

Letter to the Editor

Personal Reminiscences of Robert Emerson and Eugene Rabinowitch

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We present a glimpse into the lives of two great scientists, our professors who guided us during our PhD days (1956-1961): Robert Emerson (1903- 1959) and Eugene I. Rabinowitch (1901-1973). We have divided these reminiscences into two periods: (1) September 1956—February 1959, during which, one of us (Govindjee) was a graduate student of Robert Emerson in “Physico-Chemical Biology”, from 1956, whereas the other (Rajni) was in Botany, from 1957. During this time, Eugene Rabinowitch was a professor next door, but working in the same “Photosynthesis Project”; and (2) March 1959—onwards, when both of us were under Rabinowitch following Emerson’s death in a plane crash on February 4, 1959. After completing PhD (in Biophysics) under Rabinowitch in September 1960, Govindjee worked as a NIH Postdoctoral Fellow until he was appointed as an Assistant Professor in Botany in September 1961. After that, Govindjee and Rabinowitch were faculty colleagues until the latter left Urbana to go to Albany, New York in 1968. Meanwhile, Rajni finished her PhD in Botany in May 1961, and later did extensive research, as a NIH Postdoctoral Fellow and then as a Research Associate under Rabinowitch for many years.

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EMERSON AND RABINOWITCH: September 1956–January 1959

The Laboratories of Emerson and Rabinowitch were next door to each other, located in rooms 155–157 of the Natural History Building, on the campus of University of Illinois, on Matthews Avenue, in Urbana, Illinois (for a photo, see Govindjee, 2020). Emerson lived in his home on 806 West Main Street in Urbana, Illinois, and Rabinowitch lived in his home on 1021 West Church Street in Champaign, Illinois. Emerson walked to the office, whereas Rabinowitch came by car. Figures 1 and 2. show (mid 2000) photographs of their homes, when Bob Buchanan of the University of California, Berkeley, visited Govindjee and Rajni in Urbana-Champaign.

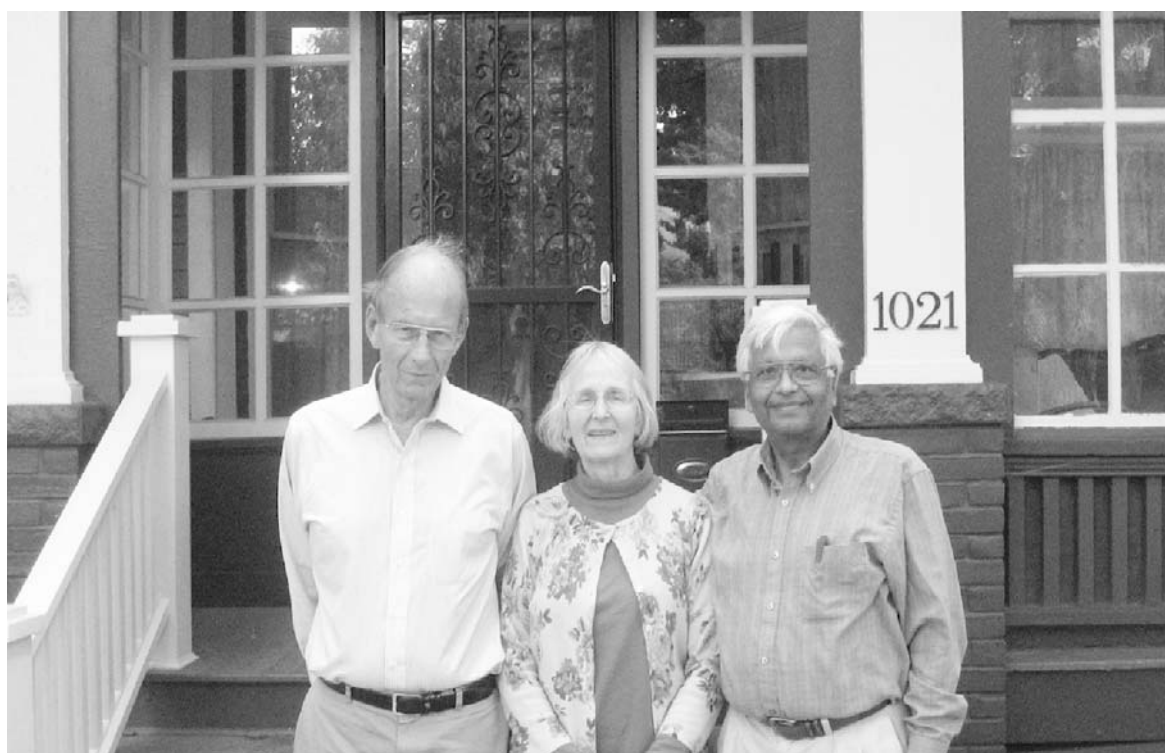
Robert Emerson

Emerson (see Figure 3) was called “Doc” by his assistants and Bob by his friends, but we always called

