December 2016
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*American Institute of Chemical Engineers*
Knoxville-Oak Ridge Section

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For additional information about the Knoxville-Oak Ridge Section of AIChE see our Web site at: http://www.ornl.gov/sci/aiche/

# December 2016 Meeting – Joint with SWE (Spouse/Significant Other Night)

Date: Thursday, December 1, 2016
Location: Rothchild Catering and Conference Center, 8807 Kingston Pike, Knoxville TN
Cost: $20 (Cash or Check at the door - **NOTE**: There is no cost for the program or PDH Certificate)
5:00 pm Executive Committee Meeting (All members welcome)
5:30 pm Social/Networking
6:00 pm Dinner – Menu
7:00 pm Program – Howard Kerr, retired ORNL employee and former State Representative, ***Honeybees & Humans – Understanding the Relationship***

**Abstract** – Honeybees are extremely important to human societies and to ecological systems because of their pollination of numerous plants and subsequent impact on production of food and fiber. Honeybees are social insects that have complex social and physiological characteristics that have remained relatively unchanged for many centuries. During the past century, humans have developed methods to manage colonies of honeybees for specific purposes. Some of these honeybee characteristics will be described and related to modern beekeeping developments.

In recent years, various human activities have caused major stresses on honeybees and have resulted in sharp declines in the populations of honeybees and other insect pollinators. Since we are not likely to significantly change the honeybee's behavior we must determine what changes in human activities will reduce the stresses on honeybees. Some human activity/resulting stresses/potential remedies will be presented.

A colony of honeybees is a complex biological system, and increasing our knowledge of this system will require use of various physical science technologies. Some past efforts at ORNL relative to honeybees include development of an acoustic device to identify various sub-species of honeybees and a tracking device to study the mating behavior of honeybees. Honeybees were also used for environmental surveillance programs. These efforts will be summarized and other needs described.

**Bio** – See page 2

**Please make your reservations before noon, December 1, by contacting**
Paul Taylor, taylorpa@ornl.gov, (865)574-1965 or
Amber Tipton, atipto11@utk.edu, 974-6458

***See page 2 for an alternate electronic registration option using EventBrite***

***The Section will subsidize up to 15 students, including graduate students***

## December 2016 Meeting (continued)

**Bio** - Howard Kerr holds a degree in Nuclear Engineering from the University of Tennessee (UT) and was a senior research engineer at Oak Ridge National Laboratory from 1965 to 2001. During his tenure at ORNL, Howard focused on advanced reactor designs, materials irradiation, criticality safety, dosimetry, special nuclear materials safeguards and security, and research reactor safety. Mr. Kerr was also an elected 20th District State Representative from 1994 to 2000, where he chaired the Nuclear Waste Committee for the National Conference of State Legislatures for 4 years, served as the Citizen Representative of Governor McWherter's Solid Waste Roundtable, and authored and sponsored the TN Apiary Act of 1995.

Mr. Kerr is currently a board member for the Boys and Girls Club, member of the Kiwanis Club of Maryville, founder of the Blount County Solid Waste Authority and Public Building Authority, Managing Director of Alnwick Community Club, and a Lifetime Member of the TN Beekeepers Association. Mr. Kerr has been a Beekeeper for 50+ years and currently has 100 colonies. He is an officer in local and state associations and frequently teaches classes and gives presentations on beekeeping. Mr. Kerr has led efforts to establish beekeeping positions at UT and the Tennessee Department of Agriculture. He has also conducted bee related research at ORNL on use of bees with acoustic identification devices, tracking devices, and in environmental surveillance programs.

## Alternate Registration and Payment Option for Local Section Meeting Attendees

The Knoxville-Oak Ridge Section of AIChE is providing an alternate registration and payment option to cover the costs of meals, speakers, and student attendees at our monthly meeting. Attendees now have the option to pay by credit card using an online payment system at the following web-address:

https://www.eventbrite.com/e/honeybees-humans-understanding-the-relationship-tickets-29608663309

If you use this service, the cost for the meeting will be $22.09. If you do not want to use this web-based payment option, you may continue to pay $20 at the door by cash or check.

