

# Selenium Research

International Society for Selenium Research

Issue 4, Summer 2017

## *President's Remarks*

*Gary S. Bañuelos, President, ISSR*



Dear Members,

Hello members. Welcome to 2017; the year of many changes. As the days progress, we approach the 200th birthday of selenium, which will be celebrated August 13-16th in Stockholm, Sweden. The excitement within this Selenium community can be felt worldwide as preparations by Professor Elias Arnér et al. will continue at a relentless and fervent pace. As a result of uniting two selenium communities, this multi-faceted conference will be the largest and all-encompassing scientific conference bringing selenium researchers together from all the parts of the world. Not only will the entire selenium community be together at one time, but we will be convening at the world famous and prestigious Karolinska Institute, whose ambiance resonates with history, science, and intellectual fortitude. As a result, the scientific interactions and exchanges that will take place, will clearly demonstrate that we as a group can have a worldwide impact on cultivating new growth and vision on selenium research. In the past, gracious support from both USTC in China and the Brazilian government and participating universities in Brazil have strongly contributed to the growth of selenium research via our conferences. Under the leadership of Professor Elias Arnér, we are destined to have a Se-enriched learning experience that will likely propel selenium research into positive and futuristic multi-interacting directions. With our extremely busy schedules and our futile attempts at trying to find more time, it is intellectually comforting to know that we have formed an International Selenium Research Society that serves as a stable platform for reaching out to selenium research conducted by others. The anticipated success of the Se 2017 conference will further contribute to new growth for selenium research in today's and tomorrow's world.

In regards to upcoming Se symposium to be held at the Karolinska Institutet Campus Solna in Stockholm, Sweden, it is important to consider the following points in order to make your selenium experience as successful as possible:

- Register as soon as possible
- Prepare your presentation- there are many sessions- be timely and practice in clear English
- Go to website and ask your questions early- there are people to help you
- Understand that two serial symposia with overlapping plenary sessions taking place
- Remember, one US dollar is about \$8.86 Swedish Krona (SEK).

In addition to the conference, the organizers have arranged supplemental once-in-a lifetime activities that will provide us with unique, historical, and classy Swedish ambiance, which includes a boat excursion with dinner to Mariefred where Jöns Jacob Berzelius discovered selenium. Graciously, the city and council of Stockholm have invited all conference participants to a 'no cost' dinner reception in one of Sweden's most famous buildings- the Stockholm City Hall, in which the Nobel Prize banquet takes place each year. This dinner gala will certainly become a selenium-enriched memory for each of us.

In addition to having world-class speakers representing all facets of research, entertaining social events, Stockholm as the national capital of Scandinavia, is one of the most beautiful and historic capitals in the world. With a seven-hundred and fifty year history and a rich and diverse cultural life, it has a large selection of museums, medieval, memories, handicrafts and the multi-language menu- including English. Discovering the city is certainly is an activity that will be well worth the time. For those of you who wish to expand your Swedish experience, then it is also a must to spend some free time in Sweden with its long coastline, extensive forest and numerous lakes. Along with its beautiful scenery, Sweden has a rich and varied wildlife that inhabit the many "National Parks." Sweden's natural beauty will certainly provide a welcome relief to our selenium overloaded brains at the end of the conference. See some of the enclosed photos, which illustrate what we can expect to see and experience in Sweden. Allow yourself time before and after the conference to experience Sweden.

With Sweden right around the corner, it is difficult to even imagine Se 2019- but yes, we have received three requests from India, China, and Canada to organize the next conference. After careful deliberation, the choice was made to have Se 2019 in Yangling near Xi'an, China. This scenic and historical site in China will offer us an atmosphere that will promote a free flowing exchange of ideas on selenium. The organizer Professor Dongli Liang will deliver an introduction and presentation about the site and tentative plans for the conference. If you are interested in organizing one of the future conferences, please submit a letter of intent to me or Professor ZQ Lin, with detailed description of your potential site facilities, funding resources, and tentative dates.

