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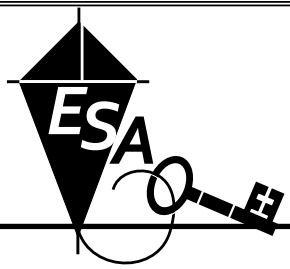

ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

Dear ESA Colleagues,

This June, a widowed mother living with her three children in a small hut on the edge of the Kalahari desert got electricity in her home. And it wouldn't have happened without the ESA.

Mrs. Tlhabologang Kebopetswe lives in Mmanoko, a small village in Botswana. She is 44 years old with seven children, three of whom still live at home. Mrs. Kebopetswe doesn't have a full-time job and she works odd jobs, barely making enough money for her family to get by. She lives in a small hut – about 100 ft2 – with her three school-age children. The hut didn't have electricity, and when it got dark out there wasn't much to do except go to bed … even if it was only 6 o'clock. Occasionally Mrs. Kebopetswe would have enough money to buy a candle, and the family could stay up after dark.

But a discussion at the 2008 ESA meeting in Minneapolis set about a chain of events that would change Mrs. Kebopetswe's lifestyle. At this meeting ESA member Rufus Akande and I discussed the possibility of collaborating on a research project addressing triboelectric charging. This discussion led to a trip to Botswana with ESA members Mohan Sankaran and Keith Forward for further discussions. Mohan and I were so excited with what we saw in Botswana that we submitted a proposal to the National Science Foundation for an undergraduate research program in Botswana entitled "Sustainable Energy for Sub-Saharan Africa". We were awarded the grant and each summer since 2011 we have been running this research program in Botswana, in collaboration with faculty from the University of Botswana. We've had 21 US students and 21 Botswana students participate in the program over the past 4 years.

This year one of the US students was ESA member Joe Toth. Joe just began his senior year at Case Western Reserve University. Joe's project in the Botswana program was to design and install a solar electrical system, on a budget of $600, for a family that had been living without electricity. Joe shopped and bought all the components in Botswana. There were many challenges – for example, Joe found out two days before the time for installation that the hut had a thatched roof, and he had to figure out how to attach the solar panel to this roof. On June 12, with help from the other students in the program, Joe installed the solar electrical system for Mrs. Kebopetswe.

Electricity will improve life for Mrs. Kebopetswe and her family. "[Living without electricity] has always been our way of life, but I am glad it is about to change. Now my family can be like other people", Mrs. Kebopetswe told the local newspaper." I am mostly happy that my children will be able to do their homework and study whenever they want, and work towards a better future than I can give them".

Four days after completing the installation in Botswana, Joe was at the ESA meeting at the University of Notre Dame, having traveled directly there without first stopping off at home.

Regards,
Dan Lacks,
President, ESA
daniel.lacks@case.edu

ESA Officers

President:
Dan Lacks, Case Western Reserve Univ.
Vice President
Shesha Jayaram, Univ. of Waterloo
Executive Council
Sheryl Barringer, Ohio State Univ.
Kelly Robinson, Electrostatic Answers, LLC
Rajeswari Sundararajan, Purdue Univ.

Calendar

- IEEE/IAS Annual Mtg. Oct. 5-9, 2014, Vancouver, BC, Canada, http://www.ewh.ieee.org/soc/ias/2014/ Contact: Rajesh Sharma, *rsharma@astate.edu*
- Electrostatics 2015, April 12-16, 2015, Southampton Solent Univ., Southampton, UK, http://elec2015.iop-confs.org/home Contact: IoP Electrostatics Group, +44 (0)20 7470 4800, *conferences@iop.org (abstracts due Oct. 29, 2014)*
- 33rd EIC (Elec Insul Conf, IEEE-DEIS), June 7-10, 2015, Seattle, WA, USA, http://sites.ieee.org/eic/ Contact: Bill McDermid, *wmmcdermid@hydro.mb.ca, (abstracts due Oct. 17, 2014)*
- ESA 2015, June 16-18, 2015, California State Polytechnic University, Pomona, CA, USA, http://www.electrostatics.org/conferences.html Contact: Keith Forward, *kmforward@csupomona.edu*

Current Events

How the electric eel got his zap

Charles Day

When fully grown, electric eels (Electrophorus electricus) are 2 meters long and weigh 20 kg. They live in the swamps and streams of the Amazon and Orinoco basins, where they stun prey and deter predators by delivering millisecond electric pulses of up to 600 volts and up to 1 ampere. Of the 60 or so species of electric ray, the largest is the Atlantic torpedo (Torpedo nobiliana), which can reach up to 1.8 meters in length and 40 kg in mass. As its name suggests, the Atlantic torpedo is found along the coasts of the Atlantic Ocean. Its electric organs can deliver pulses potent enough to knock a human diver unconscious. As fish go, E. electricus and T. nobiliana look nothing like each other. One inhabits freshwater; the other, seawater.