# Ballot — Knoxville-Oak Ridge AIChE Officers for 2017

**Chair** – Jae-Soon Choi
(Automatic succession)


**Chair-Elect** (Select one)
____ Kyle Mack
____ Write in _____

**Secretary** (Select one)
____ David DePaoli
____ Write in _____

**Treasurer** (Select one)
____ Paul Taylor
____ Write in _____

**Director** (Select two)
____ Kaara Patton
____ Lindsey Stinson III
____ Write in _____

Please bring ballots to December meeting, or send by email to: Robbie Gorsuch at taylorpa@ornl.gov or by postal mail to:

Knoxville-Oak Ridge Section, AIChE
C/o Paul Taylor,
Oak Ridge National Laboratory,
P. O. Box 2008-6384,
Oak Ridge, TN 37831-6384

**David DePaoli** is an R&D staff member of the Nuclear Materials Processing Group, Nuclear Security and Isotope Technology Division at Oak Ridge National Laboratory. David has worked at ORNL for 30 years and has experience in a variety of chemical- and energy-related research and development projects. He is currently involved in efforts related to radiochemical separations and critical materials. He has previously held several officer positions in the Knoxville-Oak Ridge local section and was a director of the Separations Division of AIChE from 2003 through 2007.

**Kyle Mack** is a professional engineer working in his eighth year as a Process Engineer contractor for the Department of Energy on the Uranium Processing Facility Project. He recently finished his Master's in Business Administration through Tennessee Technological University and has his Bachelors of Science in Chemical Engineering from the University of Tennessee. He has been an acting board member and former chair of the local AIChE section for the past five years. Other work experience involves green engineering projects with the Oak Ridge National Laboratory and work rotations at Eastman Chemical Company.

**Kaara Patton** is an East Tennessee native. She received her undergraduate and master's degrees in Chemical Engineering from the University of Tennessee. While working toward her degrees, she interned at Oak Ridge National Laboratory and Areva Federal Services. She developed an interest in the nuclear fuel cycle and was able to perform bench scale tests as well as collaborate on multiple-laboratory projects. After receiving her master's degree, she continued working at ORNL with the Process Engineering Research group. She now works for Consolidated Nuclear Security Y-12 in Development.

She is a self-starter who hopes to be elected to the committee where she can use her organizational and planning skills to ensure a successful year for the local AIChE chapter.

**Lindsey Stinson III** is a 1996 graduate of The University of Tennessee with 20 twenty years of experience in engineering. He has worked in the Oil/Gas, Pharmaceutical/Medical Device, Manufacturing and Government Nuclear industry. His experience in the Oil/Gas industry ranges from Offshore platform design to Onshore Gas well design drawings. His experience in the Pharmaceutical/Medical Device ranges from transdermal patch manufacturing validation to X-Ray film and Clean-In-Place systems. His experience in the Manufacturing industry ranges from tablet manufacturing to polymers. For the past 8 years he has been working on the UPF project. He has been married to his beautiful wife for 18 years and has a wonderful 11-year-old daughter. He enjoys fishing in his spare time.

**Paul Taylor, P.E.,** is a senior development engineer in the Nuclear Security and Isotope Technology Division at Oak Ridge National Laboratory. He has been the membership chairman of the local section for many years, and has previously served as Chair, Treasurer, and Director of the local Section. Paul is a registered professional engineer, and is a member of the National Society of Professional Engineers and the Water Environment Federation in addition to AIChE.

# UT Student Poster Presentation at December Meeting

University of Tennessee Chemical and Biomolecular Engineering PhD student, Michelle Aranha, will present a poster on her research, which is focused on ion exclusion in charged carbon nanotubes, at the December meeting of the Knoxville-Oak Ridge Section of AIChE. You are invited to either come at 5:30 p.m. or stay after the regular meeting to talk with Michelle about her work.


Michelle Aranha

**Ion exclusion in charged carbon nanotubes: A molecular dynamics study**

**Abstract** – The physical characteristics of carbon nanotubes (CNTs) such as ultra-strong $sp^2$ bonds, the single atom thick walls with exceptionally smooth surfaces and large aspect ratios that lead to a pronounced surface charge effect make them attractive in the field of nanofiltration, in energy storage devices such as electric double layer capacitors, as simplified models for biological membranes and in similar biomimetic applications. An understanding of transport at nanoscale is thus important to the rational use of these materials in advanced nanofluidic applications and still remains quite elusive. Gradients in chemical, electrical or mechanical potentials give rise to transport of water and ions which is generally described by the coupled Navier-Stokes (NS) and Poisson-Nernst-Planck equation (PNP). A major component of the solution to these transport equations in the continuum theory is the distribution of ions and electric potential which can be obtained from the Poisson-Boltzmann (PB) relation or from more complicated analytical theories such as the hypernetted chain theory by Ornstein and Zernike which requires a significant knowledge of statistical mechanics. The PB theory with its inherent approximations makes its applicability at nanoscale debatable and moreover the equation is difficult to solve [1]. A more simplified expression that ignores the effect of geometry and pore size, assumes homogeneous distribution of surface charges and an ideal behavior of free ions in solution throughout the space is the Donnan theory. This theory gives the equilibrium distribution of ions in the pore when a charged or selective membrane comes into contact with solutions of unequal concentrations.