him “Professor Emerson”. He was a New Englander, tall, lanky, athletic, and always walked very fast. He was a wonderful figure skater and a “glass blower”, and even walked on “stilts” at parties – especially in his own backyard. In addition, he was a great cook. He was meticulous and taught his skills to his students with great care and attention to detail, and always had a smile when doing so. He was, however, very strict about protocols. In his research, he was highly focused and would not accept changes easily. On the political side, he was a Pacifist and cared a lot for those in the Japanese concentration camp. He worked to get “rubber” from Guayule shrubs because he felt that rubber was the reason the Japanese had attacked Pearl Harbor in the USA. His main research technique was “manometry”—which he perfected and made much more precise than that of his own professor, Otto Warburg. (See Nickelsen and Govindjee (2011) for the controversy between Emerson and Warburg,



**Figure 1. A photograph of Robert Emerson's home, mid 2000.
Left to right: Govindjee and Bob Buchanan. Photo by Rajni Govindjee**



**Figure 2. A photograph of Eugene Rabinowitch's home, mid 2000.
Left to right: Bob Buchanan, Mrs. Buchanan, and Govindjee. Photo by Rajni Govindjee**



Figure 3. A photograph of Robert Emerson. From the Archives of Govindjee, provided by Robert Emerson's family in early 1960s.



Figure 4. A photograph of Eugene Rabinowitch. An early portrait from: <https://www.atomicheritage.org/profile/eugene-rabinowitch>.

on the minimum quantum requirement of 3-4 (Warburg) and 8-10 (Emerson) per oxygen, which was won by Emerson, and confirmed by R. Govindjee *et al.*, (1968) under Warburg's own experimental conditions.)

One personal incident Govindjee never forgets was that on October 24, 1956, when he arrived in the lab, he was surprised to see Prof. Emerson wearing an apron, surrounded by many plates full of various things: chopped onions, chopped spinach leaves, and small bits of chopped potatoes. He wished Govindjee "Happy Birthday" and then showed him how to cook and have a healthy diet to survive in the USA. Emerson told Govindjee that he needs to cook and eat well in order to be able to do a PhD!

For further information on Emerson, see Rabinowitch (1959, 1961), and Govindjee (2004, 2018, 2020).

Eugene I. Rabinowitch

Although Rabinowitch (see Fig. 4) was not our PhD supervisor initially, he was the other professor in the "Photosynthesis Project", and there was a common "Seminar" where both the research groups met once a week, and discussed, in depth, and with great

enthusiasm, photosynthesis-related research. Rabinowitch had students and postdocs mostly from Physics and Chemistry, whereas, Emerson had two research assistants (Ruth Chalmers, trained in Biology, and Carl N. Cederstrand, trained in Physics) and students (the two of us, and Marcia Brody) from Biology.

In contrast to Emerson, Rabinowitch was short and sort of big in the middle. He was highly sociable and had a great smile. He was involved in many things related to the "Bulletin of Atomic Scientists", and his 2,000-page, three-volume book on "Photosynthesis" had already been completed; the last one had been published in 1956 just before Govindjee arrived in the lab (Rabinowitch, 1945, 1951, 1956). Rabinowitch was the discoverer of the so-called "cage effect" in photochemistry, where one photon leads to many reactions. He was also one of the first people to think of doing "artificial photosynthesis". It was clear to both of us that Rabinowitch was a highly versatile scientist, and we learnt that he was even a poet (writing in Russian). Clearly, he was an "all-rounder". He gave his students total freedom to choose research topics and even "change" whenever they felt that something else had more potential or was more

promising and exciting. This was quite different from Emerson, who was much more rigid. Rabinowitch, on the other hand, was open to exploring new things and changing when necessary. In addition, he spent a lot of time in finding ways for the US and Russia to come together and have peace.