As a kind reminder to all of you, we will be holding an election for the position as President of the International Research Society. According to our bylaws, I can only consecutively serve for two terms or four years. However, I am willing to serve in an advisory role to the society as an "emeritus president." With the increased exposure of the Society to participants attending the Se 2017 conference in Sweden, it is our hope that we will attract new members, particularly student members. The addition of new members can only contribute to a more dynamic and more relevant group that strives on growing as a selenium research community.

*Parlier, California*



## 11th International Symposium on Selenium in Biology and Medicine & 5<sup>th</sup> International Conference on Selenium in the Environment and Human Health

August 13-17, 2017, Karolinska Institutet, Stockholm, Sweden

The Se2017 symposium will be held at the Karolinska Institutet Campus Solna, in Aula Medica and in the three lecture halls of the Berzelius laboratory.



Directions and map to the Karolinska Institutet Campus Solna can be found by clicking the following website: [ki.se/en/about/contact-and-visit-us](http://ki.se/en/about/contact-and-visit-us).

For updated conference information, please visit the conference website: [www.Se2017.SE](http://www.Se2017.SE)



**Elias Arnér**, PhD, MD  
*Conference Chair*  
*Professor, Karolinska Institutet*  
*Stockholm, Sweden*  
*[elias.arnér@ki.se](mailto:elias.arnér@ki.se)*

### Conference Registration

On-line registration is open now. For regular delegates, the registration fee will be SEK 4 500 ex. VAT (approx. EUR 480), but SEK 3 000 ex. VAT (approx. EUR 320) for students.

### Confirmed Invited Speakers and Chairs

(as of April 25, 2017, in alphabetical order)

- Takaaki Akaike, Tohoku University Graduate School of Medicine, Japan, Keynote Lecture
- Elias Arnér, Karolinska Institutet, Sweden, Welcome address, Keynote Lecture, Chair
- Gary S. Bañuelos, USDA-ARS, USA, Welcome address, Keynote Lecture, Chair
- Marla J. Berry, John A. Burns School of Medicine – University of Hawaii at Manoa, USA, Keynote Lecture
- Mikael Björnstedt, Karolinska Institutet, Sweden, Keynote Lecture
- Regina Brigelius-Flohé, German Institute of Human Nutrition, Germany, Plenary Lecture: "Enzymology and biological functions of glutathione peroxidases"
- Martin Broadley, University of Nottingham, UK, Keynote Lecture
- Raymond F. Burk, Vanderbilt University Medical Center, USA, Plenary Lecture: "Nutritional aspects of selenium in human beings"
- August Böck, Ludwig Maximilian University, Germany, Honorary Speaker at Conference Reception
- Sergi Castellano, Max Planck Institute for Evolutionary Anthropology, Germany, Keynote Lecture
- Joel Caton, North Dakota State University, USA, Keynote Lecture
- Laurent Charlet, Grenoble, France, Keynote Lecture

