

In Memoriam



Declan Burke
(1939-2011)

LAURENCE DECLAN BURKE presented his first ECS paper at the fall meeting in New York in 1974 on the topic "Oxygen Evolution and Corrosion Behavior of Iridium under Anodic Conditions." His final ECS meeting was in Vienna in fall 2009. In the intervening years, he presented many other papers and enlivened the discussions at many a meeting as an active member of the ECS Physical and Analytical Electrochemistry Division. In recognition of his major contributions to electrochemistry, he was named an ECS Fellow in 1995.

Declan was born in 1939 to a farming family in White's Cross, near Cork, Ireland. After graduating from University College Cork (UCC) with his BSc (1959) and MSc (1961), he joined F. A. Lewis's group at Queen's University Belfast where he pursued research on the catalytic hydrogenation of ethylene on platinum metals,¹ graduating with his PhD in 1964. He was then appointed to a faculty position in UCC, and at about the same time, he was awarded a prestigious Alexander von Humboldt fellowship to do research in Germany. There he worked on the solid state electrochemistry of ZrO_2 with Hans Rickert and Rolf Steiner at Universität Karlsruhe.²

He began his research at UCC in the quaint old Physics and Chemistry Building where he worked for a few years before moving, in 1970, to the then new Kane Building. There, he set up his research in the now famous Lab. 320, and from that same laboratory for 40 years he produced world class science, trained over 40 graduate students, taught chemistry to thousands of students, and established an international reputation for excellence in

electrochemistry. It would be hard to overestimate his achievement in building single-handedly, with limited support and even more limited resources, an electrochemistry research group that became known around the world.

Declan's early work at UCC on the oxygen electrochemistry of the noble metals was carried out at a time when conventional wisdom held that anodic oxide coverage on a noble metal surface could not significantly exceed one monolayer. However, in the early 1970s, Burke's group showed³ that thick oxide films could be formed on iridium by potential cycling and furthermore demonstrated dramatic, reversible potential-induced color changes (electrochromism) in these films. A flurry of research on electrochromism in iridium oxide films followed at Bell Laboratories and elsewhere. In addition to his ground-breaking work on iridium, Declan contributed significantly to research into electrochromism in the oxides of a variety of metals including vanadium, manganese, iron, cobalt, nickel, tungsten, and iridium.

This work led him to investigate in detail the formation and properties of anodic oxides on a range of noble metals, particularly ruthenium, platinum, and gold, but also iridium, rhodium, and palladium. The investigations, in combination with studies of the electrocatalytic properties of the metals and of the kinetics of selected redox reactions, demonstrated the central role played by incipient hydrous oxides⁴ in a wide variety of electrochemical reactions and made important contributions to our understanding of electrocatalysis.

Investigations of electrocatalysis led him to study active states of metals,⁵ a topic in which he developed a great interest. He liked to emphasize that active surface sites are among the most important species in chemistry since they dominate catalytic reactions, which are of major technological importance. His more recent work concentrated on electrochemically characterizing these active states of metals. In the process, he uncovered many interesting aspects of the electrochemistry of noble metals and of copper, with his old-style attention to detail, drawing on his long experience and detailed understanding of the area. His views were sometimes controversial because the surface sites that he postulated are, by their nature, not directly observable even by modern techniques of high-resolution microscopy. Interestingly however, recent results⁶ based on clever use of such techniques lend support to his theories.

Declan's scientific legacy is evidenced by his some 200 publications, which have been cited several thousand times, and a similar

number of presentations at international conferences. He has received many honors and awards. He was a von Humboldt Fellow at an early age. He was elected a member of the Royal Irish Academy (MRIA) in 1995, the same year when he became one of the first scientists in Europe to be elected an ECS Fellow. He was among the top 1% of most cited authors in chemistry.

His contribution to science is amplified through the many students he has educated and guided. The several thousand chemistry graduates that he taught, and more than 40 PhD and MSc students that have been trained in his laboratory, Lab. 320, have made, and are making, major contributions in industry, in universities, and in other institutions, both in Ireland and around the world. Many attended a symposium in his honor on his retirement from UCC in 2004, and the impact of his life's work was dramatically underscored by the wide variety of science and industry in which they are involved. It was a happy occasion for reunion and an opportunity for different generations of his students to socialize. Although formally retired, Declan continued to do productive research until 2011 when, sadly, he was diagnosed with cancer.