Rabinowitch's students and postdocs (and also those in Emerson's Lab) were invited to his home for lively parties, where "home-made" vodka was served and Govindjee was trusted to be the "bartender"! Furthermore, Mrs. Rabinowitch (Anya) taught one of us (Rajni) how to make good vodka at home – starting with bison grass, "Zubrowka" and grain alcohol! The Rabinowitchs gave us the feeling that we were really a part of their own family.

For further information on Rabinowitch, see A. Rabinowitch (2005); and Govindjee *et al.*, (2019).

RABINOWITCH: FEBRUARY 1959— ONWARDS

When Emerson died in a plane crash on February 4, 1959, on his way to attend a meeting at Harvard University in Cambridge, MA, we were sort of left as "orphans". However, we were very fortunate that Eugene Rabinowitch accepted us as his graduate students. Both of us learned everything that was then known about "Photobiology and Photochemistry" directly from him and from the courses he taught. Govindjee finished his PhD in Biophysics in 1960, and Rajni (Varma) Govindjee in Botany in 1961. From then on, Rabinowitch told us to address him by his first name Eugene.

During our PhD days, he gave us complete freedom to choose whatever we wanted to do. Govindjee discovered that both the photosystems are run by two different spectral forms of chlorophyll a, and Rajni discovered that the Emerson Enhancement Effect was in photosynthesis, not in respiration. Both our papers were accepted, as submitted, in *Science* (Govindjee and Rabinowitch, 1960a; R. Govindjee *et al.*, 1960). We are sure that Eugene's skill in editing our papers was the key. Furthermore, our detailed papers were also immediately accepted in Volume 1 of the newly established "Biophysical Journal" (Govindjee and Rabinowitch, 1960b; R. Govindjee and

Rabinowitch, 1961).

We owe our academic achievements to the training Emerson gave us in doing "well-planned and thorough experiments" and repeating our experiments many times, and the training Rabinowitch gave us in writing and re-writing papers until all the commas and semicolons were properly placed. (For brief summaries of research over the years, see e.g. Eaton-Rye (2019) & Govindjee (2019a,b) for Govindjee, and Ebrey (2005) for Rajni.)

We both experienced Eugene's comradery from the time we began attending conferences together, starting in 1961. Both of us remember him as the most wonderful mentor and friend. As mentioned above, we had parties at the Rabinowitchs' home; we really enjoyed these memorable parties, where wonderful Russian food was served, and we were made to feel like family. In addition, Anya and Eugene Rabinowitch were wonderful hosts to us at their summer home in Vermont; it was there that our wonderful *Scientific American* article (Rabinowitch and Govindjee, 1965), as well as our highly successful and popular book on photosynthesis (Rabinowitch and Govindjee, 1969) were written. We remember Eugene vividly and have very fond memories; he was the most wonderful human being that we have ever known.

A highly personal incident that Govindjee cannot forget is that while on the Faculty at UIUC, and leading his own research group supported heavily by grants from the National Science Foundation, one of Govindjee's research assistants went to Eugene's office complaining to him that Govindjee was not re-appointing her because of her religious preferences. Eugene knew very well that it was a totally false accusation, so instead of even bothering to tell Govindjee about it, he told her "to leave his office immediately" and to never make such "false" statements again. The only reason Govindjee knows this story is because his office was next-door, and he could hear all this! As such, we know and respect the man Eugene was.

EPILOGUE

We end this write up with two photographs. Figure 5 shows a 1961 photograph of the two of us with Eugene

Rabinowitch (for a 1958 photograph of two of us with Robert Emerson, see Fig. 3 in Govindjee, 2018). Finally, in Figure 6, we show a 2019 photograph of two of us while we were talking about our early life in the USA (including “stories” of Emerson and Rabinowitch) with students and post docs of Drs. Sneh Lata and Ashwani Pareek, while on a bus trip in India (see Wungrampha *et al.*, 2019).

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Figure 5. A 1961 photograph at the First International biophysics congress, Stockholm, Sweden. Left to right: unidentified; Eugene Rabinowitch reading a Swedish newspaper; Rajni; and Govindjee. Source: Govindjee Family archives (reproduced from Govindjee *et al.*, 2019).



Figure 6. A 2019 photograph of the authors (Govindjee and Rajni) while they were travelling in a bus, relating their stories to graduate students and postdocs in the School of Life Sciences, Jawaharlal Nehru University (JNU), New Delhi. Photo: Courtesy of Rohit Joshi.

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