

Education Initiatives of The Electrochemical Society



by Stuart B. Adler

One great strength of The Electrochemical Society (ECS) has been its diversity – a single society where scientists and engineers from numerous disciplines can meet and create new ideas. This inclusiveness has allowed ECS to continually renew and redefine itself, and thus remain at the forefront of exciting developments in science and technology.

A critical part of this renewal process has been the Society's educational and outreach initiatives. The definition of electrochemistry itself has changed, and part of our role as a society has been to aid our members in keeping up with these changes. The role of electrochemistry in the advancement of science and technology is often unheralded. It has been (and continues to be) a crucial role of our society to identify and support activities that unify and mature our field as a core discipline, and communicate that importance to society in general.

Direct Educational Services for ECS Members

Despite being much smaller in membership than some of its disciplinary colleagues (APS, ACS, AIChE), ECS has had a long and significant tradition of educational services. One of the longest traditions is the ECS Short Courses, normally configured as 1 day, 8 h mini-courses, held on-site the Sunday before the spring and fall meetings. These courses are approved, reviewed, and in some cases solicited by the ECS Education Committee.

Although these courses originally focused on topics in aqueous electrochemistry, the Short Courses gained new prominence in the late 1970s with Dennis Hess's very successful course on

plasma processing. This course mirrored the diversification occurring at that time within ECS to include solid-state sciences. Since then the Short Courses have become a major component of the biannual Society meetings. Over the last ten years, ECS has offered more than 35-40 Short Courses, with overall attendance totaling approximately 1,000 students (roughly 50 students per meeting). Table I lists general subject areas into which these courses fall. Although some courses have covered traditional electrochemical topics, the overwhelming majority of successful courses have focused on frontier areas of electrochemical science and technology.

Along these lines, for the last five years the Education Committee has also sponsored the "XYZ for the Rest of Us" series of talks, held Sunday evening before the meetings. Usually drawing ~100 people, these informal talks are tailored to a general Society audience, and highlight frontier areas of solid-state science and electrochemistry. Table II summarizes topics and speakers since 2001.

With the rise of the internet, ECS has been searching for better ways to deliver educational content to its members. The newly renovated ECS website (<http://www.electrochem.org>) now features a more prominent Education section, which will ultimately become a central reference point for relevant educational content on the Web. This site will host online Short Courses (available at all times of year), semester-long Web-based courses offered by partnering colleges and universities, and continuing education courses offered by partner organizations. It is also envisioned that this site will become a mechanism of outreach, including services to K-12

teachers, undergraduate instructors, or others interested in the societal impact of electrochemical and solid-state sciences.

To this end, ECS has recently piloted a partnership with SemiZone, an online resource for semiconductor-related education and training. Linked to the Stanford Center for Professional Development, SemiZone works with international experts in academia and industry to produce and maintain continuing education courses relevant to solid-state science and technology. As part of this partnership, ECS members receive a 10% discount on SemiZone courses. SemiZone also offers \$1,000 fellowships to ECS members who are students, faculty, or staff at non-profit universities and institutions, retired professionals, industry members under 30, or who are currently unemployed/or in job transition. ECS makes all decisions regarding the distribution of these fellowships.

ECS has just launched the new ECS Digital Library, an online resource to ECS publications and archives. The mission of the Digital Library includes creating an online archive of all ECS publications, as well as providing access to recent developments in the field on a dynamic and interactive basis. So far the last 32 years of the *Journal* have been archived, with plans to go back to the 1940s. In addition, ECS has just started a new online publication for ECS meeting proceedings, called *ECS Transactions*. This medium will replace the old proceedings volumes, and makes it faster and easier for ECS members (and nonmembers alike) to stay in touch with what is happening in our field.

Indirect Educational Impact: A Focus on Students

As a university faculty member, I am often in a position of advising students on which professional societies they should be involved with and become members of. Usually ECS is at the top of my pick list. Part of ECS's strength is its inherent diversity, exposing students to a wide array of topics and people with differing technical backgrounds. But beyond this, the Society also has a strong tradition of supporting its young people. ECS offers more educational bang for the membership buck than any other society I have been involved with.

In the age of growing student fees, ECS remains one of the best deals on the block with \$18 yearly memberships, and low biannual meeting fees. In most cases a student can apply for a travel grant to the meeting from the specific ECS Division that is closest to their interests. These travel grants vary in size from \$250 to \$750, and are often undersubscribed in some Divisions. Student membership also entitles students to 50% discount on all ECS Short Courses, and the opportunity to apply for fellowships for online continuing education courses. Students

Table I. ECS Short Courses

General Subject Areas	Attendance 1996-2005
Electrochemical Diagnostic Techniques	240
Battery Design, Simulation, and Failure Analysis	237
Materials and Manufacturing for Integrated Circuits	229
Solid Electrolyte Fuel Cells	105
Electrochemical Microdevices	98
Nanoscale Techniques and Applications	77