It would be difficult to find a thesis advisor who has inspired as much love and loyalty in his students as Declan has. They loved his easy manner and enjoyed his sense of fun in science and in life. They could talk to him in a way in which they could never talk to other faculty members. They would tell him about various exploits and practical jokes and Declan would laugh particularly heartily if the butt of the joke was someone regarded as a stuffed shirt.

His scientific talent was very great and he fostered and encouraged high standards, but in a low-key way. He had great patience with anyone who was making a genuine effort and anyone who was willing to learn, even if their talents fell short of his own. He was always supportive. His style is well described by a few lines from Oliver Goldsmith's *The Deserted Village*. These are not about the village schoolmaster, who was a rather stern character—definitely not Declan's style—but, rather, about the kindly village parson:

*And, as a bird each fond endearment tries
To tempt its new-fledged offspring to the skies,
He tried each art, reprov'd each dull delay,
Allured to brighter worlds, and led the way.*

In 1966, Declan married Susan and they had a daughter, Vivienne, and two sons John and Alan. Declan's and Susan's home, originally on the Douglas Road and later on Temple Hill with a spectacular view of the beautiful Lee Valley, was a home away from

home for his many graduate students and postdoctorals through the years. They were always assured of a warm welcome, laughter, merriment, and Susan's excellent cooking.

On Declan's death, tributes poured in from around the world, from colleagues and from former students. Perhaps the most poignant message was one from Mohammad Ilyas at the National Centre of Excellence in Physical Chemistry in Peshawar, Pakistan. He wrote: "Dr. Burke is not dead—he is alive in my heart." Mohammad arrived in Ireland in 1979 to begin work as a graduate student at UCC in Joe Cunningham's group. He was tired and hungry but everything was closed that day due to the visit of Pope John Paul II. However, Declan noticed him and, on hearing of his plight, took him to the Staff Common Room, made tea, and gave him the sandwiches that Susan had prepared for Declan's own lunch. No wonder his students loved him!

My last conversation with Declan on Sunday, November 27, 2011 reflected two of his greatest interests, science and German culture. I reminded him of a little story he once told concerning the adoption of the

symbol G for Gibbs free energy. According to his story, a scientist who didn't like the new convention (F had been used in some countries up until then) remarked sarcastically, "Yes, you can have G for free energy, God, and Guggenheim!" This reminiscence led the conversation to other thermodynamic symbols. Pointing out that the symbol A for Helmholtz free energy comes from the German *arbeit*, Declan added emphasis by quoting a German proverb: "Arbeit macht das Leben süß, aber Faulheit stärkt die Glieder." ("Work makes life sweet but laziness strengthens the limbs.") All his family were with him that Sunday and he especially enjoyed the company of his granddaughter Colleen, his daughter Vivienne's new baby. He ate his dinner unassisted, and later that evening, he fell asleep as usual but for the last time.

On the way home that night on a small country road, the car's headlights illuminated a beautiful barn owl, the only one I have ever seen in the wild. It was, perhaps, Nature's tribute to a wise man and a great scientist. ■

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3. D. N. Buckley and L. D. Burke, *J. Chem. Soc. Faraday Trans. 1*, **71**, 1447 (1975).
4. L. D. Burke, J. F. Healy, K. J. O'Dwyer, and W. A. O'Leary, *J. Electrochem. Soc.*, **136**, 1015 (1989).
5. L. D. Burke, C. A. Buckley, and R. Sharna, *ECS Trans.*, **2(6)**, 197 (2007).
6. A. M. Nowicka, U. Hasse, M. Donten, M. Hermes, Z. J. Stojek, and F. Scholz, *J. Solid State Electrochem.*, **15**, 2141 (2011).

This notice was written by D. Noel Buckley, of the University of Limerick; Chair, ECS Europe Section; ECS past President; and past Chair of the ECS Electronics Division.

