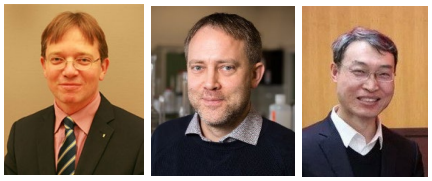
Selenium Research

International Society for Selenium Research Issue 11, 2024

President's Remarks



Dear fellow researchers, scientists and friends of Selenium!

Another interesting year is ending. I have learnt from my Chinese colleagues that the wish that I have always found very polite and positive, namely 'and may you live in interesting times', is a kind of curse that conveys uncertainty and insecurity to the recipient. But the proverb probably does not really have a Chinese origin, as the following sentence would rather be used: "Rather be a dog in times of peace than be a human in times of war" (宁为太平犬，莫作乱离人). Unfortunately, both sentences fit to the current situation around us, because all these 'interesting' things that are happening are rather frightening, mad and sad, but not calming, reassuring or peaceful. The constant barrage of terrible political news feels like a nightmare, but as mentioned in our last newsletter, we don't want to talk politics and would rather do the best we can in our own little cosmos of personal and professional interactions. Another saying from a local religious figure: 'Even if I knew the world would end tomorrow, I would still plant my apple today'. With this in mind, we should take comfort in the reliable circadian return of Selene, who sheds her pale light on both the safe and the restless, providing calm, comfort and sleep and recharging our energy.

And that brings us to our first important topic, the activities of our society outside the conferences. We asked for suggestions on how we can best support scientific and personal co-operation and interaction. But the response rate was only moderate. We can learn from the Little Prince, the wonderful novel by the French aviator and writer Antoine de Saint-Exupéry from the middle of the last century, that we should never forget a question and rather repeat it until we receive an answer. So, we ask again, how can we best increase the value of our society for its members? Should we set up a scientific monitor on the website that reflects and comments on the latest achievements in Se research made by our members and others? Should we rather share ideas and encourage communication and collaborative projects by offering lab placements, exchanges, and other support (providing master/PhD position, or visiting student/scholar position)? Support for International Cooperation and Exchange Programs may be funded by the National Natural Science Foundation of China in Asia, EU, America, Australia, and Africa (please do not hesitate to contact us in case we can support your application)? Or should we start a series of online lectures showcasing the various aspects of Se research in our society, introducing the established faces and the promising young researchers, and/or various aspects of our favorite element, and the achievements and research into its biological role, geochemistry and physiological importance in plants and animals? The latter idea has already received some substantial support by our members, so we will try it. However, we need additional volunteers and topics of interest.

Please do respond by sending an email to Professor Linxi Yuan (linxi.yuan@xjtlu.edu.cn)or one of the board members, or post comments on http://www.seleniumresearch.pro. Please indicate which of the other aspects you also consider valuable, and to what extent you would be willing to actively support these ideas, e.g. by providing interesting research results, offering lab rotations/exchanges, or suggesting a speaker and topic for such an online seminar as part of an ISSR-related series of web-based presentations.

So, the call gets out again, to combine forces, share concepts, insights and opportunities for co-operation, collaboration and joint projects. Let us not wait for another year, or until the next conference in 2025, which has been scheduled for July 6-9, in Chuzhou, Anhui Province, China, hosted by Anhui University of Science and Technology, and jointly organized by Gary Banuelos, Yuebin Yin, Zhi-Qing Lin, and several supportive local researchers.

To conclude this overview, please find below an exciting example highlighting the importance of our favorite trace element for staying alive, enabling us to join the next conferences in good health and mood. Together with colleagues from our largest cancer research institute in Germany (Deutsches Krebsforschungszentrum, DKFZ), we succeeded in analyzing more than 7,000 adult men and women and followed their fate over more than 17 years (!). As the average age span of the included participants was between 50-74 years of age, the mortality rate was around

30% during the observation period. The analysis of the Se status, measured by the transporter SELENOP, and its relation to mortality indicated a J-shaped interaction, with about two thirds showing no association of SELENOP and mortality, whereas the low tertile displayed a steadily increasing risk with decreasing Se status (Fig. 1). This result indicates the importance of a sufficiently high Se status for avoiding early mortality, and highlights that indeed around 30% of adult subjects in central Europe are living with a relevant Se deficit, likely due to an insufficient Se intake. It appears as if these data should be convincing enough to take actions, guarding the personal Se status and avoiding deficiency. While this notion is for sure of relevance to many of us regularly residing in Europe, Asia, Australia or Africa, it becomes important for all of us in times of increased Se requirements, like during inflammatory diseases, chronic illness or in pregnancy. With recent results indicating an increased risk for gestational diabetes risk and neurodevelopmental deficits of the newborns in a Se-deficiency condition, we will try to get Se status diagnosis and supplementation into the general guidelines for pregnancy care. Let us hope that we succeed and can report on this achievement in the next newsletter to come.

