

# Ernest B. Yeager—A Dedicated Electrochemical Scientist and Teacher

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ERNEST B. YEAGER

**E**rnest B. Yeager of Case Western Reserve University (CWRU) Cleveland, Ohio, USA single-handedly established an electrochemical science and technology powerhouse at CWRU. Professor Yeager, the Frank Hovorka Professor Emeritus of Chemistry at CWRU, dedicated 50 years of his professional life to two things: advancing the field of electrochemical science and mentoring and advising students. One must also appreciate that Professor Yeager was an excellent and accomplished pianist, as well as a devout church citizen.

In 1976, Professor Yeager established the Case Center of Electrochemical Studies at CWRU focusing on the advancement of knowledge of electrochemical sciences. Students, post-doctoral fellows and visiting scientists around the world came through the Center and learned and acquired knowledge and skills on various aspects of electrochemical sciences and technologies. In recognition of his immense effort and devotion to electrochemical sciences, the Board of Trustees of CWRU designated the Case Center of Electrochemical Sciences as the Ernest B. Yeager Center for Electrochemical Sciences on August 17, 1994, and the Center is now known as the Yeager Center for Electrochemical Sciences.

Throughout his professional career, Professor Yeager mentored 80 doctorate

students, 45 post-doctoral fellows, and numerous undergraduate students. Many of these graduates are now in eminent positions in academia, government agencies and industries directly related to electrochemical sciences and technologies. Professor Yeager was known by his graduate students as a diligent and devoted advisor and a “stickler.” He read every thesis carefully, line-by-line. He would make corrections that often required extra effort both from him and the student. He was always patient and he never complained. Professor Yeager was known for his uncompromising demand for excellence in research and scientific writing. Both his graduate students and the post-doctoral fellows acknowledged that Professor Yeager would even edit the cover letter of any manuscript submitted through the Center. He was meticulous and a perfectionist. Professor Yeager published extensively. He published 270 scientific journal articles, edited and co-edited 20 books. Among these books, the series of *Comprehensive Treatise of Electrochemistry* is most worth noting. The inaugural issue of Volume 1 was co-edited by Professor Yeager in 1980. This series became the “bible” of electrochemical science for its fundamental elucidation and new inspiring endeavor provided by this series.

In addition to his publications and edited books, Professor Yeager was involved in many other professional and community activities for the advancement of the scientific importance and public awareness of the electrochemical sciences. He organized and participated in numerous national and international scientific meetings, tirelessly supporting these endeavors. For his technical accomplishments and his contribution to the electrochemical community, Professor Yeager was awarded the Edward Goodrich Acheson award in 1980, and the Vittorio de Nora award in 1992 by The Electrochemical Society (ECS). Both awards are among the highest honors of ECS. He became an honorary member of ECS in 1977. Professor Yeager

was the President of ECS (1965-1966), and he was the President of International Society of Electrochemistry (ISE) (1969-1971). ECS and ISE are undoubtedly the two most important technical societies related to electrochemical sciences and technologies internationally. It would be a high honor to serve as the President of either ECS or ISE in the course of one’s professional career. Professor Yeager’s election to provide the leadership and inspiration to both societies was indicative of the respect that he had received from his peers. In 2004, the Cleveland Section of The Electrochemical Society established the Ernest B. Yeager Electrochemistry Award, which is now given every two years to an individual in recognition of significant contribution to the advancement of electrochemistry in the U.S. Midwest and Great Lakes region. This is a lasting honor that acknowledges the impact that Professor Yeager had on electrochemistry in the region.

While Professor Yeager spent more than 50 years of his professional life at CWRU, he was a native of Orange, New Jersey. He went to Montclair State College, Montclair, New Jersey and graduated *summa cum laude* with a BA degree in 1945. In 1955, Montclair State College gave an Honorary Doctor of Law degree to Professor Yeager as an outstanding alumnus. An avid pianist with a prodigious talent Professor Yeager considered studying music. Fortunately for the electrochemical community, he came to Western Reserve University, Cleveland, Ohio and became a graduate student of Professor Frank Hovorka in the Chemistry Department. Under the mentorship of Professor Hovorka, Professor Yeager earned his Chemistry PhD in 1948, established his electrochemical science expertise and grew it ever since. He joined the Department of Chemistry of Western Reserve University (now a part of the Case Western Reserve University) as a junior faculty member right after his graduation, and he became a full professor of chemistry in 1958. He was named the inaugural Frank Hovorka

Professor in 1984, and retired as the Frank Hovorka Professor Emeritus in 1990. Throughout the years, Professor Yeager and Professor Hovorka remained colleagues and collaborators as well as close personal friends. During the tenure of his academic career at CWRU, Professor Yeager served as the Chair of the Department of Chemistry between 1969 and 1972. He also chaired the Faculty Senate at CWRU in 1972 and 1973. These administrative responsibilities required much time and energy and Professor Yeager performed exceptionally well and was universally praised and respected. In 1994, CWRU honored Professor Yeager with the Frank and Dorothy Humel Hovorka Prize, which is awarded annually to recognize exceptional achievement by an active or emeritus member of the faculty, whose accomplishments in teaching, research and scholarly service have benefited the community, the nation and the world. This award was an indication that CWRU very much appreciated Professor Yeager's scientific contributions as well as his leadership in teaching, research and scholarly service.

