *et al*. (1995)). In addition, I had the wonderful opportunity to work with many other visitors to Reto's Lab, e.g., Alberto Darszon (Mexico), Klaus-J. Appenroth (Germany), Amarendra N. Misra (India), Prasanna K. Mohanty (India), Friedrich Juttner (Switzerland), Berouba Guissé (Senegal), Hubert Greppin (Switzerland), Pierre Haldimann (Switzerland), Merope Tsimilli-Michael (Cyprus), and Carolina Obregon (Columbia). I would like to mention that in collaboration with these scientists, I had a very productive career in Reto's lab; I published ~ 20 refereed journal papers, 6 book chapters, and more than dozen papers in the proceedings of several national and international conferences (For Reto Strasser's work, see e.g.,https://www.pubfacts.com/author/Reto+J+Strasser;https://www. researchgate.net/profile/Reto_Strasser; also see: Haldimann *et al*. (1995), and Guisse *et al*. (1995) to get a glimpse of research at that time.)

A major theme of my research in Strasser's Lab was the adaptability of plants to heat, light and water stress. Together with the research group in the lab, we demonstrated physiological changes taking place in several plants using Chl *a* fluorescence as a major tool (see e.g., Srivastava and Strasser, 1996).

What I value most about Reto is his free thinking and his courage to follow his own beliefs, without being bothered by others in the field. I admire his unconventional behavior. He is a wonderful mentor and very open to collaborate/educate scientists around the world, including India, where I originally come from. I had an opportunity to travel with him to India in our collaborative work with the Late Professor Mohanty at Jawaharlal Nehru University (for Mohanty's life, see Tiwari *et al*. 2014 and Naithani and Govindjee 2018). I left Reto's lab in 2000. However, he continued (and continues) teaching and collaboration throughout the world. *He is truly a citizen of the World*.

Reto has always been full of life and besides his love for science, his interests extend to so many different facets including travel, taking care of his family, cooking, music and just having fun! I recall that every year, our summer would not be complete without visiting his wonderful home, where we were always greeted with warmth and affection by him and his wonderful charming wife Norma Strasser. *I wish Reto many more years filled with success and happiness*.

Alexandrina (Sandra) Stirbet, who worked with Reto Strasser, also in the 1990s, wrote:

My first meeting with Reto was in the fall of 1993, at an "open day" of the University of Geneva, where he had a "stand" presenting his new PEA fluorescence instruments. As I was passing by, I stopped to ask him about the measurements he was making with this instrument. When I told him that I was a biophysicist from the University of Bucharest (Romania) and my PhD thesis was in the area of bioenergetics of

photosynthesis, he invited me to visit his Lab (Bioenergetics Lab, University of Geneva), in Jussy-Lullier, which I did very happily. During this visit, Reto asked me if I was interested in a collaboration on modeling the fast (seconds) Chl *a* fluorescence induction (the so-called OJIP transient), and showed me one of his papers on this topic (Baake and Strasser, 1990). I immediately accepted the offer since I liked the idea of this research, being already familiar with this type of modeling. Our project was supported by the Swiss National Science Foundation during all my stay, almost eight years, in Reto's Lab, and our first modeling paper (Stirbet and Strasser, 1995) was published in *Archives des Sciences*. Later, we published a much more advanced model in collaboration with Govindjee, who was a Visiting Professor during that time (Stirbet *et al.,* 1998). Besides modeling, I also worked with Reto on what is called "PSII energetic connectivity" – when an exciton visiting a Photosystem II (PSII) Reaction Center (RC), with the first plastoquinone acceptor Q_A (already) reduced (closed PSII), is redirected to another PSII RC with an oxidized Q_A (open PSII) – on which Reto had already done pioneering work (Strasser, 1978, 1981). Together, we developed a method to evaluate the so-called connectivity parameter by using the OJIP (Chl *a* fluorescence) transient, (see Strasser and Stirbet, 2001). Information on this parameter provided additional mechanistic understanding of the OJIP curves, obtained from a set of parameters in the so-called JIP-test, published earlier by Reto (Strasser and Strasser, 1995), which characterize PSII and the photosynthetic electron transport activity in samples illuminated after a period of darkness, and are derived by using not only the minimum (F_O) and maximum (F_M) fluorescence, but also fluorescence levels at 0.3 ms (F_K), at 2 ms (F_J), and at 30 ms (F_I).