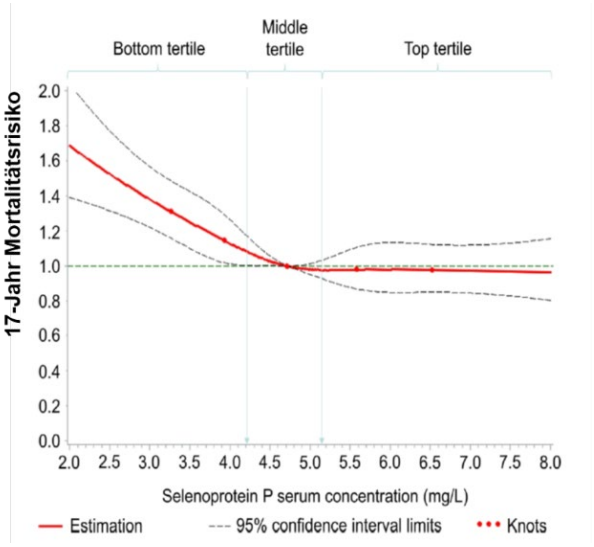


Figure 1. Selenium deficiency and survival. A prospective cohort study of >7,000 senior adults residing in Germany indicates a particular association of mortality risk (y-axis) with Se status (determined as concentrations of the Se transporter SELENOP), over the course of > 17 years. The data indicate an increased mortality risk in the low tertile of subjects and highlights the importance of a sufficiently high Se intake for living a long and healthy life ("Strong associations of serum selenoprotein P with all-cause mortality and mortality due to cancer, cardiovascular, respiratory and gastrointestinal diseases in older German adults", 2024, PMID 38198038).

Yet, for the time being, these results highlight again that ignoring our Se intake and living with Se deficiency is not a smart choice, and that we should use our influence as researchers of Se to mention low Se intake as a relevant, prevalent and addressable health risk, and work on measures to avoid it by improving soil, diets, vegetables, fruits, animal-derived food items and supplements, or whatever way appears suitable. This challenge is probably the foremost task of our society and our fruitful collaborations. An interesting development into this direction was observed in the local supermarkets, where we found next to fluoride-enriched table salt also the first packages of Se- and Iodine-enriched table salt.

But increasing table salt intake to cover the Se requirements seems counter-intuitive, as salt comes with higher health risk particularly for the cardiovascular system. In our meetings of the ISSR, I have seen many better ways, ideas, and products to address this issue, and we should combine forces to get them on the market and make them available for our fellow citizens. Accordingly, it is encouraging to see the acceptance of Se-enriched table salt indicating the growing awareness for this topic in the society.

With this positive aspect, we are wishing you all a wonderful, peaceful and boring (*i.e.* not interesting) festive season and a healthy and happy start into 2025 all best from the three of us, residing in Berlin, Ghent, and Chuzhou.

Yours sincerely,

Lutz Schomburg, President (Germany)
Gijs Du Laing, Vice President (Belgium)
Xuebin Yin, Vice President (China)

News from the Society

News Event on Selenium Awardee

The World Food Prize Foundation has selected Dr. Gary Bañuelos among 38 candidates worldwide for his outstanding contributions to transforming food systems worldwide with his research on *selenium*. His innovative efforts and dedication to improving agriculture and food systems are what make him a perfect fit for the list. As one

of award members, he now joins a distinguished network of trailblazers dedicated to co-learning and collaboration across food systems. The World Food Prize calls forth the global imperative to provide safe, affordable, nutritious, sustainable and equitable food for all. By honoring those who have worked successfully toward this goal, the Prize uplifts the work and reminds us of what needs to be accomplished in the future. The World Food Prize Foundation annually convenes discussions and activities each October in the USA, drawing over 1,200 participants from over 60 to 65 countries.

The World Food Prize is the foremost international award recognizing the accomplishments of individuals who have advanced human development by improving the quality, quantity, or availability of food in the world. The World Food Prize is a $500,000 award formally presented at the Borlaug Dialogue in Des Moines, Iowa, October 29-31, 2024.

(The World Food Prize Foundation - https://www.worldfoodprize.org/)

The China Youth Branch

The China Youth Branch have made excellent progress on selenium research in 2024. Some of their selenium research publications and research awards are highlighted as follows:

Linxi Yuan, Senior Associate Professor
Xi'an Jiaotong-Liverpool University
https://scholar.xjtlu.edu.cn/en/persons/LinxiYuan

Zhang, L. et al. 2024. Protective effects and mechanism of chemical- and plant-based selenocystine against cadmium-induced liver damage. J. Hazardous. Mat., 468: 133812.