- Krishna Chatterjee, University of Cambridge, UK, Plenary Lecture: “Phenotypes and molecular pathogenesis of disorders of human selenoprotein synthesis”
- Wen-Hsing Cheng, Mississippi State University, USA, Keynote Lecture
- Allan Chilimba, Agricultural Research Services for Technology Development, Malawi, Keynote Lecture
- Marcus Conrad, Helmholtz Zentrum, Germany, Keynote Lecture
- Gijs Du Laing, University of Ghent, Belgium, Keynote Lecture
- Aristi Fernandes, Karolinska Institutet, Sweden, Chair
- Leopold Flohé, University of the Republic, Uruguay, Chair
- Graham George, University of Saskatchewan, Canada, Chair
- Vadim Gladyshev, Harvard University, USA, Plenary Lecture: “Selenium utilization in diverse animals,” Chair
- Rayudu Gopalakrishna, PIBBS, University of California, USA, Keynote Lecture
- Luiz Roberto Guimarães Guilherme, Federal University of Lavras, Brazil, Chair
- Jean Hall, Oregon State University, USA, Keynote Lecture
- Hugh Harris, University of Adelaide, Australia, Chair
- John Hesketh, Newcastle University, UK, Keynote Lecture
- Arne Holmgren, Karolinska Institutet, Sweden, Keynote Lecture, Chair
- Robert Hondal, University of Vermont, USA, Keynote Lecture
- Kaixun Huang, Hubei Key Laboratory of Bioinorganic Chemistry & Medicines, China, Keynote Lecture
- Dean Jones, Emory University, USA, Keynote lecture
- Anna Kipp, German Institute of Human Nutrition, Germany, Keynote Lecture
- Josef Köhrle, Charité, Germany, Chair
- Byeong Jae Lee, Seoul National University, South Korea, Keynote Lecture
- Xingen Lei, Cornell University, USA, Keynote Lecture
- Dongli Liang, Northwest A&F University, China, Keynote Lecture
- Zhi-Qing Lin, Southern Illinois University Edwardsville, USA, Keynote Lecture, Chair
- Graham Lyons, University of Adelaide, Australia, Keynote Lecture
- Matilde Maiorino, University of Padova, Italy, Keynote Lecture
- Bernhard Michalke, Helmholtz Zentrum, Germany, Chair
- Ingrid Pickering, University of Saskatchewan, Canada, Chair
- Elizabeth Pilon-Smits, Colorado State University, USA, Keynote Lecture
- N. Tejo Prakash, Patiala, India, Keynote Lecture
- Nick Ralston, University of North Dakota, USA, Plenary Lecture: “Mercury’s effects on selenium physiology: The five ‘SOS’ mechanisms of mercury toxicity”
- Margaret Rayman, University of Surrey, UK, Keynote Lecture
- Andre Rodrigues dos Reis, Sao Paulo State University, Brazil, Chair
- Michael Rother, Dresden University of Technology, Germany, Keynote Lecture
- Carmen Sanmartín, Universidad de Navarra, Spain, Chair
- Ed Schmidt, Montana State University, USA, Chair
- Lutz Schomburg, Charité, Germany, Chair
- Ulrich Schweizer, University of Bonn, Germany, Chair
- Helmut Sies, University of Düsseldorf, Germany, Chair
- Julian Spallholz, Texas Tech University, USA, Keynote Lecture
- Roger Sunde, University of Wisconsin, USA Chair
- Joanna Szpunar, CNRS, France, Keynote Lecture
- Dieter Söll, Yale University, USA, Keynote Lecture
- Jan Trofast, Sweden, Plenary Lecture: “Berzelius and his discovery of Selenium”
- Fulvio Ursini, University of Padova, Italy, Keynote Lecture
- Philip White, The James Hutton Institute, UK, Plenary Lecture: “Selenium metabolism in plants”
- Lenny Winkel, Eawag, Switzerland, Plenary Lecture: “The global cycle of selenium,” Chair
- Masayuki Yamamoto, Tohoku University Graduate School of Medicine, Japan, Keynote Lecture
- Björn Åkesson, Lund University, Sweden, Chair

### *EXCURSION TO MARIEFRED ON AUGUST 15*



Don't miss this wonderful opportunity to have a unique excursion experience to the small town of Mariefred, with a visit to the lab where Berzelius discovered selenium. The visit will be followed by a boat tour on the classic ship Gustafsberg VII that was built in 1912, and then a 3-course dinner back in Stockholm. The bus to Mariefred leaves from the conference venue at 16:45. The boat will return in Stockholm at midnight. Price: 1500 SEK incl. VAT. The number of seats is limited.