To Charles Darwin, the fact they and other species of electric fish share the ability to generate electric fields was, if not a challenge to evolution, then at least an observation that his theory had to accommodate. In **On the Origin of Species** Darwin argued that because of their diversity, the electric fishes could not have a recent common ancestor. Having rejected the common ancestor explanations, Darwin reached a different conclusion:, "*I am inclined to believe that in nearly the same way as two men have sometimes independently hit on the very same invention, so natural selection, working for the good of each being and taking advantage of analogous variations, has sometimes modified in very nearly the same manner two parts in two organic beings, which owe but little of their structure in common to inheritance from the same ancestor.*" The process that Darwin identified has become known as convergent evolution.

Current Events (cont'd.)

In a paper published in Science, Michael Sussman of the University of Wisconsin and his collaborators describe their investigation of the genomic basis of convergent evolution. The focus of their study was on the electric organs of E. electricus and other electric fish. The team's starting point was the long-held assumption that electrocytes (as the cells that generate the electric fields are known) evolved from muscle cells, with which they share some properties. Like muscle cells, electrocytes are covered in transmembrane ion channels and are connected to neurons. But electrocytes lack the molecular structures that endow muscle cells with their ability to contract. And because potential difference depends on charge separation, electrocytes are large—larger than muscle cells. Myosin is a motor protein essential for contraction. A muscle cell makes it when the cell's protein factories, the ribosomes, receive a stretch of messenger RNA (mRNA) that encodes the myosin gene. If electrocytes are not descended from muscle cells, none of the mRNA molecules present in electrocytes would carry the myosin gene. But if electrocytes are descended from muscle cells, the various regulatory processes that control which mRNAs are transcribed might still produce some myosin-encoding mRNA, albeit in small quantities.

To find out, Sussman and his collaborators extracted mRNA from the electric organs of five species of electric fish. They also extracted mRNA from the fishes' kidney, brain, skeletal muscle, and heart. Taken together, the mRNAs represented around 20 000 protein-encoding genes. Thanks to sequencing technology and the statistical tools of bioinformatics, the team could identify genes and measure the frequency with which the researchers showed up in the variously sourced mRNA. In particular, they could determine which genes are more common (up-regulated is the biological term) in electric organs than in skeletal muscle and which genes are less common (down-regulated).

The team's findings paint a remarkably consistent picture. The most strongly up-regulated genes in electric organs turned out to be ones associated with electricity. For example, a gene called scn4aa that encodes a sodium ion channel is strongly up-regulated in electric organs and strongly down-regulated in muscle. The converse is also applies. The myosin gene smyd1a is strongly down-regulated in electric organs and strongly up-regulated in muscle. In general, evolution entails the mutation of proteins. In the case of electric organs, the mutated proteins are evidently transcription factors and other proteins that regulate the expression of genes.

Although the paper that Sussman and his colleagues wrote is about convergent evolution, I struggled to discern anything in it that marked convergent evolution as being fundamentally different from ordinary, nonconvergent evolution.

(excerpted from http://scitation.aip.org/content/aip/magazine/physicstoday/news/the-dayside/how-the-electric-eel-got-his-zap-a-dayside-post?dm_i=1Y69,2L953,E1NTWU,9GGDC,1)

2015 Annual Meeting of the Electrostatic Society of America

California State Polytechnic University, Pomona
Pomona, CA
June 16 - 18, 2015

California State Polytechnic University, Pomona (Cal Poly Pomona) is proud to be hosting the 2015 Annual Meeting of the Electrostatic Society of America (ESA). The meeting will bring together experts across the diverse field to present the latest developments in electrostatics.

Anticipated Technical Session Topics

- Contact charging and triboelectric effects
- Gas discharges and microplasmas
- Breakdown phenomena, safety and hazards
- Electrically-induced flows and electrokinetics
- Atmospheric and space applications
- Biological and medical applications
- Electrospinning and material processing
- Measurements and instrumentation

Conference information, including abstract submission, registration, student travel grants and lodging, will be updated and available at *http://www.electrostatics.org*

Conference Chair
Prof. Keith M. Forward
kmforward@csupomona.edu
Cal Poly Pomona

Technical Chair
Prof. Peter Ireland
peter.ireland@newcastle.edu.au
University of Newcastle

About Cal Poly Pomona: The University is located 25 miles east of Los Angeles and is one of two Polytechnics in the 23 member California State System. With a student population of just over 22,000, it is the second largest in the California State System.