Zhang, L. et al. 2024. Effects of Se-cadmium co-enriched *Cardamine hupingshanensis* on bone damage in mice. Ecotoxicol. Environ. Safety, 272: 116101.

Zang, H. et al. 2024. Effects of elevated CO_2 concentration on Se accumulation and associated rhizobacterial community in *Cardamine hupingshanensis*. Plant Soil. doi:10.1007/s11104-024-07072-0.

Farooq, M.R. et al. 2024. Characterization of Se speciation in Se-enriched crops: Crop selection approach. J. Agri. Food Chem., doi:10.1021/acs.jafc.3c08116.

One research project entitled "Research and Application of Se-Rich Biological Resources for the Prevention and Treatment of Immune Metabolic Diseases" won the 3rd place award of 2024 Hubei Provincial Prize for Science and Technology Advancement.

Hua Zhang, Professor
Chinese Academy of Sciences
https://sciprofiles.com/profile/1746805

Yang, X. et al. 2024. Interactions of Se and mercury in soil-plant systems: Characterizations, occurrences, and mechanisms. Critic. Rev. Environ. Sci. Technol. doi:10.1080/10643389.2024.2332135.

Yang, X. et al. 2024. Advancing the analysis of volatile Se species in high-humidity and low-volatility paddy systems: A novel approach for speciation and quantification. Sci. the Total Environ., 957, 177514.

The research team also received a key project grant from the National Natural Science Foundation of China for research on the molecular basis and functional aspects of Se-related microorganisms.

Xiaohu Zhao, Senior Associate Professor
Huazhong Agricultural University
https://www.researchgate.net/profile/Zhao-Xiaohu-2

Zhang, H. et al. 2024. Bacteria from the rhizosphere of a Se hyperaccumulator plant can improve the Se uptake of a non-hyperaccumulator plant. Biology and Fertility of Soils, 60: 987-1008.

Zhang, H. et al. 2024. Metabolism interaction between Bacillus cereus SESY and Brassica napus contributes to enhance host Se absorption and accumulation. Plant, Cell & Environ., doi:10.1111/pce.15278.

He, C. et al. 2024. Foliar spraying with synthetic community of Bacillus increases the Se content, quality and contribution to phyllosphere microecology of pak choi. Scientia Horticulturae, 331, 113131.

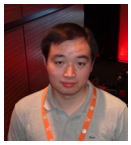
Tang, Y. et al. 2024. Se-mediated shaping of citrus rhizobiome for promotion in root growth and soil phosphorus activation. J. Agri. Food Chem., 72, 16624-16637.

Tang, Y. et al. 2024. The pivotal role of secondary nutrients and micronutrients in regulating fruit quality and root exudates metabolism profile of citrus. Plant Soil, 500, 461-479.

Han, C. et al. 2024. Soil Se enhanced the resistance of oilseed rape to *Sclerotinia sclerotiorum* by optimizing the plant microbiome. J. Exp. Bot., 75(18): 5768-5789.

Wang, Z. et al. 2024. Silicon and Se alleviate cadmium toxicity in *Artemisia selengensis* Turcz by regulating the plant-rhizosphere. Environ. Res., 252, 119064.

Zhang, H. et al. 2024. Selenium and *Bacillus proteolyticus* SES increased Cu-Cd-Cr uptake by ryegrass: highlighting the significance of key taxa and soil enzyme activity. Environ. Sci. Poll. Res., 31, 29113-29131.



Tao Yu, Professor
China University of Geosciences, Beijing
https://www.researchgate.net/profile/Tao-Yu-42

Zhang, C. et al. 2024. Insight into the availability and desorption kinetics of Se and Cd in naturally-rich soils using diffusive gradients in thin-films technique. J. Hazard. Mat., 465: 133330.

Guo, R. et al. 2024. Using machine learning to predict Se and cadmium contents in rice grains from black shale-distributed farmland area. Sci. the Total Environ., 912: 168802.

Li, B. et al. 2024. Environmental Se and human longevity: An ecogeochemical perspective. Chemosphere, 347: 140691.

Students in his research group won the 1st prize in the Beijing Division of International College Students' Innovation Competition of China, received the Excellent Presentation Award for Student at the National Applied Geochemistry Academic Annual Conference, and the Excellent Oral Presentation Award at the 4th Geoscience Graduate Forum.

