The Open Channel

Newsletter for the Hampton Roads Section

The Institute of Electrical and Electronics Engineers, Inc.

March 2001

March Meeting

"Bioelectrics – New Applications for Pulsed Electrical Power Technology"

Speaker: Karl H. Schoenbach
Physical Electronics Research Institute
Department of Electrical and Computer Engineering
Old Dominion University
Norfolk, VA 23529

Date: Thursday, March 15, 2000

Location: Sammy & Nicks
2718 Mercury Blvd
Hampton, Virginia

Schedule: 6:00 p.m. - Administrative Meeting
6:30 p.m. - Social
7:00 p.m. - Dinner
7:30 p.m. - Speaker

Price: Member - $15.00
Student - $7.50
Guest - $15.00

Directions: Take I-64 to Mercury Blvd. (from the south side, go through the Hampton Roads Bridge Tunnel), Exit westbound on to Mercury Blvd., and travel approximately 1.5 miles. Sammy and Nick's is on the right.

About the Speaker: KARL H. SCHOENBACH received the Diploma degree in physics and the Dr.rer.nat. degree in physics in 1966 and 1970, respectively, from the Technische Hochschule Darmstadt (THD), Germany. From 1970 to 1978, he was working at the THD in the areas of high pressure gas discharge physics and on the dense plasma focus. From 1979 to 1985, he held a faculty position at Texas Tech University, where he was involved in research on fast opening switches, especially electron-beam and laser controlled diffuse discharge opening switches. In 1985, he joined Old Dominion University in Norfolk, VA. He was active in research on photoconductive switches until 1993, and has now concentrated his research efforts on high-pressure glow discharges, glow (streamer) discharges in liquids, and on environmental and medical applications of pulse power technology. He has chaired a number of workshops and conferences, among them the 1991 IEEE International Conference on Plasma Science. Most recently he has organized the First International Symposium on "Nonthermal Medial/Biological Treatments Using Electromagnetic Fields and Ionized Gases". He was elected Fellow of IEEE in 1994 for "contributions to the research and development of very-high-power electronic devices", and has received the 2000 High Voltage Award, presented by the Executive Committee of the International IEEE High Voltage Workshop 2000. He was guest editor of the IEEE Transactions on Electron-Devices (1990) and the IEEE Transactions on Plasma Science (1999), and is presently an associate editor of the IEEE Transactions on Plasma Science.

Topic Abstract: Electric phenomena play an important role in biophysics. Bioelectric processes control the ion transport processes across membranes, and are the basis for information transfer along neurons. These electrical effects are generally triggered by chemical processes. A new program in bioelectrics, which focuses on external electrical control of cell functions and of transport processes across cell membranes, has been initiated by Old Dominion University and Eastern Virginia Medical School. This program, which is based on an unique collaboration of electrical engineers, cell and molecular biologists, and microbial ecologists targets novel medical and environmental applications of pulsed power technology. One such application of "bioelectrics" is prevention of biofouling, an effect that is based on reversible "electroporation" of cell membranes. Pulsed electric fields of several kV/cm amplitude and submicrosecond duration have been found effective in preventing the growth of aquatic nuisance species on surfaces. Reversible electroporation is also used for medical applications, e.g. for delivery of chemotherapeutic drugs into tumor cells, for gene therapy, and transdermal drug delivery. Higher electric fields cause irreversible membrane damage. Pulses in the microsecond range with electric field intensities in the tens of kV/cm are being used for bacterial decontamination of water and liquid food. A new type of field-cell interaction, "Intracellular Electromanipulation" by means of nanosecond pulses at electric fields exceeding 50 kV/cm has been recently added by scientists at ODU and EVMS to known bioelectric effects. It is based on capacitive coupling to cell substructures,

has therefore the potential to affect transport processes across subcellular membranes, and may be used for gene transfer into cell nuclei. There are also indications that it triggers intracellular processes, such as programmed cell death, an effect, which can be used for cancer treatment. In order to generate the required electric fields for these processes, high voltage, high current sources are required. The pulse duration needs to be short to prevent thermal effects. Pulsed electrical power technology is the enabling technology for bioelectrics. The field of bioelectrics, therefore opens up a new research area for pulse power engineers, with fascinating applications in biology and medicine.

Opportunities to Volunteer

Part time volunteers are needed to help administer the Electricity and Electronics Merit Badges at the 2001 National Scout Jamboree. The National Boy Scout Jamboree is a ten day encampment held every four years (including 2001) in which Scouts from all over the USA and several foreign countries meet to celebrate the joys of scouting.

One of the biggest and most prestigious events of the Jamboree is the group of more than 50 Merit Badges. Hampton Roads and Richmond have traditionally been the principle supporters of merit badges in IEEE. The jamboree will occur on July 23 through August 1 at Fort A. P. Hill, Virginia, located just to the east of I 95 near Fredericksburg.

If you are interested, contact any of the Hampton Roads officers. If you would like to learn more about our Jamboree project, go to the web site: http://www.emeritbadges.com. If you have any questions, please send them to emeritbadges.volunteers@ieee.org.

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Educational Activities Board

For complete access to IEEE educational products and programs, log onto www.ieee.org/eab. The site offers the online education reading room, video on-demand, the NewsWire, contests and prizes, and much more.

March is WOMEN'S HISTORY MONTH

Celebrate Women's History Month in March along with the IEEE History Center. Visit http://www.ieee.org/organizations/history_center/whm.html to read the life stories of female electrical and computer engineers who have made significant contributions to their fields. As you read their life stories, they have one word in common, first!

Other Web sites:

http://womenshistory.about.com

U.S. Naval Astronomers
http://maia.usno.navy.mil/women_history/history.html

The History of Women in Astronomy
http://astron.berkeley.edu/~gmarcy/women/history.html

Biographies of Women Mathematicians, from Agnes Scott College
http://www.agnesscott.edu/lriddle/women/

International Women's Air and Space Museum
http://www.iwasm.org/

The Ninety-Nines
URL: www.ninety-nines.org/bios.html

Minerva
URL: www.minervacenter.com

Women Airforce Service Pilots of World War II
URL: www.wasp-WWII.org

WORLD CONFERENCE OF WOMEN ENGINEERS AND SCIENTISTS

The World Conference of Women Engineers and Scientists is coming to Ottawa, Canada in July 2002! This tri-annual conference has never been held in Canada since its inception in 1960! Visit our web site for a view of the exciting program with symposia on Global Climate Change, Ethics and Science, and Globalization and impact on women. There will be many exciting debates, workshops, roundtables, and up-to-date research on women in science and engineering. The cultural program will be as inviting as the scientific one and Ottawa is a delightful multi-lingual city full of parks, rivers, and a canal. Bring your family! Special programs are planned for accompanying persons and children. We hope to also have a strong participation of students and men. For more information, log-on to http://www.icwes12.org or email: Cheryl_cadrin@carleton.ca (coordinator) with subject line: ICWES12.