Using molecular dynamics simulations, we investigate the effect of external solution concentration, membrane charge density, pore size and ion specificity on ion exclusion phenomena through positively and negatively charged CNTs in contact with a monovalent electrolyte and provide a detailed comparison with the theoretical predictions from Donnan theory. The qualitative counterion ion uptake and coion exclusion trends show an excellent agreement with Donnan theory predictions at high charge densities (highly selective CNTs). We obtain a coion exclusion that is fairly higher than the Donnan theory predictions. Additionally, we also investigate in atomic detail the intriguing structural and dynamical features of a NaCl solution under confinement in sub-3 nm diameter charged carbon nanotubes.

The cases studied enable us to assess if Donnan equilibrium theory can be used to ascribe a relation between membrane fixed charges and the concentration of ions within the nanotube. The goal is to integrate fast water flow with ion selectivity through modulation of pore sizes and surface charges with potential applications in desalination, as molecular gates for separation of biomolecules, and other nanofluidic devices.

[1] P.Maarten Biesheuvel, Simplifications of the Poisson–Boltzmann Equation for the Electrostatic Interaction of Close Hydrophilic Surfaces in Water, Journal of Colloid and Interface Science, Volume 238, Issue 2, 2001, Pages 362-370.

**Bio** – Michelle Aranha received her Bachelor's degree in Chemical Engineering from Marathwada University, India in 2008. After spending three and half years as a Process engineer for Reliance Petrochemicals, India, she joined the Department of Chemical and Biomolecular Engineering at UTK in Fall 2012 as a PhD student.

# VOLUNTEER'S CORNER

***Engineers making a difference in our community.***

| Date | Event |
|---|---|
| **Anytime** | K-12 Outreach<br>• Teach Math or Science to a Middle/High Schooler? Junior Achievement, www.jaeasttennessee<br>• AIChE Academy can deliver chemical engineering educational resources to help Chemical Engineering professionals connect, learn, and solve pressing challenges. Visit www.aiche.org/academy and see what AIChE Academy has to offer.<br>• AIChE Young Professionals Committee. We sponsor a competition for our collegiate student chapters, the Global Undergraduate Student Video Competition. This competition requires chapters to create a video about a relevant chemical engineering subject that will be shown to high school students to teach them about that topic, and ultimately encourage them to study chemical engineering. |
| **Anytime** | AIChE K-OR needs help with:<br>• Social Media Committee – The local section desires to establish a presence on various social media outlets, such as: Facebook™, Twitter™, Linkedin™, and YouTube™.<br>• Young Professionals Committee – The local section desires to establish a Young Professional's Group to increase participation and interactions with young chemical engineers within the East Tennessee region.<br>• Monthly Newsletter - Submit an Article, Editor-At-Large<br>• AIChE K-OR Webmaster |
| **Anytime** | Engineer's Without Borders – http://www.ewb-usa.org |
| **Anytime** | **Why did you choose to be a tnAchieves mentor?** I truly believe the Tennessee Promise is a game changer for our state. Working with students who until now did not believe college was a possibility for them is amazing. This program is changing lives and improving our state. I am proud to be a small part of that effort.<br><br>If you have not yet registered to mentor with the Class of 2017 and would like to do so please visit https://tnachieves.org/mentors/apply/ to do so today! |

| Date | Event |
|---|---|
| **January**<br>**February 17-18, 2017** | Tennessee Science Bowl<br>See http://www.orau.gov/sciencebowl/volunteers/index.html for details.<br>  |
| **February 18, 2017** | Boy Scouts Merit Badge College – Roane State Community College - Merit Badge College<br>• Help teach the chemistry merit badge<br>• Contact Paul Taylor or Mark Swientoniewski if you can help |
| **February 19-25, 2017** | Engineer's Week – DiscoverE.org |
| **March 22 - 25 2017** | TN FIRST Robotics, See http://www.usfirst.org/community/volunteers |
| **March 31, 2017 – April 1, 2017** | AIChE UT Student Chapter is hosting a regional meeting |
| **March** | **Chem-E-Car Competition** - AIChE's annual Chem-E-Car Competition® engages college students in designing and constructing a car powered by a chemical energy source, that will safely carry a specified load over a given distance and stop. |
| **March 27-30, 2017** | Southern Appalachian Science & Engineering Fair (SASEF) – UTK Thompson Boling Arena<br>To register as a judge: http://sasef.com/. Select "Judges" and then "Register Online." |
| **May**<br>**June** | **Volkswagen-Sponsored Camp Introduces Students to UT, Engineering**<br>With the Volkswagen-sponsored Engineering VOLunteers for Tenth Graders, or eVOL10, now under way at the University of Tennessee, Knoxville, College of Engineering, students in high school and middle school are getting a chance to take a deeper look into future possibilities in science, technology, engineering and mathematics, or STEM. |
| **July** | AIChE K-OR Planning Meeting for the upcoming academic year needs ideas and help planning speakers and arranging meeting locations. |
| **August** | |
| **September** | |
| **October** | |
| **November** | |
| **December** | |