Yanan Wan, Associate Professor
China Agricultural University
https://sciprofiles.com/profile/2037305

Wang, Q. et al. 2024. Absorption and biotransformation of selenomethionine and selenomethionine-oxide by wheat seedlings (*Triticum aestivum* L.). Plants, 13, 380.

Kong, L. et al. 2024. Simultaneous biofortification: interaction between zinc and selenium regarding their accumulation in wheat. Agronomy, 14, 1513.

Huang, S. et al. 2024. Selenate simultaneously alleviated cadmium and arsenic accumulation in rice (*Oryza sativa* L.) via regulating transport genes. Environ. Pollut., 359, 124725.

Zhangmin Wang, Associate Professor
Suzhou University of Science and Technology
https://www.researchgate.net/scientific-contributions/Zhangmin-Wang-2069977648

Huang, L. et al. 2024. Assessment of Se exposure and health risks among residents in areas with different Se levels. China Environmental Science (Chinese), 44(8):4683-4689.

Li, C. et al. 2024. Comprehensive insights into the health effects of Se exposure and supplementation among the Chinese community middle-aged and elderly: A combined retrospective cohort study and intervention study. Biol. Trace Elem. Res., 202, 3517–3528.

Rongqiang Zhang, Professor
Shaanxi University of Chinese Medicine
https://sciprofiles.com/profile/1643688

Qi, Y. et al. 2024. Evaluating the link between DIO3-FA27 promoter methylation, biochemical indices, and heart failure progression. Clin. Epigenetics, 16(1):57. doi:10.1186/s13148-024-01668-0.

Liu, Y. et al. 2024. The dynamics of methylation concentrations in glutathione peroxidase 3 promoter from patients with chronic heart failure and their association with key clinical parameters. J. Nutr, 154(11): 3365-3374. doi:10.1016/j.tjnut.2024.08.033.

Miao, Q. et al. 2024. A study on the methylation patterns of DIO3 in patients with heart failure and its correlation with key clinical parameters. Heliyon, 10(17): e37582. doi:10.1016/j.

Wang, Y. et al. 2024. Selenoprotein GPX3 is a novel prognostic indicator for stomach adenocarcinoma and brain low-grade gliomas: Evidence from an integrative pan-cancer analysis. Heliyon, 10(17): e37582. doi:10.1016/j.

Wang, Y. et al. 2024. Selenoprotein S (SELENOS) is a potential prognostic biomarker for brain lower grade glioma. J. Trace Elem. Med. Biol., 86:127539. doi:10.1016/j.jtemb.2024.127539.

Jing Wang, Lecturer
Central China Normal University

Wang, J. et al. 2024. Spatiotemporal process and mechanism of Kashin-Beck disease regression in Xizang during 2000-2015. Acta Geographica Sinica (Chinese), 79(11): 2849-2863.

Wang et al. 2024. Research on effective prevention and control of Kashin-Beck disease in Tibet based on optimal parameters-based geographical detector. Chin. J. Endemiol. In press.

(Linxi Yuan, Xi'an Jiaotong-Liverpool University)

China Youth Branch is Looking for Selenium Research Collaborators for International/ Regional Cooperative Research Funding Opportunities

In collaboration with different international science funding agencies (e.g. NSF in the USA and ERC in European Union), National Natural Science Foundation of China (NSFC) supports two types of international cooperative projects: (1) The Joint Research Program - NSFC and other funding organizations jointly fund bilateral or multilateral joint research projects to support Chinese researchers and their collaborators to conduct basic research projects; (2) The Exchange Program that supports Chinese researchers with active NSFC projects in fostering international collaboration and exchange initiatives. The Exchange Program also consists of personnel exchange and academic conference. Currently, theses international cooperative projects could be applied in Asia (Japan, South Korea, Mongolia, Thailand, Pakistan, Iran, Israel, Egypt), America and Australasia (USA, New Zealand, Brazil, Argentina, Chile), and Europe (European Union, Russia, Germany, UK, Netherland, Belgium, Czech Republic, Belarus, Switzerland, Finland, Turkey). China Youth Branch calls for collaborators for international cooperative research funding opportunities. Researchers who are interested in international collaborative research with Chinese researchers of China Youth Branch can contact Dr. Linxi Yuan (email: linxi.yuan@xjtlu.edu.cn) to initiate the conversation and explore the opportunities.

For more information on NSFC's International (Regional) Cooperation and Exchange Programs, please visit: https://www.nsfc.gov.cn/english/site_1/pdf/NationalNaturalScienceFundGuidetoPrograms2024.pdf

(Linxi Yuan, Xi'an Jiaotong-Liverpool University)

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. For a lifelong membership the membership due is $300 (USD).