(People continued on next page)

In Memoriam



Arnie Reisman
(1927-2011)

ARNOLD REISMAN, ECS member for 47 years, passed away on November 1, 2011. In addition to serving as a Chair of the Electronics Division, he also received many ECS awards. He was inducted into the very first class of ECS Fellows in 1990, received the Electronics Division Award in 1984, and the Society's Solid State Science & Technology Award in 2001. Dr. Reisman was also a Divisional Editor in the 1980s for the *Journal of The Electrochemical Society*.

Dr. Reisman received his BS in chemistry from CCNY (1949), his MA in chemistry from Brooklyn College (1953), and his PhD in physical inorganic chemistry from The Brooklyn Polytechnic Institute (1958). In 1953, he was one of the first of 13 physical scientists hired at IBM to help start the original T. J. Watson Research Center in New York City. From 1958 until 1982, he served also at the Center in Poughkeepsie (NY) and Yorktown Heights (NY), first as a research group manager, and finally as a senior manager.

From 1982 until 1990, Dr. Reisman also helped start the Microelectronics Center North Carolina (MCNC), a consortium involving five universities in North Carolina (NC State, UNC Chapel Hill, UNC Charlotte, NC A&T, and Duke), and served as its vice-president of semiconductor research and technology. From 1997 to his retirement in 1999, while continuing to direct the research of his graduate students, he served as the Director of Graduate Studies in the ECE Department.

Dr. Reisman was co-founder (in 1972) of the *Journal of Electronic Materials* of IEEE and TMS. He is a past Chair of the Gordon Research Conference on Crystal Growth. He was an organizer or co-organizer of numerous symposia at ECS, EMC, and IEEE meetings, as well as of three International Conferences on Radiation Damage. Dr. Reisman served on a National Academy of Science (NAS) International Panel on Microelectronics and Computer Science, on the Computer Science Board of the NAS, and on the Supercomputing Policy Panel of the IDA. He served for five years on the ISAT advisory group of the IDA for DARPA. He was also a member of the Solid State Sciences Committee of the NRC for a number of years.

In his scientific work, Dr. Reisman pioneered studies of materials, processes, and thin film technologies used in microelectronic devices. He authored over 170 technical papers, books, and book chapters, holding over 50 patents, for which he received numerous awards. He oversaw inventions in technologies now used in everyday electronics, such as plasma screen TVs, flash drives, and ink jet printers.

Dr. Reisman is survived by his wife Hilda; his children and their spouses, Richard (and Susan), Robert (and Lisette), David (and Emma), and Daniel (and Gabriella); and his eleven grandchildren, Elizabeth, Lillian, Jacob, Eli, Rachel, Simone, Joseph, Isaac, Jackson, Raquel, and Ethan.

Milan Paunovic (1924-2012)

MILAN PAUNOVIC, a devoted chemist and scientist, passed away on January 22, peacefully and quietly surrounded by his loving family. Dr. Paunovic was predeceased by his wife of more than forty years, Natalja Paunovic, as well as his sister, brother, and mother. He is survived by his children Bogdan and Alexander Paunovic; and four devoted grandchildren, Nicole, Alex, Daniel, and Isabel Paunovic. He is also survived by his sister-in-law, Susan Paunovic.

Dr. Paunovic came from Belgrade, Yugoslavia to the United States to maintain a life of freedom and dignity. He received his Dipl. Chem. in 1952 from the University of Belgrade. He was an assistant lecturer there from 1953 to 1961, and a research assistant at the University of Pennsylvania from 1961 to 1964. Throughout his career, Dr. Paunovic worked at Reynolds Aluminum, Photocircuits (which later became Kollmorgen) and Intel. He worked on electrochemical metal deposition for over four decades, and until his retirement, most recently in the Electrodeposition Technology Department at IBM's T. J. Watson Research Center. He was also an adjunct professor at Adelphi University for several years.