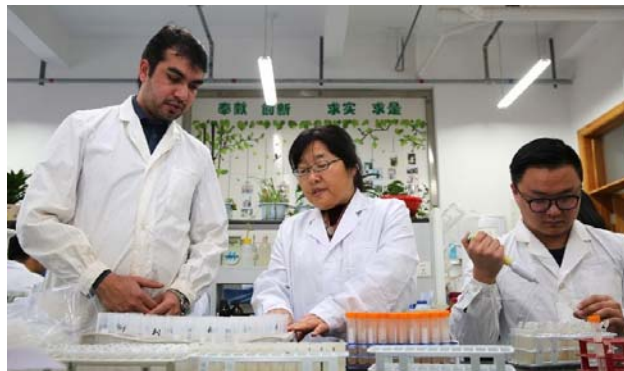
## RESEARCH HIGHLIGHTS

### SOIL CHEMISTRY CHARACTERISTICS OF NATURAL-OCCURRING SELENIUM IN ZIYANG, CHINA - RECENT RESEARCH FINDINGS BY RESEARCHERS AT NORTHWEST A&F UNIVERSITY, CHINA

Besides Enshi, Ziyang is another seleniferous region in northwestern China. Ziyang is located 260 km away from Xi'an. Interestingly, approximately 357 km north of Ziyang, Se-deficiencies and the appearance of the Keshan Beck disease occur due to low soil selenium levels. Since 2006, we at Northwest A&F University have been primarily focusing on soil Se biogeochemistry research, including the environmental transport and transformation of Se in different soil-plant systems as affected by different limiting environmental factors related to the soil chemistry of Se. The bioavailability of Se in agricultural soil is closely related to the chemical transformation and speciation of Se. Thus, chemical behaviors of soil Se are critically important in determining their impact on environmental health. Based on the field survey of ambient Se contents in different agricultural areas, we have systematically explored the speciation and chemical transformation of Se under different agricultural conditions and examined distribution of Se among different fractions of soil and its equilibrium between soil solid and liquid phases, as well as their relationships to major soil properties. Our research group has examined three typical agricultural regions and found that the soil Se content varies greatly in Ziyang. The Se concentrations in soil, water and plants were considerably high (0.21- 36.07 mg/kg in soil, 0.02-17 mg/kg in corn, 1.86-52.82  $\mu\text{g/L}$  in drinking water ), compared to the surrounding regions. These high concentrations sometimes reached toxic levels leading to potential Se poisoning within local residents in some villages of Ziyang County. However, about 280 km north of Ziyang in Shannxi Province, soils in the Jinghui region contained insufficient amounts of Se (0.020-0.603 mg/kg in soil and 0.003-0.485 mg/kg in wheat grain). Both the seleniferous and Se deficient soils have been observed approximately 280 km apart in Shannxi Province.

We have explored the important roles of soil organic matter-bound Se fraction or OM-Se in soil, and found OM-Se could be an important source of bioavailable Se for crops. The chemical transformation of exogenous Se was affected by its original concentrations and chemical forms. With increasing the soil incubation time, the fraction of iron (Fe)/manganese (Mn) oxide-bound Se remained constant, while OM-Se and residual Se increased. The soluble, exchangeable, and carbonate-bound Se only accounted for small portions of the total Se in the soil. The solid-liquid distribution coefficient ( $K_d$ ) in 18 different Chinese soils ranges from 4.1 to 21763 L/kg, as a function of both soil pH and exogenous Se concentrations. We also found that a 21-day aging time would be needed for selenite stabilization/equilibrium in

krasnozems and fluvo aquic soils, but 30 days for black soil, which is helpful in conducting experiments with Se-treated soils. Furthermore, the Se adsorption and desorption processes in the soils were mainly influenced by soil pH, amorphous iron, and soil OM contents. The soluble  $\text{Se}^{6+}$ , exchangeable Se, and OM-bound Se in soil significantly affected the Se uptake in crops.



Dr. Dongli Liang (center) supervising her graduate students in her research lab.