The membership due of $50 (for a regular member for two years), $20 (for a student member for two years), or $300 (for lifelong membership) can be paid via the following approaches: (1) The payment can be made in cash at the selenium conference; (2) The fund can be transferred through Western Union or other companies with money transfer service; or (3) Remitting the payment in the form of a cashier's check, certified check, or money order payable to: *International Society for Selenium Research*. A personal check in US currency will also be acceptable. Please send your check or fund transfer notice to:

Dr. Zhi-Qing Lin, Department of Environmental Sciences, 2165 Science West, Southern Illinois University, Edwardsville, Illinois 62026-1099, USA; Tel.: 1-618-650-2650; Email: zhlin@siue.edu.

The 8th International Conference on Selenium in the Environment and Human Health to be held in Chuzhou, Anhui, China on July 6-9, 2025

The 8th International Conference on Selenium in the Environment and Human Health will be hosted by Anhui University of Science and Technology in Chuzhou, China under the auspicious of International Society for Selenium Research.

Conference Website: www.seleniumresearch.net

Conference Chairs

- Dr. Gary S. Bañuelos, Plant Soil Scientist, Department of Agriculture - ARS, California, USA
- Dr. Xuebin Yin, Professor, Anhui Science and Technology University, Anhui, China
- Dr. Zhiqing Lin, Professor, Southern Illinois University Edwardsville, Illinois, USA

Keynote Lectures

- Autoimmunity to Its Transporter Offers Novel Insights into the Physiological Role of Selenium
  Lutz Schomburg
  Charité Universitätsmedizin Berlin, Germany

- **Selenium Biofortification: Strategies, Progress and Challenges**
  Xuebin Yin
  Anhui Science and Technology University, China

Confirmed Invited Speakers

(as of December 28, 2024)

- Bañuelos, Gary S.; Department of Agriculture - Agricultural Research Service, United States
- Broadley, Martin R.; Rothamsted Research, United Kingdom
- Churchill, David G.; Korea Advanced Institute of Science and Technology, South Korea
- dos Reis, Andre Rodrigues; Universidade Estadual Paulista - Tupã, Brazil
- Du Laing, Gijs; Ghent University, Belgium
- Guilherme, Luiz Roberto Guimaraes; Universidade Federal de Lavras, Brazil
- Hall, Jean A.; Oregon State University, United States
- Huang, Chuying; Hubei Minzu University, China
- Huang, Zhen; Sichuan University, China
- Hughes, David; University College Dublin, Ireland
- Li, Li; Department of Agriculture – Agricultural Research Service, United States
- Li, Miao; Anhui Agricultural University, China
- Liang, Dongli; Northwest A&F University, China
- Lin, Zhi-Qing; Southern Illinois University - Edwardsville, United States
- Liu, Siwen; National Research Center for Geoanalysis, China

- Lobinski Ryszard; Institute of Analytical Sciences and Physical Chemistry for Environment and Materials, France
- Ma, Lena Q.; Zhejiang University, China
- Muñoz, Fernando; Universidad Nacional de Mar del Plata, Argentina
- Pan, Canping; China Agricultural University, China
- Prakash, N. Tejo; Thapar Institute of Engineering and Technology, India
- Prakash, Ranjana; Thapar Institute of Engineering and Technology, India
- Schiavon, Michela; Università degli Studi di Torino, Italy
- Shi, Weiming; Chinese Academy of Sciences, China
- Szpunar, Joanna; Institute of Analytical Sciences and Physical Chemistry for Environment and Materials, France
- Tangkoonboribun, Rochana; Thailand Institute of Scientific and Technological Research, Thailand
- Wan, Yanan; China Agricultural University, China
- Xiong, Yongming; Xi'an Jiaotong University, China
- Yin, Shutao; China Agricultural University, China
- Yu, Tao; China University of Geosciences, China
- Yuan, Linxi; Xi'an Jiao Tong -Liverpool University, China
- Zhao, Fang-jie; Nanjing Agricultural University, China
- Zhao, Xiaohu; Huazhong Agriculture University, China
- Zhang, Hua; Chinese Academy of Sciences

City Tour & Post-Conference Excursion

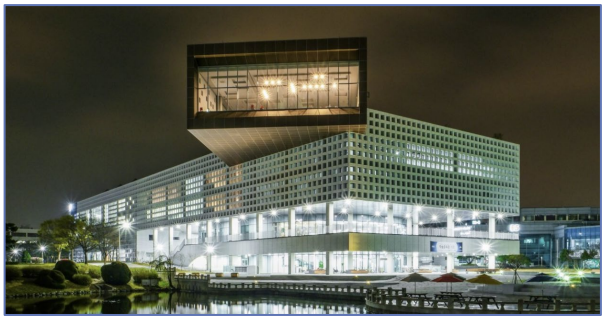
- July 9, 2025: Tours of Chuzhou & Chuzhou Higher Education Science and Technology Industrial Park
- July 10, 2025: Post-Conference Excursions – Shitai (a longevity village) or Enshi (world capital of selenium)