Dr. Paunovic was Chair of the ECS Electrodeposition Division and sat on the Board of Directors (1993-95). He was most proud of his book, co-authored with Mordechai Schlesinger the ECS monograph, *Fundamentals of Electroplating*, which is now in its second edition. Dr. Paunovic also co-edited, with Dr. Schlesinger, earlier editions of the ECS monograph, *Modern Electroplating* (now in its fifth edition).

During his career, he conducted symposia for ECS and remained an active member through retirement. Dr. Paunovic earned eleven patents and completed 42 research papers, making valuable contributions to the world of science.

LAURENCE D. BURKE (1939-2011), member since 1988, Physical & Analytical Electrochemistry.

GUIDO A. CAPUANO (1925-2012), member since 1968, Electrodeposition Division.

WADE H. JORDAN (1932-2011), member since 1959, Battery.

ROBERT L. LAMBERT (1915-2009), member since 1945, Electronics & Photonics Division.

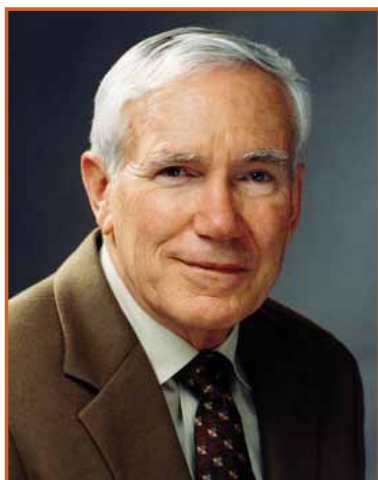
HENRY LEIDHEISER, JR. (1920-2012), member since 1957, Corrosion Division; received the ECS Corrosion Division H. H. Uhlig Award (1991).

WILLIAM A. PLISKIN (d. 2010), member since 1959, Electronics & Photonics Division; long-time Chair of the ECS Individual Membership Committee, who would personally recruit new members at ECS meetings.

ROBERT L. TICHENOR (1918-2011), member since 1946, Battery Division.

ANGELO TULUMELLO (1932-2011), member since 1962, Electronics & Photonics Division.

GLEN S. R. WALKER (1914-2011), member since 1943, Electrodeposition Division



Wayne L. Worrell
(1937-2012)

WAYNE L. WORRELL, 74, Professor Emeritus of Materials Science and Engineering at the University of Pennsylvania, passed away on Saturday, February 18, at his home near Philadelphia.

Professor Worrell was born in Rock Island, Illinois, on October 25, 1937. In the fall of 1947, his family moved to Memphis, Tennessee, where he completed his early education. In 1955, he received a scholarship to attend the Massachusetts Institute of Technology (MIT) where he received his Bachelor of Science degree in 1959 and his PhD, under the guidance of John Chipman, in June 1963. After two years as a postdoctoral fellow and lecturer at the University of California, Berkeley, he joined the University of Pennsylvania as an Assistant Professor of Metallurgy in 1965. He was promoted to Associate Professor in 1967 and to Full Professor in 1974 in the Department of Materials Science and Engineering in the School of Engineering and Applied Science.

As Associate Dean of Graduate Education and Research from 1986 to 1992, he was responsible (along with the Graduate Affairs Committee) for increasing the quality and doubling the number of full-time graduate students in the Engineering School, for revising and consolidating graduate courses, and for initiating the highly successful Executive Master's in Technology Management Program at the University of Pennsylvania. He encouraged and supported research collaborations with industry as well as new interdisciplinary research programs. The external research funding in the Engineering School increased from twelve to nearly nineteen million dollars during his term as Associate Dean.

Dr. Worrell served as Interim Chair of the Department of Materials Science and Engineering in 1996 and 1997, and on a number of Engineering School and University committees, including the Engineering Dean

Search Committee; Engineering Long Range Planning Committee; Chair of the Academic Performance Committee of the Engineering School; Chair of the University Committee on Admissions and Financial Aid; Faculty Advisory Committee to the Provost for Undergraduate Admissions; and Corporate-Sponsored Research Board of the University of Pennsylvania.