During my stay in Reto's Lab, I was fortunate to meet other scientists working with him. They were: Peter Eggenberg, Pierre Haldimann, Alaka Srivastava (see above for her comments), Merope Tsimilli-Michael, Berouba Guissé, Gert Schansker and Szilvia Tóth. I vividly remember Paulette Kummer (Reto's laboratory assistant), who helped me not only in and around the Lab, but also in my use of the French language. I had a wonderful time during my stay in the Lab since Reto was extremely hospitable with all the visiting scientists. He introduced me to his wife Norma and their marvelous children (Tamara, Roland, and Pablo), and invited me several times to their house for lunch with his family, and also at a birthday party of one of his little boys. I very much enjoyed the time spent in Reto's Lab, where I witnessed a very rich scientific activity. I left Geneva with a heavy heart when I moved to USA in June, 2000. Together with Govindjee, I have honored Reto Strasser on the occasion of his retirement, when we reviewed the field of Chl *a* fluorescence transient (*see* Stirbet and Govindjee, 2011). I am glad that we are now honoring him on his 75th birthday.

To Reto's credit, while in USA, since 2000, I have continued my interest in Chl *a* fluorescence induction and modeling; I continue to publish with Govindjee and others: see e.g., a review on modeling of Chl *a* fluorescence transient and its relation to photosynthesis (Stirbet *et al.,* 2014), as well as an original modeling paper on the slow (minute range) PS(M)T phase of the Chl *a* fluorescence induction (Stirbet and Govindjee, 2016; see Kana et al. (2012) for experimental results), in which we 'showed' that the S-M fluorescence rise is due to a transition from 'State 2' (low Chl *a* fluorescence yield) to 'State 1' (high Chl *a* fluorescence yield) in green algae that were kept initially under anaerobic conditions. All this is a tribute to Reto since it is with him that I began my research on modeling Chl *a* fluorescence transient.

Vineet Soni, who has been associated with Reto since 2003, wrote:

It is often said that saplings do not grow and flourish under Banyan trees. My association with Reto and Govindjee (see Soni, 2018) has demanded a scrutiny of this saying. I have seen many young scientists growing and flourishing under the affectionate and gigantic shadow of these two stalwarts. Reto Jörg Strasser is uniquely incredible in his own way and in many other ways. He is my post doctorate mentor and one of the pole stars among the galaxy of photosynthesis and plant bioenergetics researchers. I connected with Reto through email in 2003, for helping me in one part of my PhD research; his reply was

highly motivating, straight and unmitigated. After completion of my PhD, he provided me an opportunity to work as *a post-doctoral fellow* on various aspects of photo-protection mechanism in lichens; it was like a dream come true.

Reto believes '*Science without art is like a human without soul*'. These words always motivated me to pursue science in simple and artistic way. Besides, being a true and excellent plant biologist, Reto is an excellent flutist (**Fig. 3**). His love for music and humorous nature placate all kind of turbulence, likely or possible in a research laboratory, especially in an international center of excellence.

Recently, in the first half of May, 2019, Reto was with us at our university in Udaipur, as a university guest. During this short visit, he not only spent some prime time in our laboratory of Plant Bioenergetics, but also delivered a keynote address during the International Conference on Photobiology, Phytochemistry and Plant Biotechnology. His address was a chronicle of the discovery of the analysis of Chl *a* fluorescence transient, the so-called "JIP" test; further, he provided new ideas and trends in

Figure 3(A): Reto Strasser at Mohan Lal Sukhadia University (MLSU), Udaipur, India, playing flute, and (B): Reto Strasser being honored in a typical Rajasthani regalia, in May, 2019. Photographs were taken and provided by Vineet Soni (see his recollections).

photosynthesis research. We are grateful to Reto that he consented for his felicitation during the inaugural ceremony of the above-mentioned International Conference (**Fig. 3**). His presence enhanced the glory of our university and also inspired young minds to undertake research with zeal, fervor and innovation.