(Gary Bañuelos, Zhi-Qing Lin, Xuebin Yin)

International Symposium on Selenium in Biology and Medicine (ISSBM 13) to be held on October 26 - 29, 2025 at The Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea

The International Symposium on Selenium in Biology and Medicine (ISSBM) is well known among experts as one of the most influential conferences in its area in the World today. It covers the topic of selenium deeply and with respect to conventional and hot topics. This major meeting has been held worldwide roughly every 4 years since the inaugural event in 1976. The first ISSBM conference was held in Corvallis, USA (1976). Since then, 12 different cities worldwide in Europe, and America and East Asia have since hosted but it has never been held in Korea so far.

The most recent installation of the conference was in Hawaii (Honolulu) in 2022 (Organizer: Peter Hoffmann); before that, it was held in Stockholm in 2017 (Organizer: Elias Arnér) in which a joint meeting with the 7th International Conference on Selenium in the Environment and Human Health was arranged. In 2025, ISSBM 13 will be organized by David G. Churchill (david.churchill.korea@gmail.com). at The Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea during October 26-29, 2025.

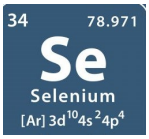


With the ISSBM 13 website fully functional (abstract submission, registration, payment) and being continually updated, with many plenary speakers already chosen, a lot of details are still being arranged. We anticipate having about 300 participants at this conference. The conference program ranges from the traditional disciplines through various interdisciplinary. Hot topics and trainee sessions will help make for a grand event. The invited speakers from worldwide institutes helping tacitly through their excellence to advertise the event. There are also special journal issues profiling ISSBM 13:

- Archives of Biochemistry and Biophysics (Elsevier) (IF = 3.9); the editor in chief is Professor Henry Jay Forman and guest editors are David G. Churchill (KAIST), Alan Diamond (UIC), and Peter Hoffmann (U. Hawaii);
- Biological Trace Element Research (BTER), (IF = 3.9), a Nature-Springer journal is also offering a special issue for this ISSBM 13 event with Professor Wen-Hsing Cheng serving as the co-editor-in-chief;
- Main Group Chemistry (Sage/IOS) is covering a special issue where the guest editor is Professor Sudesh Manjare.

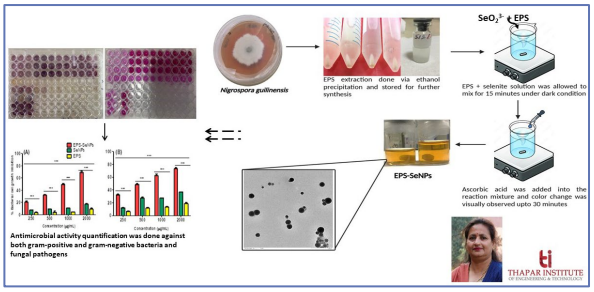
The Korean Association of Selenium Research (KASR) is the Local Organizer and Host. The organizers and large International Advisory Board sincerely welcome you to Korea in 2025; remember, Daejeon in October should be full of lovely foliage and also full of friends and colleagues. Registration is now open through the conference website - https://issbm.org/. Please also book your hotel nights soon because that time of year in Korea features many conferences. For questions or additional information, the contact email: issbr.13.korea.2025@gmail.com

(David Churchill, The Korea Advanced Institute of Science & Technology)



Selenium Research Highlights

Nano-Selenium Research in School of Chemistry & Biochemistry at Thapar Institute of Engineering & Technology, India



Biosynthesis of Selenium Nanoparticles: Research efforts have focused on leveraging natural biological systems such as fungi and bacteria to produce SeNPs. Endophytic fungi like *Nigrospora guilinensis* have been employed to synthesize SeNPs stabilized by exopolysaccharides (EPS). These EPS-capped SeNPs exhibit high stability due to their functional groups, which enhance bioactivity and minimize toxicity. Similarly, Se-tolerant bacteria have been used to synthesize SeNPs through reduction mechanisms, yielding nanospheres with controlled morphology. This approach not only reduces production costs but also aligns with sustainable practices by minimizing harmful byproducts.