Prof. Worrell was a Visiting Scholar at the Imperial College, University of London (1970), and a Visiting Professor at the University of California, Berkeley (1975-76). In 1982-83, he was a Fellow at the Max-Planck Institute for Solid State Research, Stuttgart, Germany, and a Japan Society of Promotion of Science Lecturer in the fall of 1982. He was an Italian National Research Council Fellow at the University of Rome during the summer of 1985 and a Visiting Professor of Materials Science at MIT during the fall of 1993.

Dr. Worrell served on numerous national and international advisory panels. He was a member (1971-1978) and Chair (1974-1977) of the National Research Council Committee on High Temperature Science and Technology, where he initiated a study of the future needs and anticipated developments in high temperature science, and a member (1977-1979) of the National Research Council Committee on Chemical Sciences. He was Chair in 1982 of the Gordon Research Conference on High Temperature Chemistry, and a co-editor of *Progress in Solid State Chemistry*, an international review journal, from 1978 to 1995.

Prof. Worrell served as a consultant and external advisor for over 30 government and industrial laboratories including Argonne National Laboratory, Jet Propulsion Laboratory, Lawrence Berkeley National Laboratory, Los Alamos National Laboratory, Sandia Livermore Laboratory, Honeywell International, Union Carbide, United Technologies Research Center and Westinghouse Electric Corporation. He also was the U.S. national representative on the IUPAC Commission on High Temperature and Solid State Chemistry.

Dr. Worrell was an elected Fellow of three professional societies: The Electrochemical Society, the American Ceramic Society, and ASM International; and was a member of the Minerals, Metals, and Materials Society (TMS). He became a member of The Electrochemical Society in 1970 and was particularly active in it, serving as the Chair of numerous committees including the Honors and Awards Committee (1984-87) and the High Temperature Materials Division (1985-87); a member of the Board of Directors (1985-96); and Vice-President (1989-92). He was President and Chair of the Board of Directors of The Electrochemical Society during 1992-93. In 1986, he spearheaded

Karl Spear, past ECS President, provided an additional recollection about Prof. Worrell, "I first became acquainted with Wayne in the summer of 1964 at an IAEA International Meeting on Thermodynamics of Nuclear Materials held in Vienna. I was still a graduate student, and Nancy and I were about to leave Germany after 15 months of living there while I performed a major portion of my PhD thesis research. Nancy had taught American English in a Berlitz School. Wayne was attending this meeting in Vienna after completing a postdoctoral position. We kept in professional contact for more than forty years after that meeting. We would see each other at Gordon Research Conferences on High Temperature Chemistry, American Ceramic Society Meetings, specialty meetings that included the high temperature chemical behavior of materials, and of course, at ECS meetings. Wayne was completely dedicated to the ECS, and convinced me to become active in its High Temperature Materials Division and to help run some of its symposia. Very few ECS members have volunteered more time and energy to the Society than Wayne. This time and energy was in addition to his maintaining a very productive research program at the University of Pennsylvania where he was a professor. Wayne was a very generous human being, and was selfless in mentoring his students and colleagues."

Werner Weppner, of Christian-Albrechts Univ Kiel, also recalled his friend, "I have been the host of Wayne when he has been on a sabbatical in Germany (1982-83). He came with his entire family (Judy, Caroline, and Fred) and I believe that this was one of the happiest times in the life of Wayne, both personally and scientifically. He enjoyed introducing himself and his family to the German way of life by living in the house of a German professor (who went to the U.S. for a sabbatical) and enrolling his young children in German schools. He took many trips during the weekends and discovered the heritage of his ancestors in the Black Forest. The period of time in Germany was also rich in scientific discoveries, opening up the field of controlled electronic conductivities in solid oxide ion conductors, which eventually resulted in a patent. Wayne was a pioneer in pushing the Society to do more worldwide, representing the entire community of electrochemists. As

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a result, meetings started to be held once again outside the U.S. after Wayne was President of the Society. This has strongly contributed to the growth of new members from all over the world."