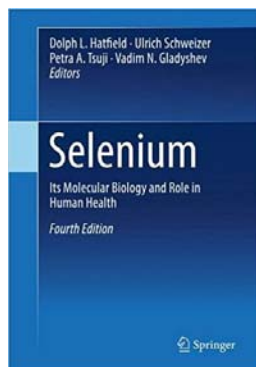
We have also determined that the application of nitrogen fertilizer could improve the efficiency of Se uptake by crops, while excessive application of phosphorus or sulfur could limit plant uptake and translocation of Se. Other trace elements (like copper) in soil could also affected soil Se bioavailability and crop Se uptake. These research findings can help us to better quantitatively evaluate soil Se bioavailability, as well as provide a better understanding in effectively managing high Se soil in Ziyang as a valuable natural resource for the implementation of Se biofortification strategies to improve human health in those Se-deficient areas.



Dr. Dongli Liang (front, center) and her research group at Northwest A&F University in Yangling, China

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## Selenium: Its Molecular Biology and Role in Human Health (4<sup>th</sup> edition)



Hatfield, D.L., Schweizer, U.,  
Tsuji, P.A., Gladyshev, V.N.  
(eds.), 2016, Springer

In the current edition, *Selenium: Its Molecular Biology and Role in Human Health* expands extensively on the previous editions providing readers with the most significant advances in the rapidly developing selenium field. Evidence from epidemiology and

veterinary science supports the essential role of selenium in human health, but its split personality in both preventing and supporting cancer and also in promoting insulin resistance has become more clearly defined. The pivotal role of glutathione peroxidase 4 in a new process of programmed cell death, ferroptosis, brings new impetus to the field. Recently defined mutations in selenoprotein and biosynthesis factor genes have been identified in patients, and the resulting disorders further emphasize the significance of selenoproteins in human health. The mechanism of selenoprotein biosynthesis, the functions of selenoproteins, and the roles of dietary selenium have been further elucidated, and new regulatory mechanisms involving selenoproteins discovered. The book, therefore, covers the breadth of current selenium research. With up-to-date chapters written by leaders in their fields, it serves as an invaluable resource for novices as well as specialists.

## Selenium in Plants - Molecular, Physiological, Ecological and Evolutionary Aspects



Editors:  
Pilon-Smits, E.A.H.  
Winkel, L.H.E.  
Lin, Z.-Q.

This book focuses on selenium (Se) metabolism in plants. It not only covers plant genetic, biochemical and physiological processes but places these in the context of Se movement in the food chain and the global environment, as well as discusses ecological and evolutionary significance. While Se is an essential micronutrient, it is toxic at high levels, and there is a narrow window between Se adequacy and toxicity.

More than a billion people and their livestock in low-Se regions have been estimated to be affected by Se deficiency, which compromises the immune system, thyroid activity, male fertility and mental function. In high-Se areas, Se toxicity is a problem. Selenium-accumulating plants may be used to alleviate Se deficiency in consumers (biofortification), or to remove environmental Se pollution (phytoremediation), both covered extensively in this volume. Plant species genetically vary in Se uptake, metabolism and tolerance. Some plants native to seleniferous soils can even hyperaccumulate Se up to 1.5% of their dry weight. The book reviews the latest knowledge about the processes involved in Se uptake, metabolism, tolerance and (hyper)accumulation, as well as successful approaches to optimize Se accumulation and speciation via classical crop breeding and genetic engineering. Global processes that control Se distribution and movement are reviewed, as are associated deficiency and toxicity issues. Relevant for Se bioavailability and for Se movement in the food chain, Se metabolism is also reviewed in prokaryotes and in mammalian consumers, and the nutritional benefits of plant Se on consumers are discussed. The reader will learn about the profound ecological effects of plant Se on interactions with herbivores, pollinators, microbes and other plants, and the likely selection pressures that drive the evolution of Se hyperaccumulation.