Stabilization and Characterization: Stabilization of SeNPs is a critical factor in their effectiveness for biological and environmental applications. EPS derived from microbial sources acts as an excellent capping agent, providing biocompatibility and preventing nanoparticle aggregation. Techniques such as UV-visible spectroscopy, dynamic light scattering, transmission electron microscopy, and Fourier-transform infrared spectroscopy have been used to characterize the nanoparticles' size, morphology, and functional groups. EPS-SeNPs synthesized by *N. guilinensis* demonstrated an average size of 43.0±13.0 nm, spherical morphology, and strong surface plasmon resonance, indicating stable and uniform nanoparticles.

Bioactivity Studies: SeNPs exhibit high efficacy in scavenging free radicals, particularly through DPPH and ABTS assays. The findings demonstrate their ability to mitigate oxidative stress, making them promising candidates for antioxidant therapies. Additionally, the broad-spectrum antimicrobial properties of SeNPs could be confirmed against a variety of bacteria. This is attributed to their membrane-interactive properties and oxidative mechanisms. The ability of SeNPs to disrupt microbial membranes and interfere with enzymatic activities highlights their potential in combating antibiotic-resistant strains. Further, in vitro studies demonstrate that SeNPs significantly reduce the viability of liver carcinoma cells (HepG2) in a dose-dependent manner, suggesting their potential in cancer treatment. Their ability to induce ROS-mediated apoptosis provides a targeted approach to cancer therapy, minimizing damage to healthy tissues.

Catalytic Applications: SeNPs, when incorporated into materials like ZnO and ZnS, exhibit enhanced photocatalytic activity. The presence of Se in these composites not only improves light absorption but also facilitates efficient charge separation, boosting overall catalytic performance. The use of SeNP-based catalysts results in nearly complete degradation of methyl orange dye under UV irradiation, converting pollutants into benign compounds like CO_2. These applications underscore the potential of SeNPs in water treatment and environmental remediation, offering a sustainable solution to tackle industrial waste.

Environmental Implications: The environmentally friendly synthesis of SeNPs provides a dual benefit: reducing the toxicity of Se oxyanions in the environment and producing nanomaterials with significant application potential. Aerobic bacteria have demonstrated the ability to detoxify Se while producing valuable SeNPs for industrial applications. Furthermore, the bioremediation potential of these nanoparticles can be leveraged to address contamination in agricultural and industrial regions, offering an integrated approach to environmental sustainability.

Advances in Functionalization and Applications: Recent research has focused on functionalizing SeNPs to enhance their specificity and efficacy in biomedical applications. By incorporating ligands, peptides, or polymers, researchers aim to improve the targeting and therapeutic potential of SeNPs. These functionalized nanoparticles are being explored for use in drug delivery systems, imaging, and combined therapies (e.g. chemo-photothermal treatments).

Challenges and Future Directions: Our studies collectively highlight the versatility of SeNPs synthesized through biological routes. Their stability, bioactivity, and catalytic potential underline their importance in therapeutic and environmental contexts. Future research should focus on optimizing these biosynthetic processes and investigating the long-term safety and efficacy of SeNPs in various applications. Continued advancements in nanotechnology and biotechnology are expected to further unlock the

potential of SeNPs in addressing global challenges in health and sustainability. Research is needed to optimize biosynthesis methods for scalability while maintaining nanoparticle quality. Understanding the long-term safety and interaction of SeNPs with biological systems is crucial for their translation into clinical and industrial settings. Future studies should explore the synergistic effects of SeNPs with other nanomaterials to expand their functional capabilities.

The author acknowledges the funding received from DST (DST/INT/JSPS/P-336/2021) under the India-Japan Science Cooperation Program.

(Ranjana Prakash, Thapar Institute of Engineering & Technology)

Functional Agriculture International Long-term Experimental Station

The iFAST research station is in Chuzhou, Anhui Province of China, encompassing an area of 3.5 hectares and within a 10-minute driving distance from the *Institute of Functional Agriculture (Food) Science and Technology at Yangtze River Delta* and the *Functional Agriculture Valley*. The experimental station supports various functional agriculture research activities including staple crops (e.g. rice, corn and soybean) and cash crops (e.g. vegetables and edible mushrooms). Current research programs primarily focus on key issues and technologies, such as "soil-fertilizer-crop/animal-food-human body" system, of functional agriculture. In accordance with "*the reverse design thinking*", the major issues have been selected, regulation and control technologies have been developed, critical technologies of functional agriculture are examined, and integrated demonstrations have been carried out at the research station.

The main research areas include: (1) breeding and propagation of functional crop variety, (2) pathways of accumulation and transport of functional mineral elements, (3) precision cultivation technologies of functional crop, (4) developing the specific harvesting and storage technology of functional grain, (5) biofortification with high mineral contents, (6) digital functional agricultural technology, (7) developing an ecological-sound, low-carbon impact and high-nutritional value functional agriculture model. The Institute of Functional Agriculture Science and Technology (iFAST) at Yangtze River Delta welcomes research experts and scholars from different countries to conduct collaborative research at the research station.