Table II. “XYZ for the Rest of Us” Speakers

Spring 2006	Bio/Nanoscience and Electrochemistry ... for the Rest of Us, by Charles Martin.
Fall 2005	Looking for Lithium Ions: New Approaches for Investigating Function and Failure of Lithium-Ion Battery Materials, by Clare Grey.
Spring 2005	Atomic Force and Scanning Tunneling Microscopy for the Rest of Us, by Andrew Gewirth.
Fall 2004	Transistors for the Rest of Us, by Howard Huff.
Fall 2003	Impedance Spectroscopy for the Rest of Us, by Bernard Tribollet
Fall 2002	Advances in Plastic Microfluidics: Disposable Microcircuitry for the Life Sciences, by Antonio Riccio
Spring 2002	Plasmas: Chemical Reactive Environments for Thin Film and Surface Engineering, by Dennis Hess
Fall 2001	Fuel Cells-Concepts and Challenges, by Ulrich Stimming
Spring 2001	Fullerenes for the Rest of Us, by Fred Wudl

may also apply for awarded student memberships. In principle, the financial impact to a student of participating in ECS can approach zero.

On the other side of the same coin, ECS is one of the most active in encouraging young people through honors and awards. One of the most visible is the biannual student poster contest, organized since 1993 as part of the general society poster session. Typically between 50 and 200 posters are reviewed by judges from various technical areas, with two winners each meeting. Because the ECS symposia are often small and topical, it is really a great opportunity for the students to get some visibility and see what else is out there.

The student Summer Fellowships, begun in 1987 to support the research of graduate students in areas core to ECS, are another opportunity. These include four named fellowships: Edward G. Weston Fellowship, Colin Garfield Fink Fellowship, Joseph W. Richards Fellowship, and F. M. Beckett Fellowship. In past years the U.S. Department of Energy also supported students on summer research through this program. A variety of other Divisional, section, and special awards are also available—these are summarized (with links) in the Education section of the ECS website. If you are a student, or someone who advises students, be sure to check this out!

Finally, despite being a “nondisciplinary” society, ECS has recently spawned a very active core group of local student chapters. These include chapters at the University of Central Florida, Case Western Reserve University, and University of Florida (main campus). The purpose of these chapters has been to foster understanding and promote electrochemical and solid-state sciences, and create a sense of professional community among young people entering their field of specialization. ECS offers up to \$1,000 per year to any group of students interested in forming a new student chapter. More information can be found by contacting membership@electrochem.org.

A Call for Coherent Educational Programs and Outreach

Despite the strength of ECS as an educationally focused society, this article would not be complete without asking the question, “What can we do better?” Relevant to this question is the common experience I have had (as perhaps have many readers): picking up the science and technology section of the newspaper, reading an article relevant to something we do (or just saw at an ECS meeting), but noticing the absence of the word “electrochemistry” anywhere in the article. Most people in the world generally have a rough idea of what chemistry and physics represent and how they contribute to societal needs. They may even have had a course on it in high school. But what is “solid-state and electrochemical science and technology?” This common experience underscores the foundational, but largely unheralded, role that the electrochemical sciences play in everyday life.

So what can we do as a society to improve our visibility? One thing would be to promote coherent educational programs that unite our “nondiscipline” into more of a core discipline. Even our name, with its dry side and wet side partitioning inscribed on the cover of JES, suggests we have still not fully decided what we want to be when we grow up. During a dialogue I had in 2001 with Daniel T. Schwartz (a colleague of mine at the University of Washington (UW) and now Associate Dean in the UW College of Engineering), he pointed out that “Electrochemical materials, processes, and devices constitute a significant and growing, but largely unheralded, part of modern technology. However, the electrochemical materials and devices community has nothing like the comprehensive and ubiquitous educational programs that exist to support the electronic materials and devices community. A large barrier to implementing such an educational program is structural, namely, a lack of critical multidisciplinary expertise at any given institution.

As a result, the current electrochemical research landscape is largely dominated by centers of excellence that focus on specific electrochemical application areas such as fuel cells, sensors, corrosion, electrodeposition, and others, but rarely on the broadest multi-disciplinary material and interfacial issues that underpin all electrochemical technologies.”

Although our Society is not in a position to establish such educational programs, we can act as a catalyst by creating international forums, nurturing students and young researchers, supporting local chapters, and in all other ways identifying and supporting activities that unify and mature our society as a core discipline. A key aspect of this effort must be better outreach to the public. If one looks at the educational section of the American Chemical Society (ACS) Web page, for example, links include a wide variety of outreach resources, not just at the college level, but also for high school teachers, parents, and students. This is a hallmark of a well-organized, disciplinary society, which recognizes its general societal importance, and takes steps to reach out to the public and carry that message. It is, after all, not the responsibility of the world to see how important we are, but rather the onus is on us to communicate that importance to the world.

About the Author

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