# Activities Calendar

| Date | Time | Topic | Speaker | Location |
|---|---|---|---|---|
| Dec 1 | 6:00 PM | Joint meeting with SWE – Honeybees & Humans – Understanding the Relationship | Howard Kerr | Rothchild's, Knoxville TN |
| Jan 19 | 6:00 PM | Quality Assurance of TVA's Landfills | Nick McClung | Rothchild's, Knoxville TN |
| Feb 21 | 6:00 PM | Joint meeting with ANS – Tennessine (element 117) Discovery | Jim Roberto, ORNL | Calhoun's, Oak Ridge TN |
| Mar 23 | 6:00 PM | Joint meeting with UT Student Chapter – Unit Operations Lab Tour | TBD | UT – Dougherty |
| Apr 18 | 6:00 PM | A Peripatetic Life – The Life of an Engineer | Emory Ford, Emeritus Director of MTI | Rothchild's, Knoxville TN |
| Apr 20 | | UT Department of Chemical & Biomolecular Engineering Awards Banquet | | TBD |
| May 16 | 6:00 PM | Finances | Jim Brogan, Brogan Financial | Rothchild's, Knoxville TN |

# Sponsoring Opportunities

We continue to accept advertising in the newsletter in order to provide funds to support student participation in the meetings.

Rates per newsletter are:

**$80** full-page advertisement

**$45** half-page advertisement

**$25** quarter-page advertisement

The section will also continue to accept individual or corporate sponsors to provide student meals at section meetings. The sponsor will be recognized at the meeting and in the Newsletter.

The cost to sponsor one meeting is **$200**. It's a great way to encourage students to attend the local meetings and become future members in the Institute!

Radiochemistry Lab at Idaho National Laboratory – Photo courtesy of the DOE Photo Archive at: https://www.flickr.com/photos/inl/9193047101/

*"The important thing in life is not the victory but the contest; the essential thing is not to have won, but to have fought well."*

**Pierre de Coubertin**
French educator and historian, and founder of the International Olympic Committee
(1863-1937)

# Officers

| | | | |
|---|---|---|---|
| **Chair:** | Mark Swientoniewski | 574-1150 | swientoniem1@cns.doe.gov |
| **Chair-Elect:** | Jae-Soon Choi | 946-1368 | choijs@ornl.gov |
| **Secretary:** | David DePaoli | 574-6817 | depaolidw@ornl.gov |
| **Treasurer:** | Paul Taylor | 574-1965 | taylorpa@ornl.gov |
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| **Term 2015-2016** | Stuart Daw | 946-1341 | studaw@aol.com |
| **Term 2015-2016** | Bamin Khomami | 974-2421 | bkhomami@utk.edu |
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| **Term 2016-2017** | Sharon Robinson | 574-6779 | robinsonsm@ornl.gov |
| **Membership:** | Paul Taylor | 574-1965 | taylorpa@ornl.gov |
| **Newsletter:** | | | |
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We're on the Web!
*See us at:*
http://www.ornl.gov/sci/aiche/

***Editor: B. Lewis***

## *About Our Organization…AIChE Engage*

AIChE Engage provides members with a forum to ask questions, share ideas, give feedback, and spread knowledge.

It's easy to get started. Members use the same login password as the main AIChE website to login at: **engage.aiche.org**. You can then create your profile by either filling out a profile manually, or importing some of your information from LinkedIn®. You can customize your profile by setting up how you want to receive emails from Engage, how much of your profile you want visible to other members, the signature area that appears under your discussion posts, and more. If you have any questions about what a certain setting means, you can email the Community Manager for help. Next you build a contact list by first selecting a directory and using the member search to find friends and colleagues belonging to AIChE. Creating a contact list helps to identify relationships and build searchable networks, which you can access via your profile. Once you complete these steps, you can now join a discussion group and participate in the Engage community.

**(Source:** http://engage.aiche.org/home)

**P.O. BOX 2008**
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**OAK RIDGE, TN 37830-6243**