## Society News

### 6<sup>th</sup> International Conference on Selenium in the Environment and Human Health in 2019

The 6<sup>th</sup> International Conference on Selenium in the Environment and Human Health will be organized by Northwest A&F University in Yangling, China in 2019. The Northwest A&F University was established in 1934 as former National Northwest Senior College of Agriculture and Forestry, and now it is one of the most prestigious national universities in China.



Northwest A&F University in Yangling, China, located approximately 90 km west of Xi'an in central China. Xi'an was home to the Zhou, Qin, Han and Tang dynasties' ruling houses. There are numerous historical sites in Xi'an's surrounding plains, including the famed Terracotta Army.





A mesmerizing mountain in Xi'an often hailed as the birthplace of Chinese civilization, Xi'an has many allurements for tourists. At the top of the list is Mount Huashan, one of the five sacred Taoist mountains in China. Featuring five distinctive peaks, Mount Huashan offers a thrilling hike and breathtaking views.

Professor Dr. Dongli Liang in the Department of Environmental Science and Engineering in the College of Natural Resources and Environment has a long-standing research interest on selenium, and she will chair the local organizing committee of the 2017 Selenium Conference. Dr. Liang will also give an introduction presentation for the 2019 Selenium Conference in Yangling/Xi'an, China at the upcoming Selenium Conference in Stockholm, Sweden in August 2017.



## International Society for Selenium Research

### How to Become a Member?

Membership is open to all who are interested in fostering the expansion of communication and scientific exchange of new and emerging concepts centered within the multi-disciplines associated with current and future worldwide selenium research efforts. The membership will include regular, student and honorary members. A regular member has the right to elect, or to be elected, as an officer of the ISSR. To

join the ISSR, individuals will need to complete the membership application form. The membership due for a regular member is \$50 (USD) for a two-year membership, and \$20 (USD) for a student member.

The current list of members can be found at the Society's webpage: [www.seleniumresearch.org/](http://www.seleniumresearch.org/)

### How to Pay Your Membership Fee?



The membership due of \$50 (for a regular member for two years) or \$20 (for a student member for two years) can be paid via the following approaches:

- The payment can be made in cash at the selenium conference;
- The fund can be transferred through Western Union or other companies with money transfer service;
- Remitting the payment in the form of a cashier's check, certified check, or money order payable to *International Society for Selenium Research*.

Please send your check or fund transfer notice to:  
Dr. Zhi-Qing Lin, Environmental Sciences Program, 2165 Science West, Southern Illinois University - Edwardsville, Edwardsville, Illinois 62026-1099, USA; Tel.: 1-618-650-2650; Email: [zhlin@siue.edu](mailto:zhlin@siue.edu)

### Elected Officers (2013-2017)

#### President:

*Gary Bañuelos, U.S. Department of Agriculture-ARS, USA*

#### Vice Presidents:

*Joel Caton, North Dakota State University, USA*

*Lutz Schomburg, Charite Medical Hospital Berlin, Germany*

#### Secretary:

*Xuebin Yin, University of Science and Technology of China, China*

#### Treasurer:

*Zhi-Qing Lin, Southern Illinois University, Edwardsville, USA*

#### Council Members:

*Martin Broadley, University of Nottingham, UK*

*Allan Chilimba, Ministry of Agriculture and Food Security, Malawi*

*Karaj S. Dhillon, Punjab Agriculture University, India,*

*Gijs Du Laing, Ghent University, Belgium*

*Graham Lyons, University of Adelaide, Australia*

*Milton Ferreira de Moraes, Ferderaz University of Parana, Brazil*



## Publications by Members

(Citations submitted by members for the time period of July 2016 to April 2017)

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Arnér, ESJ. 2017. Selective evaluation of thioredoxin reductase enzymatic activities. In: Methods in Molecular Biology – Selenoproteins: Methods and Protocols (Chavatte, L. Ed.). Springer Science + Business Media, Norwell. In press.

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