Roque Calvo, ECS Executive Director, noted that Wayne was the Society's 89th President and was an active leader in ECS for close to 40 years. He went on, "Wayne became ECS President just three months after I was appointed Executive Director, so he was essentially the first President with whom I served at ECS. It was a wonderful experience for me to have had the opportunity to work with a talented and dedicated President like Wayne in my first year. The Society is very mission-focused, always pressing forward without much time spent on reflection; but Wayne's passing caused me to reflect back to the many years we spent together, and in particular that first year. Wayne led with compassion; he knew how to motivate but always considered the best interests of people first. Wayne left a legacy that included many important contributions to ECS and to our science. For ECS, he presided over our first meeting in Hawaii—what was to become the very successful PRiME meeting. Among other things, he also led efforts to institute retirement benefits for the staff. He was highly recognized by the Society for all he contributed—the list is long and you can read about the awards in the main part of this article—but it's important to say that in the 110 year history of ECS, nobody has received more award recognition and held more top leadership positions than Wayne. He is simply the most accomplished and recognized member in the great history of our organization."

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the change in name of the then Metallurgy and Electrothermics Division to the High Temperature Materials Division; in hindsight, it is clear that this name change has been an important factor in the tremendous interest in and growth of the High Temperature Materials Division in the last 25 years.

Dr. Worrell also served as the Vice-President (1996-1997) and President (1998-1999) of the International Society for Solid State Ionics (ISSI).

Wayne Worrell's scientific and technical achievements have been recognized by a number of awards from ECS: the Outstanding Achievement Award of the High Temperature Materials Division (1988); the Carl Wagner Memorial Award (1989); the Solid State Science and Technology Award (1995); and the Edward G. Acheson Medal (2004), the highest award offered by the Society. He was elected as an Honorary Member of ECS in 1996. He was the Society's representative to the Board of Trustees of the Chemical Heritage Foundation from 1995 to 1999, and Chair of the Association History Committee and Member of the Heritage Council of Chemical Heritage Foundation from 1999 to 2002.

As a professor over about 40 years, he developed, revised, and taught numerous undergraduate and graduate courses in the chemical, electrical, and electrochemical properties of materials. His major research interests have been in high temperature solid state electrochemistry with a focus on electrical and electrochemical properties of novel materials and their applications in sensors, fuel cells, catalysis, and as protective coatings. At the University of Pennsylvania, Dr. Worrell established an internationally known research group in high temperature solid state chemistry. He mentored over 40 graduate students and over 30 postdoctoral fellows and visiting professors. Their talents resulted in over 120 papers and 10 patents. His group's research not only increased the understanding of the high temperature electrochemical properties of novel materials, but also the analysis and evaluation of their

applications in the energy conversion and storage technologies. As a measure of their love and high respect for him, his students and postdocs honored him with a Symposium at the Society's Centennial meeting (2002) in Philadelphia on the occasion of his 65th birthday.

Wayne Worrell is survived by his wife, Judy; their two children, Fred and Caroline; and six grandchildren. Dr. Worrell met his wife Judy in the fall of 1967, and they were married in June 1968. With all his family and professional commitments, Wayne was also active in his community. He served as a member and Chair of the Board of Gladwyne Montessori School in the 1970s. He enjoyed living near Philadelphia, particularly during the fall and spring. In the summers, he and his family loved to relax at their cottage on Mount Desert Island (MDI), Maine. Three of his favorite Maine activities were hiking the mountains in Arcadia National Park, sailing around the islands near MDI, and eating fresh seafood. He liked to take his graduate students for sailing on the Chesapeake Bay and invited them for long weekend visits to his Maine cottage. Many of his former students have told me that sailing with him and spending time with him at the summer cottage was a highlight of their graduate years and will remain a joyful, lifelong memory of their association with him. He also enjoyed music, and loved to travel with his family both in the U.S. and internationally.

This writer was one of Prof. Worrell's first two students at the University of Pennsylvania, and had known him for almost 47 years. He was not only my professional mentor who shaped my early perspectives on solid state electrochemistry, but also a very close friend all these years. He attended almost all the ECS meetings since joining it in 1970 up until about five years ago and had a very large number of colleagues and friends there. He was very kind-hearted and will be remembered by all as a true gentleman and a scholar. ■

This notice was prepared by Subhash C. Singhal, past Chair of the ECS HTM Division.