(Photo courtesy by Xuebin Yin)

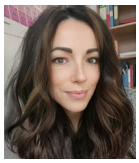
(Xuebin Yin, Anhui Science and Technology University)

Selenium Research in the Department of Agricultural, Forest, and Food Sciences (DISAFA) at the University of Turin, Italy

Dr. Michela Schiavon at the University of Turin in Italy has recently investigated the interactions of selenium (Se) with nickel (Ni) and cadmium (Cd) in rice plants, particularly in the context of forthcoming EU regulations aimed at limiting

Ni accumulation in rice grains. Her research results have revealed that different chemical forms of Se exhibit distinct effects on Cd and Ni uptake, translocation, tissue distribution and interactions, underscoring the potential of Se to enhance Ni translocation within plants.

Dr. Schiavon's research also extends to better understanding how Se hyperaccumulating plants metabolize, accumulate, and tolerate Se compared to non-hyperaccumulator plants. Her research group has explored the potential use of Se hyperaccumulators' biomass as a source of organic Se to enrich non-accumulating plants, especially microgreens. Additionally, she examines how such approach can influence the biochemistry and omics profiles of these plants. She has recently focused on strigolactones, an emerging class of phytohormones. She has investigated their role in Se acquisition, given their ability to regulate phosphate uptake, a process closely related to selenite absorption. Variations in strigolactone production and release in root exudates could significantly impact the plant's capacity for phosphorus and Se accumulation, with possible implications for both biofortification and phytoremediation efforts.



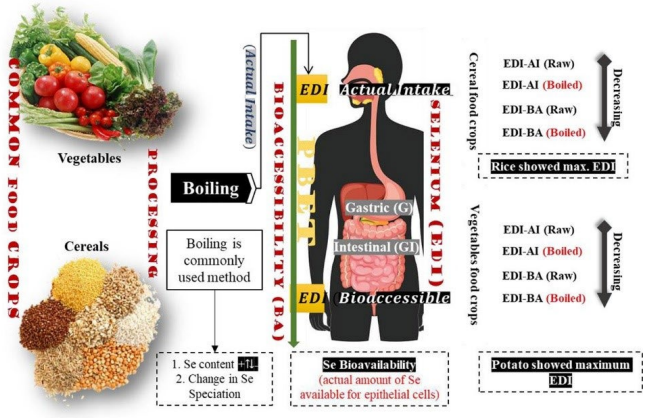
Dr. Schiavon graduated in Biology from the University of Padova in 2002 and earned her PhD in Crop Productivity in 2006. Her doctoral research focused primarily on the mechanisms underlying heavy metal and metalloid acquisition and tolerance in plants. In 2004, she started her research at Colorado State University (USA) under the guidance of Prof. Elizabeth Pilon-Smits. During this period, she developed her interest in Se remediation and crop enrichment technologies. Later, from 2015 to 2017, she worked as a Research Scientist at Colorado State University with a fellowship from the National Science Foundation, gaining expertise in selenium hyperaccumulation genetics, the interplay between selenium and competing elements, and the ecological factors influencing selenium hyperaccumulation in natural environments. Currently, she is Associate Professor in the Department of Agricultural, Forest, and Food Sciences (DISAFA) at the University of Turin, Italy.

(Michela Schiavon, The University of Turin)

RESEARCH PUBLICATIONS

Selenium loss during Boiling Processes and its Bioaccessibility in Different Crops: Estimated Daily Intake

M.R. Farooq, Z. Zhang, X. Liu, Y. Chen, G. Wu, S. Niu, J. Song, D. Chen, and X.B. Yin



This study examined the effects of boiling on Se concentration, speciation, and bioaccessibility in various crops. It provides insights into how these changes impact Se intake for humans, especially in Se-deficient populations. The major research findings include (1) boiling reduces Se content in food crops. For instance, rice loses about 11.9% of its Se, while sorghum shows a higher reduction of up to 34.9%; (2) vegetables experience Se loss ranging from 21% to 40% during boiling; (3) the bioaccessibility of Se is crucial for estimating its absorption and effective intake from cooked foods. This study demonstrated the importance of cooking methods on Se retention and suggest strategies to optimize Se intake through diet.

Full article: doi:10.1016/j.foodchem.2024.138607
(Jiaping Song, Anhui Science and Technology University)

Season's Greetings and Best Wishes for 2025

Editors: *Lutz Schomburg, Zhi-Qing Lin & Gary S. Banuelos* **Publication Date:** December 28, 2024