ESA 2014 Annual Meeting

The 2014 Annual Meeting of the Electrostatics Society of America was held on the beautiful campus of the University of Notre Dame in South Bend, Indiana. The sunny weather on highlighted this great venue that brought together over ninety electrostatics experts and enthusiasts from 15 countries worldwide, representing one of the largest non-Joint meeting in the history of the ESA. In fact, every continent was represented with participants from as far as Japan, China, India, Brazil, South Africa, the United Kingdom, Sweden, Finland, France, Romania, Israel, Australia and New Zealand, in addition to those from the United States and Canada. The highlight of the two and half day meeting was a special demonstration session and reception with eight experts from consulting and industry demonstrating everything from the practical, like electric field sensors, to the more amusing, like a functioning plasma speaker. General Chair Prof. David Go from the University of Notre Dame led the local organizing committee with significant help from his graduate students and Technical Chair Prof. Poupak Mehrani from the University of Ottawa put together an outstanding program of presentations and posters.

The technical session consisted of 51 talks organized into 12 sessions, and due to the overwhelming number of submissions, a special poster session was also added to the technical program including 14 posters. A number of distinguished scientists were able to give Keynote Addresses, with a talk by Giles Harrison from the University of Reading on atmospheric chemistry bringing a fresh perspective on a very old topic and leading off an entire session on Atmospheric and Space Applications. Dr. Sung-Jin Park from the University of Illinois introduced the audience to the emerging field of microplasmas and its applications ranging from lighting to water purification. Triboelectricity was again a popular topic, with multiple sessions dedicated to contact charging and Dr. Peter Ireland from the University of Newcastle delivering a great fundamental Keynote Address on single particle impact charging. Prof. Junhong Chen led the final day of the conference with a talk highlighting the discharge-driven synthesis of graphene and its multiple applications. A session on Safety and Hazards, including an invited talk from Charles Noll of XiPro Technologies was also a welcome addition to the program this year.

As the "friendly society," the ESA continues to encourage participation by student researchers, providing them with a welcoming venue to present their latest research breakthroughs. This year, nearly 40% of the technical talks were delivered by students and first, second, and third place awards were given out to 26 students by a panel of expert judges, with a 7 of those students distinguishing themselves with 1st place awards. Those 7 are: Michael Johnson, Cornelius Louwrens Pieterse, Shiyu Hu, John Noah Hudelson, Matthew Lee, Paul Rumbach, and Souvik Ghosh.

For the past several conferences, Dr. Glenn Schmieg has been ubiquitous with the conference banquet, providing both entertaining and educating post-dinner demonstrations. This year saw a 'passing of the torch' as Glenn 'retired' by giving one last demonstration before ceding the microphone to Prof. Mark Horenstein from Boston University, who gave a fascinating presentation on electrostatics during the great Dust Bowl of the 1930s. Special honors and recognitions were also given at the banquet: Raji Sundararajan (Distinguished Service Award), Bill Wayman (Lifetime Achievement Award), Glenn Schmieg (Lifetime Achievement Award), and Mark Zaretsky (Honorary Life Member Award).

The organizers would like to give a special thanks to the staff at the Notre Dame Conference Center, especially Harriet Baldwin, who did a wonderful job of providing delicious refreshments and helping troubleshoot any problems, The Colleges of Science and Engineering, who providing valuable resources for the Special Demonstration Session and Reception, as well as David Go's students from the University of Notre Dame, who were instrumental in helping run the conference. We would also like to thank our sponsors from this year: Trek Inc., Mystic Tan Inc., InfoSight Corporation, and the Department of Aerospace and Mechanical Engineering at the University of Notre Dame.

Next year, Prof. Keith Forward is delighted to welcome the ESA to the (California State Polytechnic University in Pomona, California from June 16-18 for the 2015 Annual Meeting of the Electrostatics Society of America. Prof. Forward will be serving as General Chair and Dr. Peter Ireland from the University of Newcastle will serve as Technical Chair.

David Go, Conference General Chair
Poupak Mehrani, Technical Chair

ESA 2014 Annual Meeting - Photo Collage

More pictures may be found at http://electrostatics.us/esa/2014/page_01.htm . Many thanks to Al Seaver for downloading and archiving the multitude of photos (several hundred!).

Electrostatics
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