Neera Bhalla Sarin, who collaborated with Reto in 2010, wrote:

It is an honor for me to be writing this congratulatory note for Reto on his birthday—that is his 75th; it is a bit difficult to reconcile it with his unwavering zeal, infectious enthusiasm and energy, and, above all his scientific curiosity, witnessed on numerous occasions during my collaboration as well as at informal meetings with him for more than a decade. I recall with nostalgia the first meeting with Reto Strasser during our Indo-Swiss collaboration in 2005. He impressed one and all with his eloquent presentation involving his favorite JIP test which he emphasized with great fervor. This was followed by my visit to his lab which was a real learning experience for me. I benefitted a lot from his research expertise. He had himself designed many instruments from unused materials which showed his innovative nature. In his subsequent visit to India in 2007, he visited my lab (at JNU, New Delhi) and worked almost 24/7 along with my students Deepak Kumar and Aslam Yusuf,

who used the well-established analysis of the Chl *a* fluorescence rise kinetics, developed by Reto Strasser, to assess the physiological performance of transgenic alpha-tocopherol enriched *Brassica juncea* plants under different abiotic stress conditions. It was fascinating to demonstrate how an experimentally simple, non-invasive technique could provide authoritative insights into the physiology of a plant. Reto taught us how to use the newly acquired Handy-PEA for measuring photosynthetic efficiency of plants–under stress and non-stress conditions. Excited by our results, Reto involved his former post-doc Merope Tsimilli-Michael to make the wonderful diagrams for the paper. At this stage, when the first draft of our paper was ready, we requested Govindjee (the first author of this Tribute) to critically examine it and incorporate relevant changes for which he worked very hard. This joint effort resulted in our publication, Yusuf *et al*. (2010), which has been garnering numerous citations from around the world, over the years.

As a person, Reto is genuinely gentle, helpful, compassionate, jovial and a wonderful host. Along with my husband Jagdish, I had the privilege of enjoying his superb hospitality at his wonderfully designed ecofriendly home with his family, in Switzerland. We had fresh fruits (peaches, pomegranates, nectarines and grapes) plucked from his exotic garden. I sincerely wish Reto many more productive years in science and personal life – I am sure that this great globe-trotting scientist will continue to churn out new knowledge on photosynthetic organisms with his Handy-PEA, and his JIP test.

Concluding Remarks

The use and analysis of Chl *a* fluorescence transient, the OJIP phase, pioneered by Reto Strasser and Govindjee, has come a long way; Kupper et al. (2019) have recently provided means and methods for fast imaging, and much for excitement in this field is just ahead of us. Reto Jörg Strasser is now making parallel measurements on many fronts to understand plants at a newer level that will surpass what is available. We wish him continuous success for many more years to come, and to extend his collaboration to all parts of the World!

We conclude this felicitation with two photographs of Reto (**Figure 4**): one with Govindjee, taken in India, while having great fun discussing science and life in general, and two with several others, taken in Switzerland, in comradery with them. We all are 100% sure that Reto will keep enjoying research and life for years to come.

Acknowledgments

First of all, we are delighted to have received an

Figure 4 (A): Reto Strasser with Govindjee; this photo was taken in 2008 by Mahendra Rathore (see Jajoo et al., 2009). Source: Archives of Anjana Jajoo, and (B): Left to right: Gert Schansker; Vineet Soni; Neha Verma (Abdallah Oukarroum is behind her); Govindjee; Reto Strasser; and Rajni Govindjee. This photograph was taken in Bern (Switzerland) in 2007, and provided by Vineet Soni (see his recollections).

invitation from C.P. Malik, Editor of Journal of Plant Science Research to write this perspective on our association with Reto Strasser, especially because he was honored at Udaipur (India) right after his 75th birthday. We thank Reto, an outstanding scientist and a great human being, to have been our friend. We are grateful to Anjana Jajoo (Indore, India), and Rajni Govindjee (Urbana, Illinois, USA) for sharing some of the photographs used in this paper. We thank Dolly Hajelay for making several useful modifications in the language of this paper.

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