His influence on his former postdoctoral fellows and graduate students has been life-long and some of their comments are noted here. Doron Aurbach, winner of the Battery Division Research Award of ECS in 2013, a Fellow of ECS, ISE and MRS, and a Professor of Chemistry Bar-Ilan University, Israel, as well as a friend of Professor Yeager, commented on the role Professor Yeager played in his life. Between August 1983 and September 1985, Professor Aurbach was a post-doctoral fellow with Professor Yeager. Professor Aurbach decided to work with Professor Yeager, because Professor Aurbach considered Professor Yeager to be the best electrochemist in the world at that time. After the experience of two years working with Professor Yeager, Professor Aurbach said, "I learned from him (Professor Yeager) how to manage a big research group; how to be 'multi-channel' thinking about and taking into account so many aspects in parallel; how to keep a good balance between basic and practical research; how to be rigorous in scientific criticism, but yet very fair and honest; how to save efforts, not to waste means, but yet to be 'large' when needed." Professor Aurbach also stated, "beyond excellent and demanding scientific work, fostering a good atmosphere in the group was highly important. Ernie inspired friendship and high standards of excellent relationships among the members of the group." Professor Aurbach is now an accomplished scientist and teacher; he leads a large research groups in electrochemical sciences in Israel. The impact of the mentoring effects of Professor Yeager are immense.

Yu Morimoto is now the research leader for automotive fuel cells in Toyota Central R&D Laboratories, Inc. He was a PhD student directly under the Professor Yeager's supervision between 1991 and 1994. During that period of time, Professor

Yeager already had to limit his activities due to the deterioration of his health. But as Dr. Morimoto recalled, "I always felt great energy and enthusiasm for the research from him, which motivated me a lot. As the thesis adviser, he was always strict and uncompromising but also warm-hearted and encouraging. His strictness to science and warmness to people have become my guiding principle in my professional life, which might be the greatest thing I learned from him." The life-long influence on electrochemical science and personal endeavor provided by Professor Yeager to his students and friends is indeed contagious.

Radoslav Adzic is currently the Electrochemistry Group Leader at Brookhaven National Laboratory and an Adjunct Professor of New York University at Stony Brook. Dr. Adzic was the first collaborator from Belgrade with Professor Yeager. At that time, many students and colleagues of Dr. Adzic from Belgrade would come to Professor Yeager's laboratory to learn electrochemical science and technology. Because of his work mentoring and training scientists from Belgrade in electrochemistry, Professor Yeager was named an Honorary Member of the Serbian Chemistry Society. Electrochemistry was always on his mind in any discussion. Dr. Adzic fondly remembered an interesting conversation with Professor Yeager. The story was that they once saw a fisherman on a primitive and remote Adriatic island repairing his wooden boat. Someone commented that here was an individual who did not care or need to be concerned about electrochemistry, and Professor Yeager quipped, "But he must own a battery." This truly reflected the love and dedication to electrochemical science and technology of Professor Yeager.

Professor Yeager was a keen advocate for the importance of electrochemical sciences and technologies. He regularly gave talks and/or demonstrations to various communities and groups to demonstrate the practical uses of electrochemistry. In a *Cleveland Plain Dealer* article in 1974, Professor Yeager commented that he believed electrochemistry would play a major role in addressing the nation's energy problems and in helping to conserve natural resources. He believed high performance fuel cells and storage batteries would play a significant role in electric cars and other applications. His prediction in 1974 on the importance of electrochemical sciences and technologies which would affect our daily lives can be seen as a reality today in 2014.

Professor Yeager was a dedicated scientist and teacher, coming in to work nearly every day if he was not traveling on business. He was a fixture in the Morley Chemistry Building on the CWRU campus. His daily uniform for work consisted of a dark blue suit and a white shirt – never a color or patterned shirt. He normally would stay until 11:00 pm and was always available and gracious when interrupted by students.

He never showed any sign of irritation or impatience with any question or any student. He always made time for any student to deal with their technical or personal issues. Professor Yeager was also very generous in hosting holiday parties for his students and visitors in his home. He would then play the piano, mesmerizing his audience. Many of his students and visitors were far from their own homes, and this caring act by Professor Yeager was much appreciated, resulting in life-long, treasured memories around the world of Professor Yeager and Cleveland.

Professor Yeager was well known for his contributions to understanding the electrochemical oxygen reduction reaction mechanisms which directly related to full cells, batteries, and energy storage systems. Because of his strong technical experience, he was highly sought after as a technical consultant by many industries and government research institutes. He had a long and fruitful association with Naval Research Laboratories and was awarded a Navy Certificate of Commendation for his many contributions. In addition, he was a consultant for Union Carbide, Energizer, Diamond Shamrock, General Motors, and Eltech Corporation. He also worked with researchers from Argonne National Laboratory, NASA, and Institute of Defense Analysis. His influence and imprints on these companies and research institutes can be seen in their focus on electrochemistry.

We in the electrochemistry community, who had the opportunity to personally work with Professor Yeager, are very grateful for all the different aspects of electrochemical sciences and technologies that we have learned from him. We appreciated very much the leadership and mentoring efforts that Professor Yeager provided for us over the years. Most importantly, we are privileged to have had Professor Yeager as a friend. ■

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